FILE COPY

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

TEL. (808) 270-7745
FAX (808) 270-7975

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

CARY YAMASHITA, P.E.
Engineering Division

JOHN R. SMITH, P.E., ACTING
Highways Division

JUL 23 2017
AUG 8 2017

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

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OFC. OF ENVIRONMENTAL QUALITY CONTROL

July 12, 2017

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

SUBJECT: 'ĪAO STREAM FLOOD CONTROL PROJECT, FINAL ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT

Dear Mr. Glenn:

The County of Maui Department of Public Works, hereby transmits the final environmental assessment and finding of no significant impact (FEA-FONSI) for the Modification to the 'Īao Stream Flood Control Project in Wailuku on the island of Maui for publication in the next available edition of the Environmental Notice.

Copies of comments and responses received during the 30-day public comment period on the draft environmental assessment and anticipated finding of no significant impact (DEA-AFONSI) have been included in the FEA.

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

If there are any questions, please contact our Engineering Division (808) 270-7745.

Sincerely,

for DAVID C. GOODE
Director of Public Works

Enclosures
DG/KO (ED17-569)
S:\ENG\DESIGN\CIP\2006\06-55 IAO STREAM FLOOD CONTROL\B CORRESPONDENCE\LETTERS\2017-07-12 FEA-FONSI.DOC

18-015

AGENCY
PUBLICATION FORM

Project Name:	Modification to the ʻĪao Stream Flood Control Project
Project Short Name:	ʻĪao Stream Flood Control Project
HRS §343-5 Trigger(s):	Use of county lands and county funds
Island(s):	Maui
Judicial District(s):	Wailuku
TMK(s):	(2)3-4-020:044, 045, 046; (2)3-4-030:002; (2)3-4-030:020; (2)3-4-030:888; (2)3-4-031:001, 008, 015, 016, 017, 023, 019; (2)3-4-032:001, 003, 005, 047, 048
Permit(s)/Approval(s):	Clean Water Act (CWA), Section 404(b)(1) and Section 401 Water Quality Certification (WQC), Coastal Zone Management Federal Consistency review, Stream Channel Alteration Permit, and National Pollutant Discharge Elimination System (NPDES) Permit (to be submitted by the contractor prior to construction activities)
Proposing/Determining Agency:	County of Maui Department of Public Works Engineering Division
Contact Name, Email, Telephone, Address	Ms. Kristi Ono, Civil Engineer IV Kristi.Ono@co.maui.hi.us (808) 270-7745 200 South High Street, 4th Floor Wailuku, HI 96797
Accepting Authority:	(for EIS submittals only)
Contact Name, Email, Telephone, Address	
Consultant:	GSI Pacific, Inc.
Contact Name, Email, Telephone, Address	Miya Akiba makiba@gsisg.com (808) 754-0624 181 South Kukui Street Honolulu, HI 96813

Status (select one)	**Submittal Requirements**
____ DEA-AFNSI	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.
__✓__ FEA-FONSI	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.
____ FEA-EISPN	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.
____ Act 172-12 EISPN ("Direct to EIS")	Submit 1) the proposing agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.
____ DEIS	Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.
____ FEIS	Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.

____	FEIS Acceptance Determination	The accepting authority simultaneously transmits to both the OEQC and the proposing agency a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
	FEIS Statutory Acceptance	Timely statutory acceptance of the FEIS under Section 343-5(c), HRS, is not applicable to agency actions.
____	Supplemental EIS 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 or is not required; no EA is required and no comment period ensues upon publication in the Notice.
____	Withdrawal	Identify the specific document(s) to withdraw and explain in the project summary section.
____	Other	Contact the OEQC if your action is not one of the above items.

Project Summary

The United States Army Corps of Engineers (USACE) is proposing to implement engineering designs to address existing flood hazards and provide the authorized level of reduced flood risk along ʻIao Stream, Wailuku, Maui, Hawaiʻi. Implementation of the Proposed Action is needed to restore the reliability of the existing flood control strucutures and to protect the health and well-being of the Wailuku Community. The Proposed Action consists of features intended to reconnect the main channel with the floodplain to reduce damaging flows along the main channel and right bank levees. The reconnection would be accomplished by lowering a portion of the left bank, grading the overflow area, and construcing a diversion wall to force flood flows to enter the existing floodplain on the left bank. A portion of the left bank would be raised downstream to contain the overflow within the floodplain. Further downstream, the left bank would be lowered to allow the return of the overflow into the main channel. The Proposed Action also includes bank stabilization and reconstruction of the existing revetment to prevent further erosion of the stream bank. An Environmental Assessment (EA) has been prepared to give systematic consideration to the environmental, social, and economic consequences of the proposed project.

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

July 11, 2017

Civil and Public Works Branch
Programs and Project Management Division

Mr. David C. Goode
Director
Department of Public Works
County of Maui
200 South High Street, Suite 434
Wailuku, Hawaii 96793

Dear Mr. Goode:

The Honolulu District, U.S. Army Corps of Engineers (Corps) hereby transmits the Final Environmental Assessment (FEA) dated July 2017 and Finding of No Significant Impact (FONSI) for the Modification to the Iao Stream Flood Control Project (FCP) in Wailuku, Island of Maui, Hawaii, to the County of Maui Department of Public Works.

The enclosed FEA has been prepared pursuant to and in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 USC 4347, Section 102 (2)(C)) and the Hawaii Environmental Policy Act (HEPA) (Chapter 343, Hawaii Revised Statutes), to aid the Corps in determining whether the proposed action would have significant adverse effects on the human environment. The joint NEPA-HEPA FEA incorporates comments received from the public in response to the Corps' publishing of the draft Environmental Assessment (DEA) in March 2009 and DEA-Anticipated FONSI in July 2015. The comprehensive evaluation presented in the FEA substantiates the Corps' determination that the proposed action will not have a significant effect on the human environment, is neither an action nor resembles an action normally requiring preparation of an Environmental Impact Statement (EIS), is not an action without precedent and accordingly, does not warrant preparation of an EIS. This letter references the findings of the FEA and constitutes the Corps' FONSI.

As the local sponsor for the Iao Stream FCP, please notify the public of the availability of the FEA-FONSI by submitting this transmittal letter and the subject document for publication in the State of Hawaii Department of Health, Office of Environmental Quality Control periodic bulletin, *The Environmental Notice*. An electronic copy of the FEA-FONSI is provided as an Adobe Acrobat PDF file on the enclosed CD.

If you have any questions, please feel free to contact Ms. Nani Shimabuku, Project Manager, of the Civil and Public Works Branch at (808) 835-4030 or by email at lorayne.p.shimabuku@usace.army.mil.

Sincerely,

James D. Hoyman, P.E.
Lieutenant Colonel, U.S. Army
District Engineer

Enclosure

U.S. Army Corps of Engineers
Honolulu District

FINAL ENVIRONMENTAL ASSESSMENT
FOR
MODIFICATION TO THE ʻĪAO STREAM FLOOD CONTROL PROJECT
WAILUKU, ISLAND OF MAUI, HAWAIʻI

CONTRACT NO. W9128A-14-P-005



July 2017

Final Environmental Assessment
for
Modification to the ʻĪao Stream Flood Control Project
Wailuku, Island of Maui, Hawaiʻi

Contract No. W9128A-14-P-005

Pursuant to:

National Environmental Policy Act, 40 CFR 1500-1508; ER 200-2-2, and
Chapter 343, Hawaiʻi Revised Statutes

Prepared By:

GSI Pacific, Inc.
181 S. Kukui Street
Honolulu HI, 96813

Prepared For:

U.S. Army Corps of Engineers
Honolulu District

July 2017

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Appendix K: Cultural Impact Assessment

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ACRONYMS AND ABBREVIATIONS

%	percent
<	less than
≤	less than or equal to
°F	degrees Fahrenheit
ADAAG	Americans with Disabilities Act of 1990 Accessible Guidelines
AECOS	AECOS, Inc.
AIS	archaeological inventory survey
ALISH	Agricultural Lands of Importance to the State of Hawaiʻi
AMP	Archaeological Monitoring Plan
BEA	Bureau of Economic Analysis
bgs	below ground surface
BMP	best management practice
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CCA	crustose coralline algae
CDP	census designated place
CDUA	Conservation District Use Application
CEQ	Council on Environmental Quality
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
chl α	chlorophyll alpha
CIA	Cultural Impact Assessment
Cl	chloride
cm	centimeter(s)
CO	carbon monoxide
CO_2	carbon dioxide
COM	County of Maui
CRAMP	Coral Reef Assessment and Monitoring Program
CRED	Coral Reef Ecosystem Division

CRM	concrete rubble masonry
CWA	Clean Water Act
CWRM	Commission on Water Resource Management
CY	cubic yard(s)
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
DAR	Division of Aquatic Resources, State of Hawai'i
dB(A)	decibel (A-weighted scale)
DBEDT	Department of Business, Economic Development and Tourism
DFW	Division of Forestry and Wildlife
DLNR	Department of Land and Natural Resources
DNL	day-night sound level
DOE	Department of Education, State of Hawai'i
DOFAW	Division of Forestry and Wildlife
DOH	Department of Health, State of Hawai'i
EA	Environmental Assessment
EAB	expected annual benefits
EAD	expected annual damage
EAL	environmental action level
EDR	Environmental Data Resources, Inc.
EDR	Engineering Documentation Report
EFH	essential fish habitat
EIS	Environmental Impact Statement
EO	executive order
EPA	Environmental Protection Agency, United States
ER	Engineering Regulation
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FICON	Federal Interagency Committee on Noise
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
fps	feet per second
ft	feet
FWCA	Fish and Wildlife Coordination Act

FY	fiscal year
GDM	General Design Memorandum
GHG	greenhouse gas
HAR	Hawai‘i Administrative Rules
HDOA	Hawai‘i Department of Agriculture
HDOT	Hawai‘i Department of Transportation
HECO	Hawaiian Electric Company
HELCO	Hawaiian Electric Light Company
HRS	Hawai‘i Revised Statutes
HUD	United States Department of Housing and Urban Development
IcB	‘Īao clay
Idb	‘Īao cobbly silty clay
IIFS	interim instream flow standard
kg	kilogram
L	liter
LEERD	land, easements, rights-of-way, relocation, and disposal areas
LEPDA	least environmentally damaging practicable alternative
LUC	Land Use Commission
m	meter(s)
MBTA	Migratory Bird Treaty Act
MECO	Maui Electric Company
mg	milligram
mgd	million gallons per day
Mg/hr	metric ton(s) per hour
mg/kg	milligram(s) per kilogram
MPD	Maui Police Department
mph	miles per hour
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MUTCD	Manual on Uniform Traffic Control Devices
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NH_4	ammonium
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service

NO	nitrous oxide
NO_2	nitrogen dioxide
NOx	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
ns	not specified
O_3	ozone
O&M	operation and maintenance
OCCL	Office of Conservation and Coastal Lands
OEQC	State of Hawai'i Office of Environmental Quality Control
OHA	Office of Hawaiian Affairs
OSHA	United States Occupational Safety and Health Administration
PAL	Planning Aid Letter
Pb	lead
PCB	polychlorinated biphenyls
PCSI	Pacific Consulting Services, Inc.
PDT	Project Delivery Team
PL	Public Law
PM	particulate matter
PM_{10}	particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
PtA	Pulehu cobbly clay loam
PUC	Public Utilities Commission, State of Hawai'i
PZUE	Pu'uone sand
RCC	roller compacted concrete
RCRA	Resource Conservation and Recovery Act
ROM	rough order of magnitude
RS	River Station
SCS	Scientific Consulting Services, Inc.
SCS/CRMS	Scientific Consultant Services/Cultural Resource Management Services
SHPD	State Historic Preservation Division

SHPO	State of Hawai‘i Historic Preservation Office
SHWS	State Hazardous Waste Site
SIP	State Implementation Plan
SMA	special management area
SO_2	sulfur dioxide
SOEST	School of Ocean and Earth Science and Technology
SPAM	Stream Protection and Management
SPF	Standard Project Flood
SPS	Standard Project Storm
SRP	Social Research Pacific. Inc.
TCP	traditional cultural practices
TCP	Traffic Control Plan
TMDL	Total Daily Maximum Load
TMK	Tax Map Key
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compounds
WQC	water quality certification
WRDA	Water Resources Development Act

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1.0 INTRODUCTION

1.1 SCOPE AND AUTHORITY

The United States Army Corps of Engineers (USACE) is proposing to implement engineering designs to address existing flood hazards and provide the authorized level of reduced flood risk along Wailuku River (formerly 'Īao Stream; 'Īao Stream was officially changed back to Wailuku River as of May 27, 2015 by the Hawaii Board of Geographic Names), Wailuku, Maui, Hawai'i. A joint National Environmental Policy Act (NEPA) and Hawai'i Revised Statues (HRS) Chapter 343 compliant Environmental Assessment (EA) is being prepared for the Proposed Action, following a Draft EA previously released in March 2009 (USACE, 2009; Appendix A). The Proposed Action is authorized under Section 203 of the Flood Control Act of 1968 (Public Law [PL] 90-483), which authorizes works of improvement for the control of destructive floodwaters. The County of Maui (COM), Department of Public Works is the non-Federal sponsor and the requesting agency for concurrent compliance with HRS Chapter 343.

The Draft EA previously released in March 2009 (Appendix A) analyzed several alternatives to satisfy the project purpose and need. Following public review, because of public and agency concerns over potential significant impacts under the alternative that was recommended in the 2009 Draft EA, including direct, indirect, and cumulative impacts, associated with impairment of groundwater recharge, sediment loading impacts to native aquatic species and habitats, and other issues, in 2010, the USACE decided to prepare an Environmental Impact Statement (EIS). During the EIS alternative screening process, a new alternative measure (the Preferred Alternative addressed within this document) that addressed the project purpose and need, and did not require significant disturbance or modification to the existing stream alignment, was identified. Since this Preferred Alternative was anticipated to have minimal impacts to the existing condition of the stream and the environment surrounding the stream, in 2013, the USACE decided to re-scope the project from an EIS to an EA.

This EA has evaluated potential environmental impacts that may exist as a result of implementing the Proposed Action (the Preferred Alternative). Information and analysis incorporated into this EA from the March 2009 EA (Appendix A) are current and were used in the selection process of the Preferred Alternative in this EA. Based on this evaluation and following consideration of agency and public comments, a Finding of No Significant Impact (FONSI) determination decision has been made for the Proposed Action.

1.2 PROJECT LOCATION AND BACKGROUND

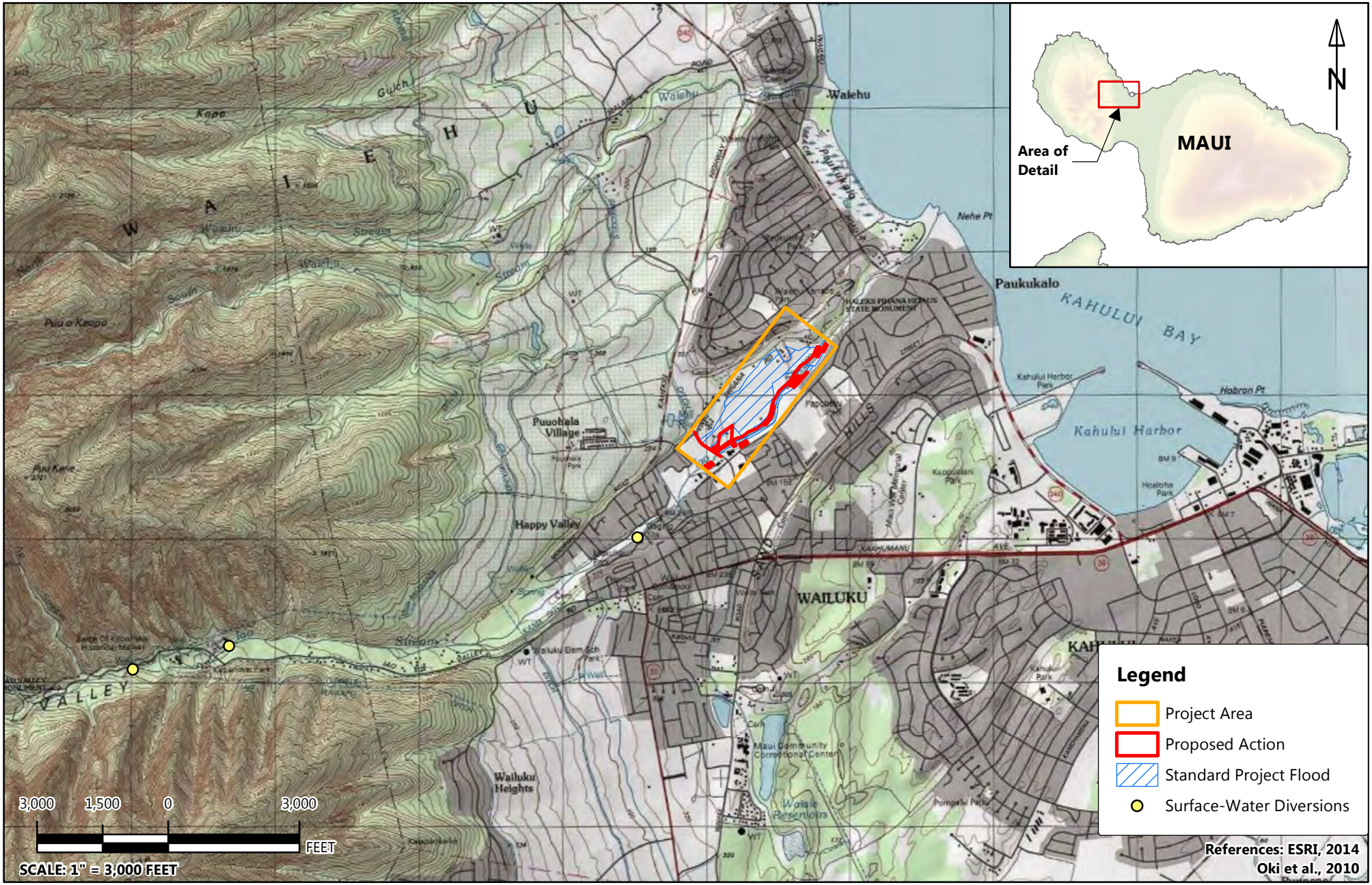
Project Location

Wailuku River is located within the Nā Wai 'Ehā Watershed in Wailuku, Maui. The Wailuku River drainage basin is a 10 square mile area that begins at the boundary between the Lahaina and Wailuku Judicial districts and extends from the crests of the Kahoolewa and Kapilau Ridges to the Pacific Ocean (Figure 1-1). The basin is 8 miles long and averages 1.25 miles in width. It is characterized by two major topographic features: a coastal plain that extends about 3 miles inland; and 'Īao Valley, the largest valley in West Maui, which extends from the coastal plain to the summit of Pu'u Kukui at an elevation of 5,800 feet (ft) above sea level.

Wailuku River is about 12,000 ft in length from an upstream sediment basin to its outlet into Kahului Bay, and about 30 percent (%) is lined with existing concrete channels. The remaining portions of the stream are an alluvial channel where the stabilization problems occur. Levees are situated on the right bank to protect the town of Wailuku. For more than a century, stream flow had been intermittent below the 'Īao intake due to three diversion structures which redirected the water to agricultural areas (Figure 1-1). Downstream of these agricultural diversion structures, stream flow had been absent 80 to 90% of the time, punctuated by infrequent high flows following intense rainfall events when stream discharge volume was sufficient to overtop the agricultural diversion structures (USFWS, 2006b). High water flows into the channelized portion of Wailuku River occurred only during periods of prolonged intense rainfall. In April 2014, an interim instream flow standard (IIFS) was established following an Order and Agreement issued by the Commission on Water Resource Management (CWRM). Pursuant to that April 2014 Settlement Agreement, the Wailuku Water Company began the release of 10 million gallons of water per day into Wailuku River on October 13, 2014.

The stream drains a steep valley with flows at the upstream limit conveyed into an existing debris basin and flood control system which was constructed between 1977 and 1981. This flood control system consists of the debris basin located 2.5 miles upstream from the stream mouth, a 3,500-ft long channel downstream from the debris basin, a drop structure with a 22-ft vertical drop, levees along the left and right bank, flood plain management along 6,950 ft of the left bank, and stream realignment for a 1,730-ft reach to the shoreline. In the flood plain management reach, levees are located on the right stream bank and are offset up to 80 ft beyond the existing stream bank (Figure 1-2).

Implementation of the Proposed Action would occur within the approximately 0.4-mile stretch of the stream between slightly downstream of Waena Street (River Station [RS] 42+30) and upstream of Imi Kala Street (RS 83+25), approximately 1.4 miles upstream from the shoreline. The area is characterized



ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED 'IĀO STREAM FLOOD CONTROL PROJECT

PROJECT LOCATION MAP
WAILUKU, MAUI, HAWAI'I

FIGURE 1-1

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Vertical drop structure (picture taken prior to flow restoration).



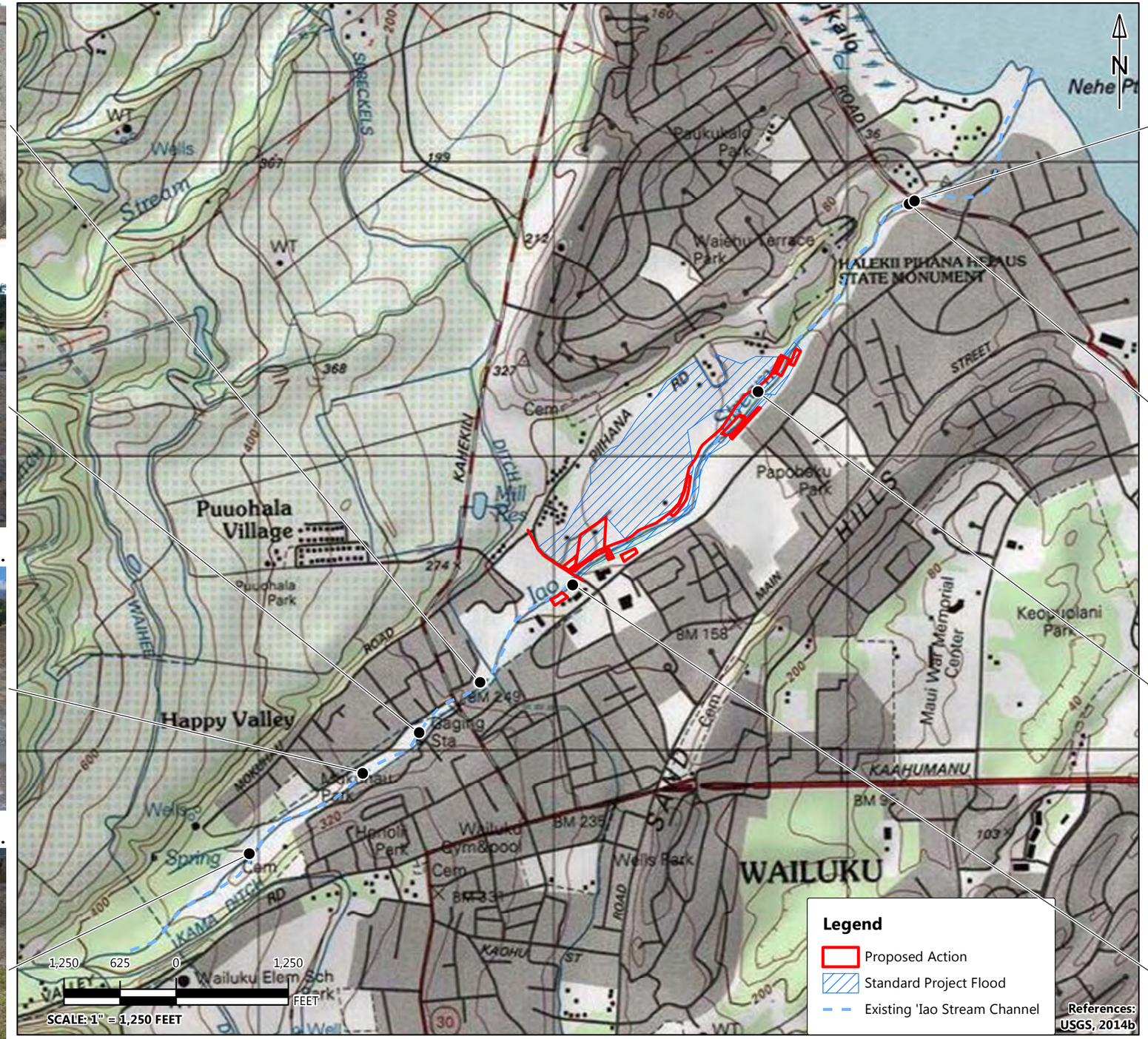
Drop structure and diversion feature (picture taken prior to flow restoration).



Low-flow stream channel (picture taken prior to flow restoration).



Spring draining into debris basin (picture taken prior to flow restoration).





Waiehu Beach Road crossing, facing west.



Low-flow channel beneath Waiehu Beach Road.



Eroded bank toe at river station 54+00.



Looking upstream from Imi Kala Bridge.

	ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED 'IĀO STREAM FLOOD CONTROL PROJECT	FIGURE 1-2
	EXISTING FLOOD CONTROL STRUCTURES WAILUKU, MAUI, HAWAI'I	

by extensive residential development on the right bank and an existing natural floodplain on the left bank, and is located upstream of existing residential and urban development associated with the town of Wailuku.

Project Background

The 1981 flood control project was authorized by the Flood Control Act of 1968 and was implemented after a NEPA-compliant EIS was completed with identified mitigation measures following approval of the EIS' Record of Decision (USACE, 1975). During the construction phase in January 1980, a flood occurred that caused extensive erosion of the sacrificial berm and undermined portions of the completed levees. To address this damage, the streamside slope of the levees was extended with a concrete riprap slope lining into the streambed. Considered to be a state-of-the-art design at the time, the toe of the cutoff walls was imbedded 5 ft in depth.

Shortly after project completion, stream flows caused erosion of the stream bottom along an approximately 7,000-ft reach between the concrete channel and Waiehu Beach Road. The project levee was undermined with scour depths extending to a maximum of 6 ft below the existing boulder concrete slope lining. In July 1982, USACE Honolulu District requested that corrective work be approved to extend the boulder concrete slope protection from the damaged portion to a minimum of 5 ft below the eroded stream bottom. The Office of the Chief of Engineers granted approval for this work in January 1983. The corrective work was completed in November 1983 under the Productive Employment Appropriation Act of 1983 and authorized under Section 205 of the Flood Control Act of 1948, PL 80-858, as amended. The stream channel has since eroded as much as 6 to 8 ft below the 1983 repair. The USACE subsequently decided to conduct a reconnaissance study pursuant to Engineering Regulation (ER) 1165-2-119 (paragraph 7a) to investigate solutions to the recurring problems that are slowly undermining areas of the levee. In March 1995, a report was submitted by USACE recommending modification to Wailuku River to replace the existing levee system with a 7,200-ft long trapezoidal concrete-lined channel.

A slope stability analysis was performed in 1997 to determine the stability of two areas identified as possible locations of levee failure. Stability analysis indicated instability could occur after flood waters recede at RS 40+00, assuming that the 1996 slope geometry would be further eroded to steepen the slope and deepen the stream bottom. If a SPF occurred prior to any repairs, flood waters would be able to pass through this portion of the levee, further erode it, and enter adjacent housing areas.

The existing stream channel has a relatively narrow width of 40 to 60 ft and is boulder lined. Levees with a surface of grouted riprap are interspersed along the right bank. The channel has an average slope of

2.6%. This steep stream channel results in critical and supercritical flows in the stream. The average channel velocity through the unlined portion of the stream varies between 8 and 32 feet per second (fps) with an average velocity in excess of 20 fps during annual floods. These high velocities have eroded the channel bed and caused severe undermining of the existing levees.

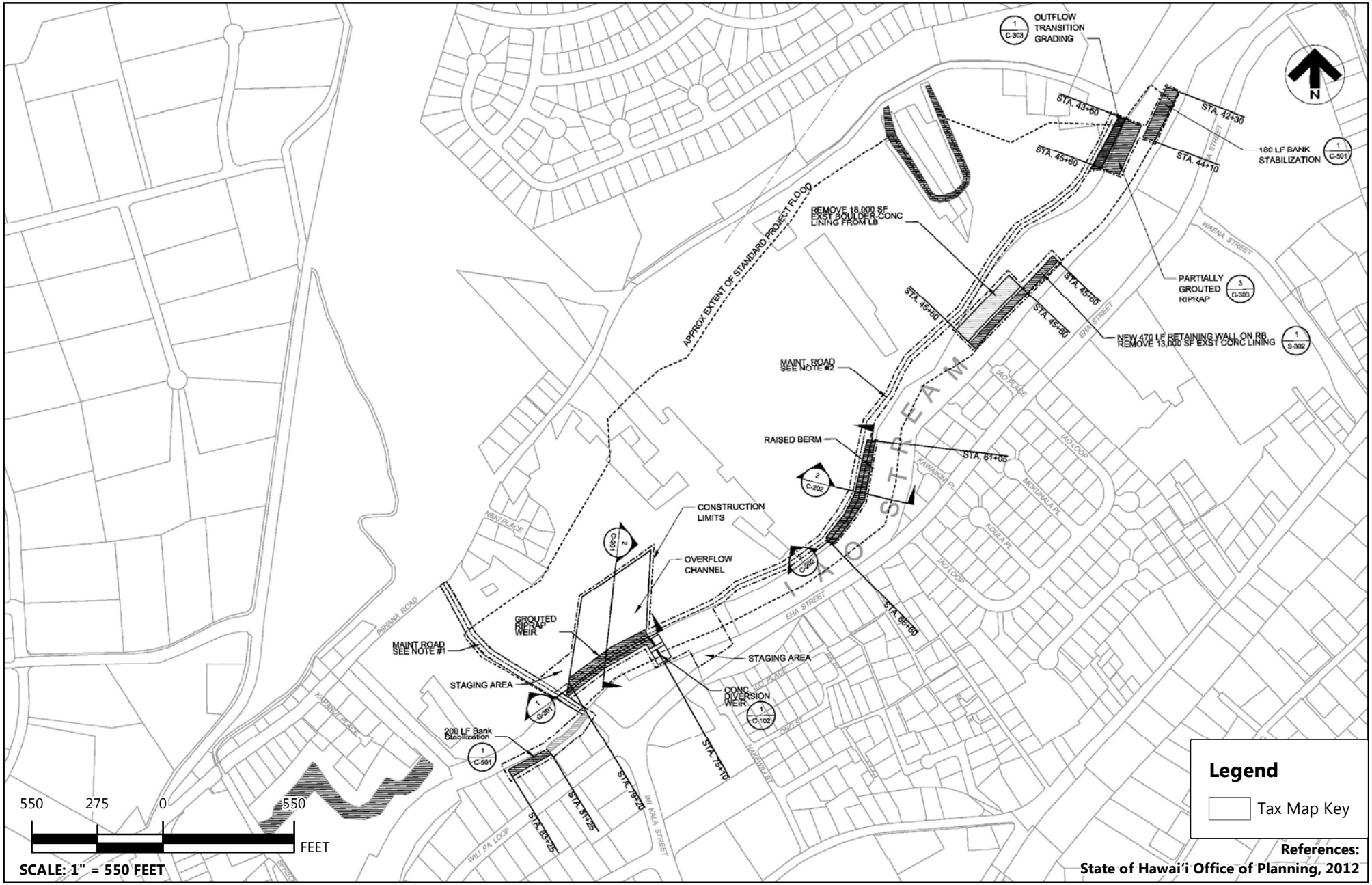
During the recent storm event that resulted in heavy rains on 15 to 16 September, 2016, significant damages to the existing levees occurred (USACE, 2016). A joint post-event inspection conducted by USACE and COM, Department of Public Works to verify and quantify the damages noted erosion of the earthen levees, levee toe erosion, and sideslope failure at multiple locations on the right bank of the stream downstream of Imi Kala Bridge. At the time of the inspection Maui County was making emergency repairs to the slideslope between RS 66+45 and RS 64+35 which was in danger of failure. Proposed methods for temporary repairs included filter fabric, large toe stones, inclusion of a toe trench and the possibility of using cement slurry to tie the armor atones together.

The original flood control project was designed to provide protection against a Standard Project Flood (SPF) (i.e., a flood event based on estimates under the most severe combination of meteorological and hydrologic conditions which are reasonably characteristic of the project site); however, the 33-year old flood control system no longer has the ability to provide its original level of protection to the town of Wailuku due to the recurring damages that have occurred since its original construction.

Wailuku River is in danger of reverting to a flood hazard zone due to deterioration/scour of the right bank and undermining of the levee toe resulting from changes in the streambed dynamic and upstream watershed use/development that have occurred during the past 30 years. In order to preserve the reliability of the existing flood control systems, additional structures are needed to protect the Wailuku community.

1.3 OVERVIEW OF THE PROPOSED ACTION

The Proposed Action consists of features intended to reconnect the main stream channel with the floodplain to reduce damaging flows along the main channel and right bank levees (Figure 1-3). The reconnection would be accomplished by lowering the left bank, grading the overflow area to disperse flow into the floodplain, and constricting the main channel with a concrete diversion weir to force flood flows to leave the main channel and enter the existing floodplain on the left bank of the stream. A portion of the left bank would be raised further downstream to contain the overflow within the floodplain. Even further downstream, the left bank would be lowered to allow the return of the overflow into the main channel. Figure 1-4 and Figure 1-5 show schematic diagrams of the features being proposed to divert the



ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻĪAO STREAM FLOOD CONTROL PROJECT

PROPOSED ACTION
WAILUKU, MAUI, HAWAI'I

FIGURE 1-3

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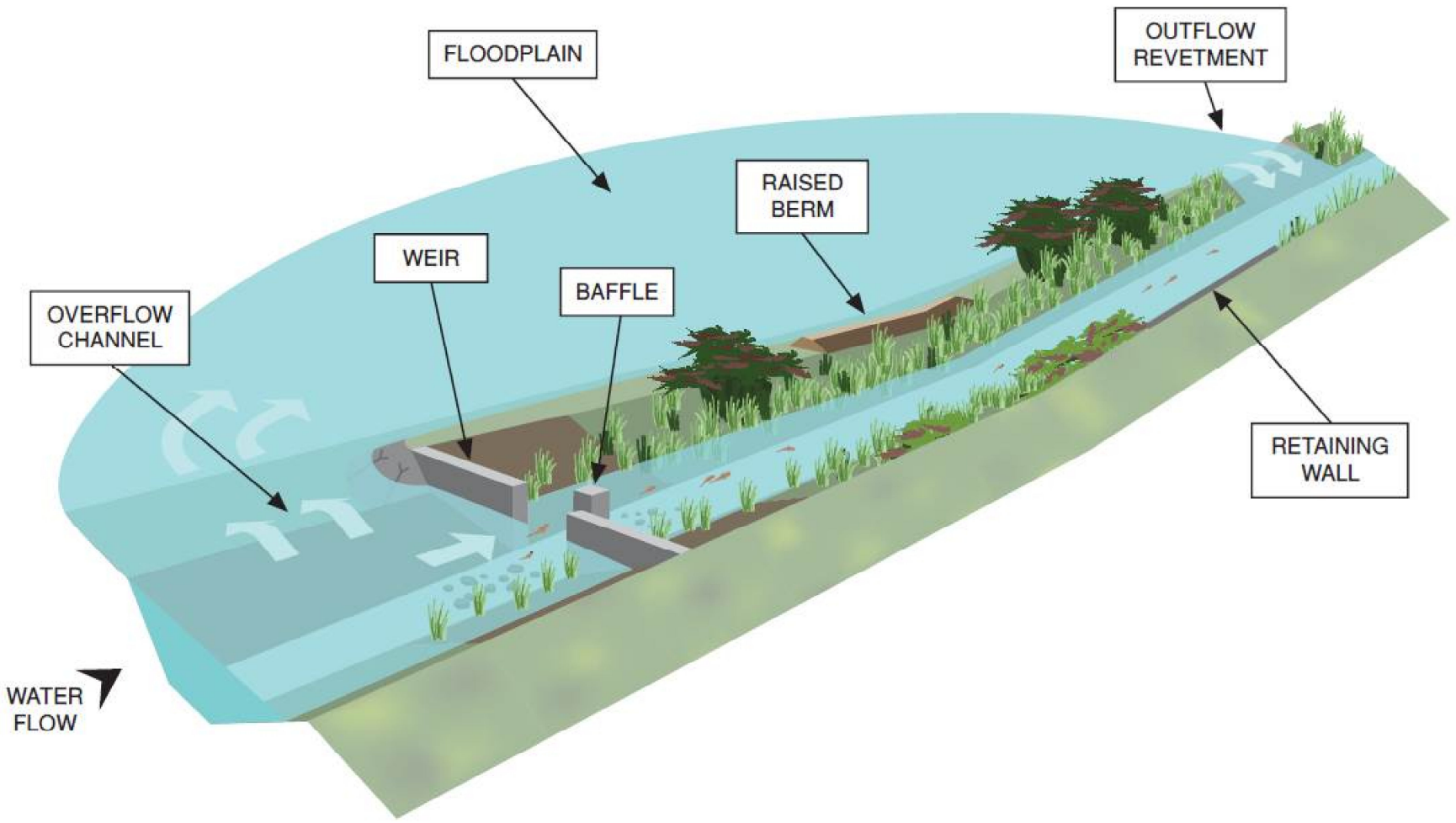

ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻIĀO STREAM FLOOD CONTROL PROJECT

PROPOSED ACTION - FLOODPLAIN RECONNECTION
WAILUKU, MAUI, HAWAI'I

FIGURE 1-4

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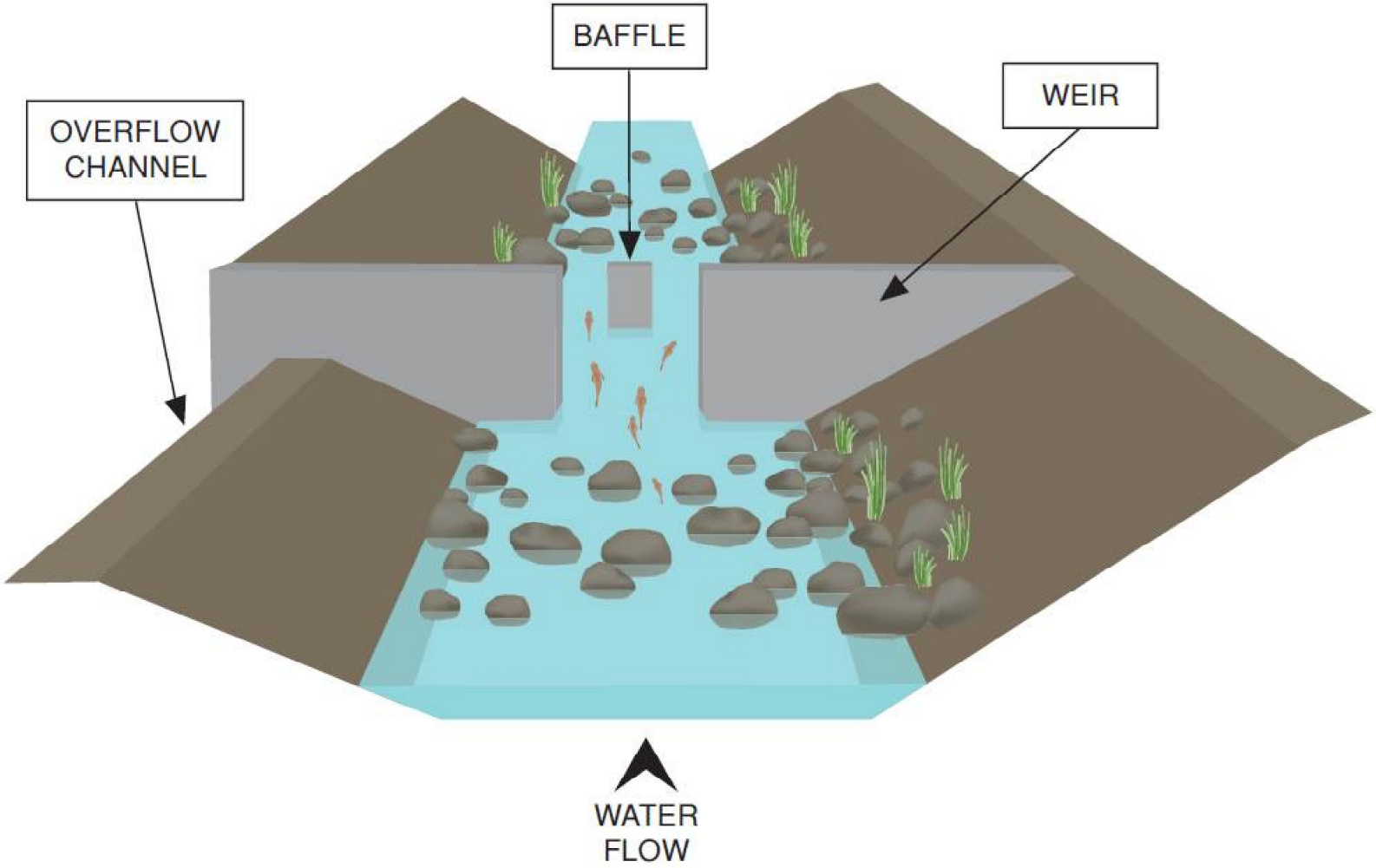

ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻIĀO STREAM FLOOD CONTROL PROJECT

PROPOSED ACTION - DIVERSION WEIR
WAILUKU, MAUI, HAWAI'I

FIGURE 1-5

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stream flow from the main stream channel to the floodplain. The Proposed Action would also include bank stabilization along the right bank upstream of the proposed overflow channel and downstream of the outflow return location to prevent further erosion in these areas. Further, the existing revetment between the overflow channel and outflow return location would be reconstructed as part of the Proposed Action.

1.4 PURPOSE AND NEED FOR ACTION

Purpose

The purpose of the Proposed Action is to address ongoing flood hazards caused by design deficiencies and long-term damage to the existing flood control structures suffered during repeated floods since their original construction in 1981 and to provide the authorized level of reduced flood risk to the town of Wailuku. The USACE is authorized to implement flood damage reduction improvements to Wailuku River that meet or exceed the SPF requirements to protect the existing Wailuku community. The SPF of 26,500 cubic feet per second (cfs) at the stream mouth was a 220-year event according to the peak discharge frequency computations presented in the 1976 General Design Memorandum (GDM) (USACE, 1976). A new comparison, using updated frequency analysis based on 62 years of recorded data at United States Geological Survey (USGS) gage 16607000 and the 2012 Federal Emergency Management Agency (FEMA) discharge frequency magnitudes (FEMA, 2012) considers the SPF peak discharge of 26,500 cfs to be closer to a 0.1% chance (or 1,000-year recurrence interval frequency) event. The Proposed Action is designed to slow the stream flow during flood events by diverting flow to the existing floodplain and by allowing the stream waters to be redirected downstream in a controlled manner.

Need

Repeated flooding of Wailuku River has resulted in undermining of the existing floodplain levees in several locations along the stream. High stream flows have resulted in downcutting (i.e., downward/vertical erosion) of the natural streambed and erosion of the base of the east bank levee structure. Several residential and commercial structures along the right bank are in danger of being undercut if streambank erosion continues as demonstrated by the extensive damages to the right bank that occurred as a result of the recent storm event in September 2016, as is the heiau along the lower reach of the left bank. The Proposed Action is needed to protect the many adjoining residences and commercial properties from flood damage during major storm events.

Certification that levees can withstand a 100-year frequency flood is required by FEMA; if not certified, this flood protection infrastructure is not deemed viable to protect property or lives from 100-year flood events. A government agency responsible for levee construction or a Registered Professional Engineer

must provide this certification. In their present condition, the 33-year old flood control structures cannot be certified as providing 100-year flood protection. The ʻĪao Stream Flood Control Project has prevented an estimated $49.6 million in flood damage as of the federal fiscal year (FY) 2013. The flood control system has instilled a sense of security in the growing community of Wailuku; however, Wailuku River is in danger of reverting to a flood hazard zone due to deterioration/scour of the right bank and undermining of the levee toe resulting from changes in the streambed dynamic and upstream watershed use/development that have occurred during the past 30 years. A failure in the deteriorating levees would cause flood waters to inundate the Wailuku River drainage basin and loss of life and extensive property damage would be inevitable. Implementation of the Proposed Action is needed to restore the reliability of the existing project and to protect the health and well-being of the Wailuku Community. Implementation of the Proposed Action would prevent further streambed erosion, thereby eliminating the risk of levee failure and the associated loss of life and property damage that could result.

1.5 REGULATORY FRAMEWORK

In planning and implementing the Proposed Action, the USACE must comply with all applicable environmental regulations and executive orders (EOs). These regulations and EOs include, but are not limited to the following:

- NEPA;
- HRS Chapter 343;
- Hawaiʻi Administrative Rules (HAR) Title 11-200;
- Clean Air Act (CAA);
- Clean Water Act (CWA);
- Coastal Zone Management Act (CZMA);
- Endangered Species Act (ESA);
- Fish and Wildlife Coordination Act (FWCA);
- National Historic Preservation Act (NHPA);
- EO 13089 (*Protection of Coral Reefs*);
- EO 12898 (*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*); and
- EO 13045 (*Protection of Children from Environmental Health Risks and Safety Risks*).

Key provisions of these regulations and EOs are discussed throughout the subsequent sections, and in detail in Section 4 of this EA.

1.6 PUBLIC INVOLVEMENT AND AGENCY CONSULTATION

This environmental review included public involvement and agency consultation, as required by NEPA and HRS 343. Public participation included an opportunity for public review and comment on this EA. Comments received on the Draft EA (2009) as well as comments received during the EIS screening process are included in Appendix B. Applicable comments were addressed as part of this EA analysis. The availability of the current draft EA was announced in the State of Hawai'i Office of Environmental Quality Control (OEQC) Environmental Notice publication on June 23, 2015 for a required 30-day public review period. As part of the draft EA public review period, 64 parties were consulted, and comments from 23 parties were received and addressed as part of the EA analysis (Appendix B).

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2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

This section provides the approach used in selecting the Proposed Action and its alternatives; a description of the No Action Alternative; identification of alternatives considered but eliminated from further analysis; a detailed description of the Proposed Action; selection of the Preferred Alternative; and a comparison of environmental consequences. The alternatives analyzed in this document in accordance with NEPA and HRS Chapter 343 are the result of agency and internal scoping input. All alternatives considered must meet the purpose and need for the Proposed Action.

2.1 APPROACH TO IDENTIFICATION OF ALTERNATIVE / LEDPA CONSIDERATION

The USACE proposes to address increased flood hazards at Wailuku River and provide an authorized level of reduced flood risk to the Wailuku community. An array of structural and non-structural alternatives that would best meet the project purpose and need in a feasible and effective manner was considered as part of the alternatives analysis process.

Code of Federal Regulations (CFR) Title 40, Part 230.10, Restrictions on Discharge outline provisions to comply with Section 404 (b)(1) guidelines of the CWA. The regulation states that "dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern." Under Section 404 (b)(1) of the CWA, only discharges of dredged or fill material into waters of the United States that represent the least environmentally damaging practicable alternative (LEDPA) that does not have significant environmental consequences are permitted. The USACE is not required to issue itself 404(b)(1) permits under 33 CFR 323.3 (b). An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes (40 CFR Part 230.10(a)(2)).

As part of the project alternative screening process, alternatives were analyzed to identify the LEDPA in accordance with 40 CFR Part 230.10(a). Under these guidelines the USACE requires that the LEDPA is considered for implementation as the Proposed Action.

Since the Proposed Action would include work in a stream that could result in potential discharge of fill and/or dredge material into an aquatic ecosystem, provisions of Section 404 (b)(1) of the CWA would apply. Therefore a Section 404 (b)(1) analysis has been prepared for the Proposed Action and is included as Appendix C. ER 1105-2-100, Appendix C was also used as guidance in preparing the Section

404(b)(1) evaluation for the Proposed Action, as well as in screening project alternatives to determine the LEDPA.

The following alternatives were considered during the initial alternative formulation process:

- Alternative A - No Action
- Alternative B - Removal of Flood Control Improvements
- Alternative C - Roller Compacted Concrete (RCC) and Grouted Boulder Invert Channel
- Alternative D - Dual Stilling and Sedimentation Basins
- Alternative E - RCC Channel with Grade Control Structures
- Other Alternatives
- Alternative F (Proposed Action) - Floodplain Reconnection

These alternatives were screened against four decision criteria, including completeness, effectiveness, acceptability, and efficiency, to determine which alternative would best meet the purpose and need of the project. Each decision criteria was specifically defined in terms of appropriate metrics to measure how well (i.e., *high*, *medium*, or *low*, or in some cases, *yes* or *no*) each alternative meets each criteria.

Factors considered in evaluating the completeness of each alternative were technical feasibility and life safety. Technical feasibility was defined as the ability of the alternative to meet the project purpose and need. Life safety was defined as the level of life safety risk reduction provided by the alternative. The effectiveness of each alternative was evaluated in terms of its ability to meet the SPF level of protection and ability to retain the floodplain as a restricted area where urbanized development is not allowed.

The acceptability criteria included multiple factors such as real state requirements, erosion and sediment transport, aquatic organism passage, and reduction in groundwater recharge. Efficiency of each alternative were evaluated based on the level of channel hardening required, operation and maintenance (O&M) requirements and cost, implementation cost, and net benefits.

A memorandum describing the steps used during the initial alternatives formulation process and detailed descriptions of each screening criteria used, as well as a complete matrix table that shows the rating of each alternative under each criterion is included in Appendix D. The following sections include a description of each alternative considered and criteria used to determine whether the alternative meets the project purpose and need.

2.2 NO ACTION ALTERNATIVE

The No Action Alternative (Alternative A) is to not construct any additional flood control structures at Wailuku River. Continuing severe erosion would likely result from implementation of the No Action Alternative, contributing to levee deterioration and ultimate failure in multiple locations, which would eventually lead to flooding of the Wailuku River drainage basin. Failure of the existing flood control structures could cause loss of life and extensive property damage. Council on Environmental Quality (CEQ) regulation 40 CFR Section 1502.14(d) requires an alternatives analysis to include a No Action Alternative. Therefore, although this alternative would not meet the project purpose and need, it is discussed throughout the document to provide the reader with a perspective of the "without-project" scenario.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANLAYSIS

As part of the NEPA and HRS Chapter 343 process, all potential alternatives must be evaluated. For alternatives to be considered reasonable, they must be affordable, implementable, meet the project purpose and need, and meet the established alternative selection criteria. Alternatives considered but eliminated as viable alternatives are described below.

Alternative B - Removal of Flood Control Improvements

Implementation of this alternative would include removal of all existing man-made improvements to the existing channel, including levees, concrete channels, flood walls, and drop structures, and returning the stream to its original natural state. With no flood protection levees in place, the Wailuku River floodplain would re-encompass community of Wailuku. Rather than relying on physical flood control infrastructure for flood protection, a state-of-the-art flood warning system would be used in advance of floods. Implementation of this alternative would require relocation of residents from the redefined flood-prone areas of Wailuku. Although this alternative does not meet the project purpose and need from an engineering perspective since it would not provide any protection against flood damage, there is expressed public support for this alternative due to its perceived environmental benefits. Removal of all man-made structures would improve the aesthetics of the stream as well as increase the potential for groundwater recharge and possibly restore habitats within the stream. Despite its public support, this alternative was eliminated from further consideration due to the high risk of loss of life and increased frequency of flood damage to the urbanized areas surrounding the stream.

Alternative C - Roller Compacted Concrete (RCC) and Boulder Invert Channel

Implementation of this alternative would include lining the unlined portion of Wailuku River using RCC, and was designed for SPF protection with a peak design discharge of 27,500 cfs downstream of RS 84+42 (0.5 miles upstream from the stream mouth) and 26,000 cfs downstream of RS 92+02. Typical stream stabilization improvements would consist of boulders in the main channel low-flow section with RCC stream bank protection in order to replicate a more natural stream bed. Design elements would be included into existing and planned channel segments to facilitate the movement of native fish and other aquatic organisms. Total project length extends from RS 22+00 to the debris basin (2.5 miles upstream from the shore).

Design elements would include:

- Modification to the existing drop structure between RS 96+74.21 and 97+23.21 to a new stepped drop structure to eliminate the dangerous 22-ft vertical drop and improve passage of in-stream fish (ʻ*o*ʻ*opu*) and other aquatic organisms.
- Modification to the existing low flow concrete channels with small blocks to break up high velocity flows and to facilitate fish passage.
- Adding hydraulic improvements to the concrete channel between RS 92+02 and 95+41 including baffle blocks and a weir within the existing concrete channel to more evenly distribute flow.
- Incorporating RCC side slopes and an approximately 15-ft wide and 20-inch deep grouted boulder invert channel that would mainly follow the alignment of the existing stream between RS 22+00 and 92+02 (approximately 7,200 ft long). The median base width range would vary from 40 to 60 ft.
- Stream realignment and widening between RS 76+02 and 85+30. The channel would be realigned to the north on the left bank to avoid existing structures to the right bank and be widened to reduce water surface profile at the ʻImi Kālā Street Bridge. As a result of the channel widening, the 10-year flood (i.e., the low flow condition of 7,200 cfs) would be contained within the channel but floods greater than 7,200 cfs and up to the SPF of 27,500 cfs would spread out on the existing left bank floodplain area.
- Construction of a low-flow boulder channel within the RCC portion. The approximately 15-ft wide low flow channel would use boulders embedded in concrete to replicate a more natural streambed substrate. Retrofit design elements would also be included to facilitate the movement

of native organisms through the modified channel area. These elements include a step structure at the 22-ft vertical drop (RS 97+23), widening existing low-flow channel areas, installing low-flow channel segments in existing flat-bottomed cement channel segments and in the center of the existing debris basin, blocks along the sloped portions of the existing channel to provide a resting place for climbing organisms, and an alignment along the vegetated portions of the left bank to provide shade and reduce water temperatures. These mitigation measures were proposed as compensation for unavoidable impacts, and were agreed to by the United States Fish and Wildlife Service (USFWS).

- Incorporation of right bank levee raises. The existing right bank levee would be raised at RS 45+37 to 48+85 by 4.5 ft using a concrete rubble masonry (CRM) wall on top of the existing earth levee and up to 0.7 ft at RS 25+62 to 26+46.

Alternative C was considered to achieve the project purpose and need, and feasible from an engineering and cost perspective. In addition, this alternative was initially considered to be the "environmental alternative" because it would minimize negative environmental impacts to the project area by: 1) utilizing the original floodplain along the left bank of the project for flood flows greater than 7,200 cfs and as a result keeping this area in open space; and 2) incorporating a boulder lined low-flow channel that would simulate a natural stream thereby creating a less severe stream environment than one that is strictly concrete lined. The low-flow channel was also designed to facilitate upstream and downstream migration of aquatic organisms. This alternative was recommended as the "Preferred Alternative" in the March 2009 Draft EA (USACE, 2009); however, in spite of the discussions between the USFWS and the USACE, and subsequent incorporation of additional mitigation measures, it was determined that Alternative C would result in unavoidable environmental impacts, including elimination or significant reduction in the potential for groundwater recharge and increase in the potential for upstream sedimentation to be transported to the ocean due to the concrete lining of the stream channel. Therefore, this alternative was eliminated from further consideration.

Alternative D - Dual Stilling and Sedimentation Basins

Implementation of this alternative would involve construction of two large stilling basins designed to dissipate the energy of large floods. The stilling basins would further act as debris traps as well as potential habitat and recreational areas. This alternative would also include realigning the stream channel where the natural alignment of the stream causes excessive erosion at the existing levee toe. This alternative was considered effective in meeting the project purpose and need by temporarily retaining stream waters during large storm events, thereby reducing stream velocity, which in turn would reduce

erosion downstream of the stilling basins. This alternative was also considered beneficial from an ecological standpoint since temporary storage of stream waters at the stilling basins would facilitate aquatic organism passage, allow sediment and debris to settle out, as well as allow groundwater recharge. However, due to its high implementation cost (specifically associated with real estate acquisition and O&M), this alternative was determined to be infeasible and eliminated from further consideration.

Alternative E - RCC Channel with Grade Control Structures

This alternative expands on Alternative C (RCC and Boulder Invert Channel) by adding small grade control structures within lined portions of the stream that would slow stream velocities and provide habitat within the stream channel. In addition, the channel would be realigned to avoid areas that cause erosion at the levee toe and banks. As with Alternative C, this alternative was considered effective in meeting the project purpose and need, and was considered environmentally beneficial by incorporating a low-flow channel designed to facilitate upstream and downstream migration of aquatic organisms. The addition of the small grade control structures was intended to decrease the stream velocity thereby reducing the potential for upstream sedimentation to be transported to the ocean. However, environmental concerns including a high level of channel hardening and reduction in potential for groundwater recharge remained. Therefore, this alternative was eliminated from further consideration.

Other Alternatives

The following three alternatives were initially carried forward from an earlier project development phase (USACE, 2009), but were eliminated from further consideration because they did not meet the project purpose and need.

Trapezoidal Concrete-Lined Channel

This alternative consists of a trapezoidal, concrete-lined channel with a 40-ft bottom width, 90-ft top width and interior splitter walls at channel curves. The new channel would mainly follow the existing stream alignment from RS 22+00 (0.5 miles upstream from the stream mouth) to 92+02 (1.8 miles upstream from the stream mouth), for a distance of 7,200 ft. The channel would also be realigned to the north between RS 76+40 to 86+60 (an approximate 950-ft length extending east and west of the 'Imi Kālā Street Bridge) to avoid affecting structures that have been constructed on the right bank. All design flows up to the SPF would be contained within the channel, thereby eliminating the need for the existing floodplain on the left bank and making the land available for development.

This alternative was considered to achieve the project purpose and need, and feasible from an engineering and economic perspective. However, this alternative would result in the most changes to the existing

habitat of the native stream fauna. Proposed changes in stream alignment and smooth concrete channelization (70% conversion) was considered to significantly impact existing natural habitat as well as alter stream flow, so that native amphidromous species may not survive. Due to the significant environmental impacts and objections by public and resource agencies with regard to the conversion of a natural stream bottom to a concrete-lined invert, this alternative was eliminated from further consideration.

Rectangular and Compound Channel

This alternative consists of a rectangular and compound, concrete-lined channel with a 20-ft bottom width and 145-ft top width between RS 22+00 and 92+02 for a distance of approximately 7,200 ft. Improvements would include a straightened alignment and a shallow 55-ft wide grass-lined channel adjacent on the left bank (to contain up to the SPF). Although effective in addressing flood control concerns, negative environmental impacts include destruction of the existing stream habitat due to straightening of the natural channel alignment and concrete lining of the stream, which will likely generate strong objections from the public and resource agencies. This alternative was eliminated from further consideration due to environmental concerns and economic viability.

Levee Toe Reconstruction

Rebuilding and extending toe protection was tried at Wailuku River after a storm in January 1980 and after a storm in 1981. Wailuku River has continued to erode adjacent to the toe protection works and is now 8 to 10 ft below the last toe protection repair that was completed in November 1983. The toe continues to erode because the cutoff wall at the levee toe is a fixed hard point in a moveable boulder and gravel bed stream. Although COM continues to fill areas adjacent to the toe cutoff wall after flood events by placing boulders against the eroding levee toe, the fixes are temporary because the work is not effective for low frequency events (USACE, 2008). No flood events larger than a 4% flood have occurred in the Wailuku River since project construction. Floods larger than the 4% flood would likely have enough force and duration to erode the stream near the toe of the cutoff wall causing undermining and consequential levee slope failure.

Installation of sheetpile cutoff walls to a depth sufficient to provide adequate toe protection and levee stability was not considered feasible due to the alluvial fill that comprises the streambed and physical characteristics of the areas below the levee toe (i.e., presence of boulders), which would preclude the ability to drive sheetpile to depth. Further, topographic characteristics of the area restrict the accessibility of heavy equipment (such as pile-drivers) along the right bank of the stream, where toe protection is

needed. Therefore, levee toe protection with a cutoff wall is not considered a viable solution for Wailuku River flood control. This alternative was therefore eliminated from further consideration.

2.4 ALTERNATIVE F - PROPOSED ACTION

This alternative consists of features that would reconnect the main channel with the existing floodplain on the left bank to reduce damaging flows along the main channel and right bank levees (Figure 1-3 and Figure 1-4; refer Appendix E for the engineering drawings). The reconnection would be accomplished by lowering the left bank approximately 5 to 9 ft between RS 78+99 and 75+10 (an approximate length of 417 ft along the left bank) and grading the overflow area to disperse flow into the floodplain. Following grading, revegetation (in the form of grass) would be provided throughout the approximately 116,060-squrare foot overflow channel to prevent erosion during diversion of stream waters. The stream would be constricted by a concrete diversion weir, located within the channel at RS 75+10, downstream and at the base of the overflow channel section. The diversion weir would be approximately 18-ft high with a 15-ft wide opening to allow for fish passage and some flow to remain in the channel (Figure 1-5). The invert of this structure would be at or below the existing stream bed elevation and low flow through the opening would be controlled by the natural riffles and pools formed by the existing boulder stream bed both up and downstream of the diversion weir. This design incorporates public and agency concerns regarding biological resources in the stream, including input provided by USFWS regarding biological function of the stream. This alternative also incorporates designs that minimize channel hardening within the stream, which in turn minimizes potential impacts to groundwater recharge, which was also a principal concern raised during preparation of the Draft EA released in March 2009 (USACE, 2009).

Constriction of the stream would force flood flows to leave the main channel and enter the existing designated floodplain area on the left bank of Wailuku River. Flood flows entering the floodplain at the overflow channel would spread out and follow the natural topographic gradient until reentering the main channel downstream at the outflow section. This alternative design replicates, to the extent practical, the natural hydrological pattern of an alluvial floodplain that existed within the area prior to modern development. Potential erosion within the floodplain during diversion of flood waters is expected to be minimized by existing vegetation within the floodplain. Transport of sediments to the main channel may occur during a flood event as great as an SPF; however, the proposed diversion would reduce erosion and associated sedimentation in the main channel resulting in overall reduction in sediment transportation to downstream areas, including Kahului Bay. Section 3.5.5 includes the results of the sedimentation study conducted for the Proposed Action.

The left bank between RS 66+60 and 61+05 (approximately 473 linear ft along the bank) would be raised by an earthen berm, up to approximately 6 ft, to contain the overflow within the floodplain. Further downstream, between RS 45+60 and 43+60, the left bank would be lowered to allow the return of the overflow into the main channel. At two locations, from RS 83+25 to 81+25 and RS 44+10 to 42+30, slope revetment is necessary to protect the bank from eroding under conditions of high stream velocities. These locations would be stabilized with boulder concrete slope lining or "shotcrete" to accommodate the steep bank slopes and protect the bank from erosion.

In addition, from RS 55+50 to 51+90, approximately 290 linear ft of revetment along the left bank would be removed entirely and restored to a natural earth embankment typical of upstream and downstream conditions. Restoration of the stream banks to its natural condition at this location is being proposed to remove the excess revetment that was added in 1984 which resulted in constriction of stream flow and subsequent increase in erosion in adjacent areas. Along the right bank, from RS 55+10 to 50+25 (approximately 470 linear ft), the concrete toe berm that has severely eroded would be removed and replaced with a concrete retaining weir to provide support to the existing embankment and prevent further erosion of the bank toe.

Currently, approximately 5,274 linear feet (RS 127+00 to 91+50 and 22+00 to 4+76) of the stream channel is lined with approximately 6,950 linear feet remaining unlined (RS 91+50 to 22+00). The Proposed Action will result in additional 83 linear feet of stream channel invert lining near RS 75+10.

Other features of this alternative include construction of a permanent 15-ft wide gravel road along the stream on the left bank between RS 75+10 and 43+60. This road would be used for future O&M activities. Site access during construction activities would be from Piihana Road along an existing road ending at RS 79+00. This road would also be used for future O&M activities.

This alternative would divert high-velocity and high-volume flood flows into the existing left-bank floodplain thereby reducing (but not eliminating) the main channel flow in the approximately 3,200-ft long reach of the stream. Hydraulic modeling used to assess the efficiency of this alternatives' design shows that in conjunction with natural overflow into the left bank upstream, the overflow channel and diversion weir adequately divert enough stream flow during an SPF event to restrict the flow downstream to less than the 10-year frequency event discharge. This would result in a reduced risk of flooding during high-flow/flood events to authorized levels.

Diversion of stream waters would also reduce erosion of the stream banks, which would prevent further damage to the existing flood control systems and increase its reliability. Finally, under these

improvements, required certification of the levee system could occur to verify that this flood protection system would be viable to protect property and lives from 100-year flood events.

During the alternatives formulation process in the past, project design features intended to minimize environmental disturbance such as adding structural features within the stream to facilitate aquatic organism passage or creating shaded areas to reduce water temperatures for aquatic species present in the stream were considered. Previous design alternatives included modification or disturbance to a larger section of the stream reach (as compared to the current Proposed Action) which would have resulted in significant impacts to biological resources; as such, those impacts required measures to mitigate impacts to biological resources and also included opportunities to construct design features that would support native aquatic species habitat function within the modified portions of the stream. The Proposed Action does not include modification to the existing drop structure between RS 96+74.21 and 97+23.21 since it is outside of the project area and beyond the scope of the project objective to address this feature.

On September 17, 2014, the Project Delivery Team (PDT) met with resource agencies (USFWS, United States Environmental Protection Agency [EPA], National Marine Fisheries Service [NMFS], State of Hawaiʻi Division of Aquatic Resources [DAR], and COM) to provide an overview of the current Proposed Action. The team explained to the resource agencies that mitigation measures would not be required since channel hardening within the stream is no longer being proposed and since no significant impacts to biological resources are anticipated. The resource agencies concurred with this determination and expressed support on the Proposed Action. The meeting minutes from this meeting are included in Appendix F.

In April 2014, the CWRM issued an order establishing an IIFS, the minimum required flow, of 10 million gallons per day (mgd) (approximately 15.5 cfs) for Wailuku River near Kepaniwai Park, approximately 2.8 miles upstream of the project site; further, the order stipulates that a minimum flow of 5 mgd be maintained at the mouth of the stream, less than 1 mile downstream of the project site. It was also ordered that no water may be diverted at the Waihe'e/Spreckels Ditch intake located upstream of the proposed project area, except when the stream flow is adequate to satisfy the IIFS of 5 mgd (approximately 7.7 cfs) at the mouth of Wailuku River (Osher, 2014). The IIFS was implemented in October 2014. The proposed 15-ft wide opening in the diversion weir would not impact the ability for an IIFS of greater than 5 mgd to remain in the channel through the project area and downstream to the stream mouth. Further, the Proposed Action is designed to disperse approximately 21,800 cfs of the total SPF peak discharge (27,500 cfs) across the floodplain, which would accommodate the IIFS and provide adequate protection against SPF events following implementation of the IIFS.

A detailed description of the Preferred Alternative including documentation of the hydraulic modeling used to assess the efficiency of the proposed structures and cost estimates is included in the Engineering Documentation Report (EDR) prepared for the project.

2.5 SELECTION OF PREFERRED ALTERNATIVE

After comparing each alternative against the established selection criteria identified in Section 2.1, the USACE selected Alternative F as its LEDPA/Preferred Alternative. This alternative was considered the LEDPA/Preferred Alternative because it meets the project purpose and need by offering adequate flood protection to the currently built environment without requiring significant disturbance or modification to the existing stream alignment. Since this alternative would not involve hardening of the existing channel, impacts to the surrounding environment are expected to be minimal and the LEDPA. Flood waters would be dispersed into the natural floodplain where sediment and other entrained constituents would be able to settle out instead of being directly channeled downstream and into the nearshore marine environment.

In addition, of the alternatives considered, Alternative F was considered the most economically feasible and beneficial alternative. Determination of whether the considered alternatives offered net benefits were based on the estimated benefits and rough order of magnitude (ROM) costs. The benefits analysis was based primarily on structural damages prevented. Structural damages generally started to occur at a 1% Annual Chance Exceedance event; therefore, there were not a significant amount of benefits incurred for smaller flood events. Since all of the alternatives had the same effect (i.e., in providing protection against floods greater than 1% Annual Chance Exceedance events), the benefits were assumed to be constant among all alternatives considered. The ROM costs for Alternatives B through E were significantly higher than Alternative F; thus, Alternative F was considered to offer the greatest net benefit. The major elements of the Preferred Alternative are included in Table 2-1.

Table 2-1: Preferred Alternative Construction Details

Element	Description
Overflow Channel	• Lower the left bank by approximately 5 to 9 ft between RS 79+20 and 75+12 (approximate length of 437 ft). • Placement of grouted riprap along the lowered left bank for bank protection. • Grade and provide grassing throughout the approximately 116, 060-square foot overflow channel on the left bank. • An approximately 18-ft high concrete diversion weir downstream of the overflow channel.
Raised Berm	Placement of an approximately 6-ft high (maximum height) earthen berm on the left bank between RS 66+60 and 61+05 (approximately 473 linear ft).
Floodplain Outflow	• Lower the left bank between RS 45+60 and 43+60 (up to 6 ft). • Placement of partially grouted riprap on the left bank for protection against erosion during the return of the overflow to the main channel.
Slope Revetment	• Placement of boulder concrete slope lining or "shotcrete" on the right bank between RS 83+25 and 81+25 (approximately 200 linear ft). • Removal of revetment along the left bank between RS 55+00 and 51+90 (approximately 290 linear ft) and restoration to natural earth embankment typical of upstream and downstream conditions. • Removal of existing concrete toe berm between RS 55+00 and 50+25 (approximately 470 linear ft) and replacement with a concrete retaining wall. • Placement of boulder concrete slope lining or "shotcrete" on the right bank between RS 44+10 and 42+30 (approximately 180 linear ft).
Grading required	The existing grade within the overflow channel would be evened out to create a flat surface.
Total impervious surface	Approximately 38,650 square feet or 0.9 acres; approximately 8,500 square feet for bank stabilization (shotcrete), 6,000 square feet for the concrete diversion weir and related invert (concrete), and 24,150 square feet for the overflow weir (grouted riprap).
Staging areas	Two staging areas at the overflow channel location: one on the right bank (near Eha Street and Imi Kala Street) and one on the left bank near the Imi Kala Bridge.
Site Access	• From Piihana Road along an existing 15-ft wide, 750-ft long gravel road. • A permanent 15-ft wide gravel O&M road will be constructed along the stream between RS 75+10 and 43+60.

Element	Description
Best management practices (BMPs) to be included during construction	Use of silt fences; concrete structures would be constructed in halves by temporarily diverting the stream to one side of the channel. While one side is constructed, the other side would be used for stream flow to accommodate the IIFS of 5 mgd.
Types of construction equipment to be used	Excavator, front-end loader, and dump trucks.
Location of disposal of debris and excavated materials	• Excavated soil removed to create the overflow channel will be tested and reused to construct the raised berm downstream. • Any excess excavated material will be tested and disposed of at the Maui Demolition and Construction Landfill (approximately 6 miles from project site) in Māʻalaea, Maui.
Construction duration	Approximately 21.32 months.
O&M	• Clearing the overflow channel and diversion weir once every five years • Grass cutting at the diversion weir, new berm, and access/O&M road six times per year.

2.6 COMPARISON OF ENVIRONMENTAL CONSEQUENCES

Table 2-2 summarizes the alternatives effects on each resource based on the impact analysis described in Section 3, Affected Environment and Environmental Impacts, of this EA.

Table 2-2: Summary of Potential Impacts

Resource Issue	Preferred Alternative	No Action Alternative
Geology, Soil, and Topography	Short-term: Grading activities needed to construct the overflow channel would have minor impacts to site soil. Long-term: No impacts/minor change in topography due to construction of the overflow channel system and bank stabilization.	Short- and Long-Term: Continued erosion of the stream bank and increase in soil loss during high flow events.
Climate, Air Quality, Greenhouse Gases (GHGs)	Short-term: Temporary increase in fugitive dust and vehicle emissions during construction activities. Long-term: No impacts.	No impacts.
Noise	Short-term: Temporary increase in noise levels from construction equipment and vehicles. Long-term: No impacts.	No impacts.
Water Resources	Short-term: Less than significant impacts during construction. Implementation of best management practices (BMPs) would prevent runoff from entering stream waters during construction activities. Long-term: Beneficial impacts to water quality due to decrease in erosion and sediment transport.	Short- and Long-Term: Continued transportation of sediment and debris in stream waters. Significant impacts on water quality in nearshore waters in Kahului Bay.
Biological Resources	Short-term: Less than significant impacts during construction due to temporary displacement of widespread common species. Long-term: No long-term loss of species or habitats is anticipated. Decrease in sedimentation would have beneficial impacts to the marine species in nearshore waters of Kahului Bay.	Short- and Long-Term: Continued significant impacts to the nearshore marine habitat due to sedimentation.

Resource Issue	Preferred Alternative	No Action Alternative
Historical and Cultural Resources	Short- and Long-Term: No impacts are anticipated; archaeological monitoring to be conducted during ground-disturbing activities.	Short- and Long-Term: Significant impacts to the Halekiʻi-Piʻihana Heiau located along the stream bank located in a high erosion area.
Land Use	Short-term: Less than significant impacts during construction activities. Long-term: Beneficial impacts due to reduced flood risk.	Short- and Long-Term: Significant impacts to residential/commercial areas along the stream bank due to the current inadequate flood control measures.
Visual/Aesthetics	Short-term: Less than significant impacts during construction activities. Long-term: Less than significant.	Short- and Long-Term: Significant impacts due to potential levee failure.
Recreational resources	No impacts.	No impacts.
Socioeconomics	Short-term: Beneficial impacts by creating temporary employment opportunities during the construction period. Long-term: Beneficial impacts due to decreased flood risk.	Short- and Long-Term: Significant impacts from extensive damage to residential and commercial properties due to inadequate flood control.
Public Infrastructure and Utilities	Short-term: No impacts. Long-term: Beneficial impacts by preventing flooding and damage to public infrastructure.	No impacts to public infrastructure; however, undermining of the existing flood control system would continue.
Traffic and Circulation	Short-term: Less than significant impacts during the construction period. Long-term: Less than significant impacts during maintenance of flood control structures. Beneficial impacts by preventing traffic/circulation inhibitors during potential flooding.	No impacts.
Solid and Hazardous Material and Wastes	Short-term: Less than significant impacts during construction activities. Long-term: Less than significant impacts from maintenance activities.	No impacts.

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3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

The environmental, social, and economic setting of the project site and the probable impacts of the No Action Alternative and the Proposed Action - Preferred Alternative are described in this section of the EA. Impacts may apply to the full range of natural, aesthetic, historic, cultural, and economic resources. The following subsections define key terms used throughout Section 3.

Impacts

Direct Impacts are caused by the action and occur at the same time and place.

Indirect Impacts are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect impacts may include growth inducing impacts and other impacts related to induced changes in the pattern of land use, population density or growth rate, and related effects on air, water and other natural systems, including ecosystems.

Beneficial Impacts are those that would produce favorable outcomes and add value to the environment.

Adverse Impacts are those that would produce detrimental effects and cause harm to the environment.

Cumulative impacts are impacts on the environment which result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Impacts include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historical, cultural, economic, social, or health, whether direct, indirect, or cumulative. Impacts may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (40 CFR 1508.8).

Significance of Environmental Impacts

A "significant effect" is defined by HRS Chapter 343 as "the sum of effects on the quality of the environment, including actions that irrevocably commit a natural resource, curtail the range of beneficial uses of the environment, are contrary to the State's environmental policies or long-term environmental goals as established by law, or adversely affect the economic welfare, social welfare, or cultural practices of the community and State."

According to the CEQ regulations (40 CFR 1500-1508), the determination of a significant impact is a function of both context and intensity.

Context: This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of a Proposed Action. For instance, in the case of a site-specific action, significance would usually depend on the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

Intensity: This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

1. Impacts that may be both beneficial and adverse. A significant impact may exist even if the Federal agency believes that on balance the effect will be beneficial.
2. The degree to which the Proposed Action affects public health or safety.
3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.
5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the ESA of 1973.

10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment (40 CFR 1508.27).

To determine significance, the severity of the impact must be examined in terms of the type, quality and sensitivity of the resource involved; the location of the proposed project; the duration of the effect (short or long-term) and other consideration of context. Significance of the impact will vary with the setting of the Proposed Action and the surrounding area (including residential, industrial, commercial, and natural sites).

3.1 GEOLOGICAL RESOURCES

3.1.1 Definition of Resource

Geological resources typically consist of surface and subsurface materials and their inherent properties. Principal geologic factors affecting the ability to support structural development are seismic properties (i.e., potential for subsurface shifting, faulting, or crustal disturbance), soil stability, and topography.

The term *soil*, in general, refers to unconsolidated materials overlying bedrock or other parent material. Soils play a critical role in both the natural and human environment. Soil structure, elasticity, strength, shrink-swell potential, and erodibility all determine the ability for the ground to support man-made structures and facilities. Soils typically are described in terms of their complex type, slope, physical characteristics, and relative compatibility or constraining properties with regard to particular construction activities and types of land use.

Topography is the change in elevation over the surface of a land area. An area's topography is influenced by many factors, including human activity, underlying geologic material, seismic activity, climatic conditions, and erosion. A discussion of topography typically encompasses a description of surface elevations, slope, and distinct physiographic features (e.g., mountains), and their influence on human activities.

Natural hazards prone to the area include earthquakes, tsunamis, and volcanic activity. Earthquakes typically result from release of energy from the earth's crust and manifest themselves by shaking and sometimes displacement of the ground which can result in property damage. Earthquakes can also trigger landslides and occasionally volcanic activity. When the epicenter of a large earthquake is located offshore, the seabed may be displaced sufficiently to cause a tsunami. A *tsunami* is a series of water waves caused by the displacement of a large volume of a body of water. Great wave heights can be generated by large events; although the impact of tsunamis is limited to coastal areas, their destructive

power can be enormous. *Volcanology* addresses evaluation of activities associated with volcanoes (including eruptions, lava flow, magma) and related geological phenomena.

3.1.2 Regulatory Setting

The Maui County Code Section 20.08.250 describes proper permitting and inspection procedures necessary for grading, soil erosion, and sediment control during earthwork activities. All work, including excavation and fill work, shall be in accordance with current construction standards and all local, state, and federal regulations.

3.1.3 Existing Conditions

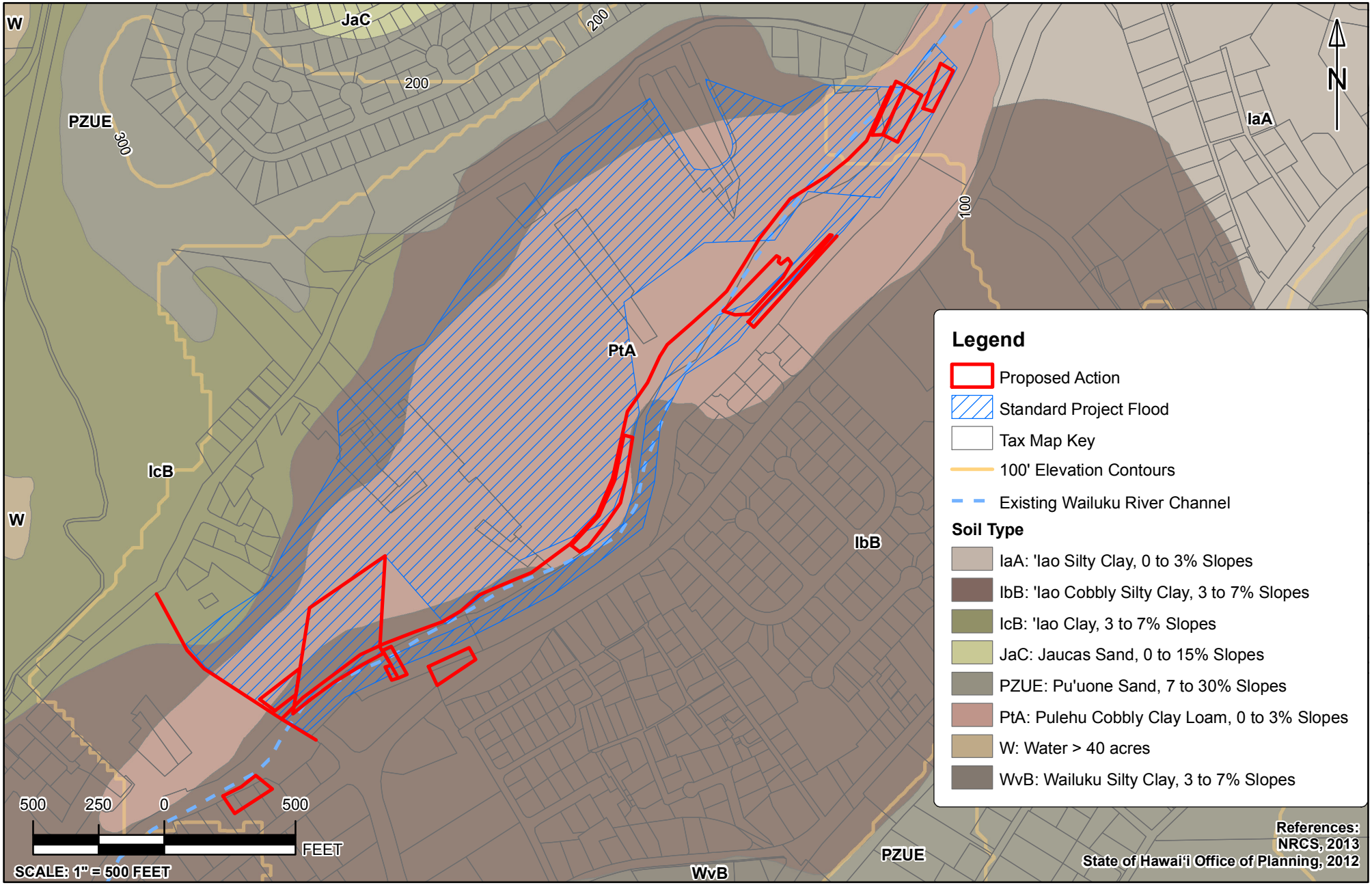
Geology

The Hawaiian Archipelago is a chain of seamounts and islands in the North Pacific extending 1,616 miles west by northwest from the largest Island of Hawaiʻi. Igneous rocks are the dominant rock type and consist of basaltic flows, caldera and dike complexes, and pyroclastics. The Island of Maui, the second largest of the Hawaiian Islands, was formed by the intersection of two shield volcanoes, East Maui (Haleakalā) and West Maui (Mauna Kahalawai or the West Maui Mountains), linked by the narrow isthmus of overlapping lava flow events. The older, smaller, and more eroded volcanic center constitutes West Maui, while East Maui is the product of Haleakalā, a younger, much larger, and less dissected volcanic shield (Hazlett and Hyndman, 1996; Stearns, 1985). West Maui rises 5,788 ft above sea level and is 18 miles long and 15 miles wide. Thin flows of pāhoehoe lava formed the young shield of West Maui, completed around 1.3 million years ago. The lavas that erupted during this main stage of growth are known as the Wailuku basalts. Rift zones were developed that trend north and south of the caldera at the summit of West Maui.

Topography and Soils

Soils in the area of Wailuku generally retain a high organic matter content, and are composed of clay, silt, and sand, mixed with varying degrees of gravel, cobble, and boulders. Major soil types underlying the area of the Proposed Action and SPF floodplain include ʻĪao cobbly silty clay (Idb), ʻĪao clay (IcB), Pulehu cobbly clay loam (PtA), and the Puʻuone sand (PZUE) (Figure 3-1).

The Proposed Action would require earthwork activities only in the ʻĪao cobbly silty clay and the Pulehu cobbly clay loam. The ʻĪao cobbly silty clay is present on alluvial fans and valley fill areas, has an erosion hazard of slight to medium, and a medium degree of runoff. The Pulehu cobbly clay loam is



ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻĪAO STREAM FLOOD CONTROL PROJECT

SOILS MAP
WAILUKU, MAUI, HAWAI'I

FIGURE 3-1

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present on alluvial fans and basins, has a slight erosion hazard, and a slow degree of runoff (NRCS, 2013).

Earthquakes

In Hawai'i, earthquakes are generally linked to volcanic activity and occur thousands of times annually; the vast majority of which are at very small magnitudes. On Maui, the USGS classifies the island as within seismic zone 2B, indicating that ground accelerations of 20% of the acceleration due to gravity are likely to occur at a probability of 10% in a 50 year exposure time (USGS, 2001).

Tsunamis

A tsunami is a series of great waves, typically the result of a violent displacement of the seafloor. Tsunamis are characterized by high speeds (up to 560 miles per hour), long wave lengths (up to 120 miles), and long periods between successive wave crests (up to several hours). Tsunamis have the potential to inundate the coastline, causing severe property damage and/or loss of life. Located in the middle of the Pacific Ocean, Hawai'i is susceptible to tsunamis from earthquakes and tsunamis generated in the Pacific Rim. The Proposed Action is outside the limits of the tsunami evacuation zone; however, downstream portions of Wailuku River are within the tsunami evacuation zone (Figure 3-2).

Volcanology

The East Maui Volcano, also known as Haleakalā, is the only active volcano in Hawai'i outside of the Big Island; however, it is generally considered to be dormant. The last eruption occurred in the late 1700s, and Haleakalā is in the post-shield volcanic stage (USGS, 2003).

3.1.4 Approach to Analysis

Determination of the significance of potential impacts to geological and soil resources is based on 1) the importance of the resource (i.e., commercial, ecological, and/or scientific); 2) the proportion of the resource that would be affected relative to its occurrence in the region; and 3) the susceptibility for deleterious effects on the resource due to the Proposed Action. Impacts to geological and soil resources are significant if the physical structure, chemical composition, or visual aesthetic character are significantly impacted over a relatively large area.

3.1.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, no construction or change in ground surface is expected. Although no significant impacts to soil, topography, or geologic resources are expected to result from implementation of the No Action Alternative as it pertains to construction, soil erosion of stream banks would continue to occur, undermining existing flood control levees and contributing to nearshore sedimentation downstream of the project site.

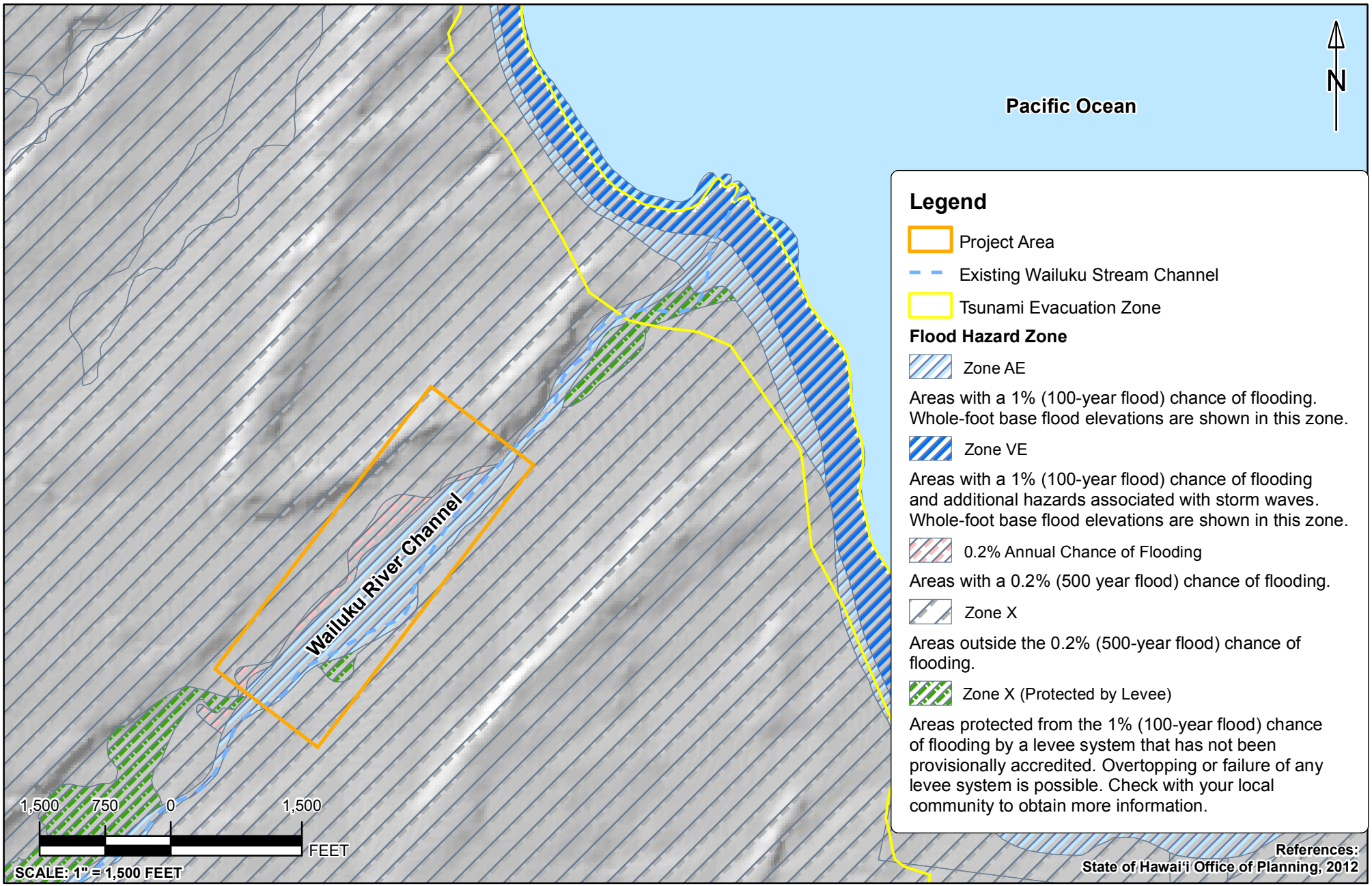
Proposed Action

Implementation of the Proposed Action would have less than significant short-term impacts on affected soils within the project area during the construction period. Minor topographic alterations at the project site would be necessary in order to construct the proposed overflow channel system. Excavated soil to construct the overflow channel would be tested and reused to construct the raised berm downstream. Any excess soils would be tested and either be reused elsewhere on the island or would be trucked to an appropriate on-island landfill and properly disposed. As part of project development, BMPs addressing soil and erosion control (e.g., silt fencing, tarping/covering, surface revegetation, etc.) would be implemented to minimize/eliminate soil migration from the proposed construction area.

There are no anticipated significant long-term impacts to site soils, geology or topography during the operation of the Proposed Action. The proposed overflow channel system would retain sediment and debris entrained in flood waters, and would result in a long-term decrease in downstream sedimentation and debris deposit. Routine monitoring and maintenance (e.g., clearing the system of collected sediment and debris) would ensure that the channel system continues to function as designed.

Given the shallow depth of excavation for grading activities, lack of sensitive geological resources, and implementation of soil-control BMPs, no significant impacts to geology, soils, or topography are anticipated.

The Preferred Alternative would not result in change to the natural hazards boundaries of floods and tsunamis, and would not significantly affect the generation of a natural hazard. Construction activities proposed under the Preferred Alternative have the potential to be impacted by flooding events. A limited amount of ground surface is expected to be exposed temporarily during ground disturbing activities, which may increase the potential for runoff during flooding events. Significant impacts during flooding events would be minimized by both temporary and permanent erosion and sedimentation control measures, such as silt fences or grass block pavers, in and around the areas where ground surface is



ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻĪAO STREAM FLOOD CONTROL PROJECT

FLOOD AND TSUNAMI HAZARD MAP
WAILUKU, MAUI, HAWAI'I

FIGURE 3-2

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exposed. If a natural hazard occurs during construction activities, all site work would cease until it can be resumed safely.

3.2 CLIMATE, AIR QUALITY, AND GREENHOUSE GASES

3.2.1 Definition of Resource

Climate

Climate is defined as long-term atmospheric patterns that characterize a region or location, and includes measures of temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count, and other meteorological variables. Knowing the climate of an area enables the predictability of short-term weather phenomena; however, only the weather can specify actual short-term atmospheric conditions. Some geographic regions with great topographic variations over relatively short distances (e.g., slope steepness, aspect, etc.) have micro-climates that are distinct to small areas (e.g., canyons, leeward vs. windward, hilltops, basins, etc.).

Air Quality

Air quality at a given location is a function of several factors, including the quantity and type of pollutants emitted locally and regionally, as well as the dispersion rates of these pollutants. Primary factors affecting pollutant dispersion are wind speed and direction, atmospheric stability, temperature, the presence or absence of inversions, and topography. Air quality is affected by stationary sources (e.g., industrial development) and mobile sources (e.g., motor vehicles).

Air quality at a given location is determined by the concentration of various pollutants in the atmosphere. National Ambient Air Quality Standards (NAAQS) are established by the EPA for criteria pollutants, including: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than or equal to (≤) ten microns in diameter (PM_{10}) and ≤2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). NAAQS represent maximum levels of background pollution that are considered safe, with an adequate margin of safety, to protect public health and welfare.

Ozone (O_3). The majority of ground-level (or terrestrial) O_3 is formed as a result of complex photochemical reactions in the atmosphere involving volatile organic compounds (VOC), nitrogen oxides (NO_x), and oxygen. O_3 is a highly reactive gas that damages lung tissue, reduces pulmonary function, and sensitizes the lung to other irritants. Although *stratospheric* O_3 shields the earth from damaging ultraviolet radiation, *terrestrial* O_3 is a highly damaging air pollutant and is the primary source of smog.

Carbon Monoxide (CO). CO is a colorless, odorless, and poisonous gas produced by incomplete burning of carbon in fuel. The health threat from CO is most serious for those who suffer from cardiovascular disease, particularly those with angina and peripheral vascular disease.

Nitrogen Dioxide (NO_2). NO_2 is a highly reactive gas that can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections. Repeated exposure to high concentrations of NO_2 may cause acute respiratory disease in children. Because NO_2 is a key precursor in the formation of O_3 or smog, control of NO_2 emissions is an important component of overall pollution reduction strategies. The two primary sources of NO_2 in the United States are fuel combustion and transportation.

Sulfur Dioxide (SO_2). In Hawaiʻi, the main source of SO_2 is vog (i.e., volcanic smog) from volcanic eruptions. When volcanoes are active, SO_2 is released and reacts with sunlight, which transforms the sulfur gases and water molecules to sulfuric acid, creating the volcanic haze. SO_2 is also emitted from stationary source coal and oil combustion, steel mills, refineries, pulp and paper mills, and from nonferrous smelters, although these are less of a factor in Hawaiʻi. High concentrations of SO_2 may aggravate existing respiratory and cardiovascular disease; asthmatics and those with emphysema or bronchitis are the most sensitive to SO_2 exposure. SO_2 also contributes to acid rain, which can lead to the acidification of lakes and streams and damage trees.

Particulate Matter (PM_{10} and $PM_{2.5}$). Particulate matter (PM) is a mixture of tiny particles that vary greatly in shape, size, and chemical composition, and can be comprised of metals, soot, soil, and dust. PM_{10} includes larger, coarse particles, whereas $PM_{2.5}$ includes smaller, fine particles. Sources of coarse particles include crushing or grinding operations, and dust from paved or unpaved roads. Sources of fine particles include vog, all types of combustion activities (e.g., motor vehicles, power plants, wood burning) and certain industrial processes. Salt spray from the ocean is also a contributing factor because it holds significant amounts of PM.

Exposure to PM_{10} and $PM_{2.5}$ levels exceeding current standards can result in increased respiratory and cardiac-related respiratory illness. Short-term effects from PM may include headaches, breathing difficulties, eye irritation, and sore throat. The EPA has concluded that $PM_{2.5}$ is more likely to contribute to health problems than PM_{10}.

Airborne Lead (Pb). Airborne Pb can be inhaled directly or ingested indirectly by consuming Pb-contaminated food, water, or non-food materials such as dust or soil. Fetuses, infants, and children are most sensitive to Pb exposure. Pb has been identified as a factor in high blood pressure and heart disease. Exposure to Pb has declined dramatically in the last 10 years as a result of the reduction of Pb in gasoline and paint, and the elimination of Pb from soldered cans.

Greenhouse Gases (GHGs)

GHGs trap heat in the earth's atmosphere, affecting climate change and contributing to global warming. Both naturally occurring and anthropogenic (man-made) GHGs include: water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO), and O_3. According to guidance from the CEQ during an analysis of direct effects, it is appropriate to: (1) quantify cumulative emissions over the life of the project, (2) discuss measures to reduce GHG emissions, including consideration of reasonable alternatives, and (3) qualitatively discuss the link between such GHG emissions and climate change.

However, it is not currently useful for NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions, as such direct linkage is difficult to isolate and to understand. The estimated level of GHG emissions can serve as a reasonable proxy for assessing potential climate change impact and provides decision makers and the public with useful information for a reasoned choice among alternatives (CEQ, 2010).

3.2.2 Regulatory Setting

The Clean Air Act Amendments (CAAA) of 1990 place most of the responsibility to achieve compliance with NAAQS on individual states. The State of Hawaiʻi Department of Health (DOH) Clean Air Branch is responsible for air pollution control in the state. The primary services of the branch include: 1) Engineering, which includes engineering analysis and permitting; 2) Monitoring, which performs monitoring and investigations; and 3) Enforcement, in which federal and state air pollution control laws and regulations are enforced.

The EPA requires each state to prepare a State Implementation Plan (SIP). A SIP is a compilation of goals, strategies, schedules, and enforcement actions that will lead the state into compliance with all NAAQS for CO, PM_{10}, $PM_{2.5}$, SO_2, NO_2, and O_3 to thus reach *attainment* status. Areas not in compliance with a standard can be declared *nonattainment* areas by EPA or the appropriate state or local agency. There can be lenience for Exceptional Events, which are defined as "unusual or naturally occurring events that can affect air quality but are not reasonably controllable using techniques that tribal state, or local air agencies may implement in order to attain and maintain the NAAQS" (EPA, 2013). An example of an Exceptional Event is a volcanic eruption, which affects air quality by causing exceedances of NAAQS and cannot be controlled by human intervention.

3.2.3 Existing Conditions

The average annual temperature in Wailuku on the island of Maui, Hawaiʻi, is 74.8 degrees Fahrenheit (°F). The annual average total precipitation of the area is 27 inches (Climatemps, 2013). The months of the year with the most rainfall occur from November through February.

The prevailing winds on Maui (known as trade winds) are from the east-northeast, with a mean wind speed of 10.6 miles per hour. The trade winds prevail approximately nine months of the year. Trade winds blow vog from the island of Hawaiʻi's volcanoes, as well as other air contaminants, to the southwest. During the winter months, winds tend to be less predictable; there are longer periods of light and variable winds and occurrences of strong southerly, or "Kona" winds, associated with weather fronts and storms. In addition, when trade winds are absent for prolonged periods, vog travels up the island chain and can affect air health by increasing levels of airborne SO_2 and $PM_{2.5}$. Although both of these pollutants are regulated by the EPA, Hawaiʻi's advisories for volcanic SO_2 and $PM_{2.5}$ have been customized for local conditions.

Air monitoring stations in communities near the volcano record regular exceedances of the NAAQS for SO_2 and occasional exceedances of the NAAQS for $PM_{2.5}$. The EPA considers the volcano a natural, uncontrollable event, and therefore the state requests exclusion from these NAAQS exceedances for attainment/non-attainment determination (DOH, 2013). Shorter exposure time intervals have also been adopted due to variable wind conditions, which can cause volcanic gas concentrations to change rapidly (USGS, 2014a).

Wailuku River is located in EPA attainment zones for CO, NO_2, O_3, $PM_{2.5}$, PM_{10}, and Pb (EPA, 2014b). In 2012, Hawaiʻi was in attainment with NAAQS annual averages of PM_{10}, $PM_{2.5}$, O_3, CO, and SO_2, based on three year averages of annual mean values from 12 air quality stations (four on Oahu, one on Maui, and seven on Hawaiʻi Island) that represent the State of Hawaiʻi. The air quality station positioned closest to the project area is located approximately 11 miles southeast from Wailuku in Kihei. The Kihei air quality station is the lone air monitoring station on the Island of Maui and only measures $PM_{2.5}$ levels. The annual averages of $PM_{2.5}$ from this air quality station from 2008-2012 were approximately one-third of their respective State (HAR 11-59) and Federal (40 CFR Part 50) Standards (DOH, 2013).

3.2.4 Approach to Analysis

The 1990 Amendments to the CAA require that Federal agency activities conform to the SIP with respect to achieving and maintaining attainment of NAAQS and to addressing air quality impacts. The EPA *General Conformity Rule* requires that a conformity analysis be performed, which demonstrates that a

proposed action does not: 1) cause or contribute to any violation of any NAAQS in the area; 2) interfere with provisions in the SIP for maintenance or attainment of any NAAQS; 3) increase the frequency or severity of any existing violation of any NAAQS; or 4) delay timely attainment of any NAAQS, any interim emission reduction goals, or other milestones included in the SIP. Provisions in the *General Conformity Rule* allow for exemptions from performing a conformity determination only if total emissions of individual nonattainment area pollutants resulting from the proposed action fall below *de minimis* threshold values.

3.2.5 Potential Impacts and Mitigation

No Action

Under the No Action alternative, the overflow channel system would not be constructed. The project area would remain unchanged from current conditions. No construction activity would occur, hence no ground disturbance, fugitive dust, or vehicular emissions would be generated. No impacts to air quality or climate would occur under implementation of the No Action Alternative.

Proposed Action

The Proposed Action would result in less than significant short-term impacts to air quality arising from construction activities. Ground disturbance could generate fugitive dust (e.g., PM) and the use of construction equipment (e.g., backhoes, dump trucks, transportation vehicles) and personal vehicles to access the project area could lead to temporary increases in vehicular airborne pollutant concentrations (e.g., CO concentrations).

These impacts would be temporary, and applicable BMPs, including covering and/or watering stockpiled soil, would be implemented. To reduce vehicle and equipment emissions, carpooling and ensuring that equipment is functioning properly should be included in regular construction work practices.

The CEQ suggests the emission indicator of 25,000 metric tons of CO_2-equivalent per year to determine if a federal agency should conduct a GHG emission study on a proposed action (CEQ, 2010). It is not anticipated that the short-term construction emissions associated with implementation of the Proposed Action would produce GHG emissions at or above the CEQ standard, or emissions at or above NAAQS standards. The operation of the proposed diversion channel and concrete diversion weir would not result in any ongoing airborne emissions. With the exception of possible emissions from maintenance vehicles, all activity associated with the Proposed Action would be passive (e.g., natural debris collection and settling of sediment) and no mechanization (e.g., petroleum burning engines, generators, or other

emission sources) would be utilized. Therefore, no long-term impacts to air quality from the operation of the Proposed Action would be expected.

Since the Proposed Action is designed to provide protection up to the SPF level, the impacts of climate change are considered insignificant to the project design level. The SPF magnitudes were based on a Standard Project Storm (SPS) of 26 inches of rain in 24 hours. Data from National Oceanic and Atmospheric Administration (NOAA) Atlas 14 indicates 1,000-year recurrence interval rainfall of 20.8 inches in over 24 hours at a location adjacent to the centroid of the drainage basin (NOAA, 2014). There is no consensus on future changes to rainfall intensities in Hawai'i, and it is not expected that the 1,000-year rainfall event would increase by 5 inches (in 24 hours) or by 24% in any future climate change scenarios; therefore, future climate change is not anticipated to impact the Proposed Action.

The lowest range of elevation for the Proposed Action is approximately 70 to 90 ft above mean sea level. The tidal backwater effects of the Pacific Ocean to Wailuku River only extend to approximately 10 ft above mean sea level, which is approximately 1,000 ft downstream of the Waiehu Beach Road Bridge at the very downstream end of the proposed project area. Sea level change would not impact the Proposed Action due to its distance from the ocean.

3.3 NOISE

3.3.1 Definition of Resource

Noise is generally defined as unwanted sound. Noise can be any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise annoying. Human responses to noise vary depending on the type and characteristics of the noise, distance between the noise source and receptor, receptor sensitivity, and time of day.

Determination of noise levels are based on: 1) sound pressure level generated (decibel [dB] scale); 2) distance of listener from source of noise; 3) attenuating and propagating effects of the medium between the source and the listener; and 4) period of exposure.

An A-weighted sound level, measured in dBA, is one measurement of noise. The human ear can perceive sound over a range of frequencies, which varies for individuals. In using the A-weighted scale for measurement, only the frequencies heard by most listeners are considered. This gives a more accurate representation of the perception of noise. The noise measure in a residential area, similar to conditions within the project area, is estimated at approximately 70 dBA. Normal conversational speech at a distance of five to ten feet is approximately 70 dBA. The decibel scale is logarithmic, so, for example, sound at 90 dBA would be perceived to be twice as loud as sound at 80 dBA.

Passenger vehicles, motorcycles, and trucks use the roads in the vicinity of the project area. Noise levels generated by vehicles vary based on a number of factors including vehicle type, speed, and level of maintenance. Intensity of noise is attenuated with distance. Some estimates of noise levels from vehicles are listed in Table 3-1.

Table 3-1: Typical Noise Sources

Source	Distance (ft)	Noise Level (dBA)
Automobile, 40 mph	50	72
Automobile Horn	10	95
Light Automobile Traffic	100	50
Truck, 40 mph	50	84
Heavy Truck or Motorcycle	25	90

mph = miles per hour
Source: Cavanaugh and Tocci, 1998.

3.3.2 Regulatory Setting

State of Hawaiʻi HAR Title 11, Chapter 46 Community Noise Control sets permissible noise levels in order to provide for the prevention, control, and abatement of noise pollution in the State. The regulation creates noise districts based on land use that dictate acceptable noise levels. The project area is located in a conservation/open space area within the vicinity of residential use - the closest residences are 50 ft from the project site. Therefore, the project area is in a Class A zoning district, as defined by HAR 11-46 as "all areas equivalent to lands zoned residential, conservation, preservation, public space, open space, or similar type." The maximum permissible sound level in a Class A district is 55 dBA from 7:00am-10:00pm and 45 dBA from 10:00pm-7:00am (DOH, 1969).

The EPA has identified a range of yearly day-night sound level (DNL) standards that are sufficient to protect public health and welfare from the effects of environmental noise (EPA, 1977). The EPA has established a goal to reduce exterior environmental noise to a DNL not exceeding 65 dBA and a future goal to further reduce exterior environmental noise to a DNL not exceeding 55 dBA. Additionally, the EPA states that these goals are not intended as regulations as it has no authority to regulate noise levels,

but rather they are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

The U.S. Occupational Safety and Health Administration (OSHA) has established acceptable noise levels for workers. Table 3-2 shows permissible noise levels for varying exposure times.

Table 3-2: OSHA Permissible Noise Exposures

Duration per day-hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Source: OSHA, 2012

The Noise Control Act of 1972 (42 United States Code [U.S.C.] 4901 to 4918) established a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. To accomplish this, the Act establishes a means for the coordination of Federal research and activities in noise control, authorizes the establishment of Federal noise emissions standards for products distributed in commerce, and provides information to the public respecting the noise emission and noise reduction characteristics of such products (42 U.S.C. 4901). The Act authorizes and directs that Federal agencies, to the fullest extent consistent with their authority under Federal laws administered by them, carry out the programs within their control in such a manner as to further the policy declared in 42 U.S.C. 4901.

Federal workplace standards for protection from hearing loss allow a time-weighted average level of 90 dBA over an 8-hour period, or 85 dBA averaged over a 16-hour period. Noise annoyance is defined by

the EPA as any negative subjective reaction on the part of an individual or group (EPA, 1977). For community noise annoyance thresholds, a day-night average of 65 dBA has been established by the U.S. Department of Housing and Urban Development (HUD) as eligibility for federally guaranteed home loans (FICON, 1992).

3.3.3 Existing Conditions

The project area is located in open conservation land in the suburban town of Wailuku. The noise environment in Wailuku town is characteristic of a suburban environment; the setting is dominated by vehicular and residential noise. The project area is not affected by airfield noise. The closest airfield to the project area is Kahului Airport, which is 5 miles east of the center of Wailuku.

3.3.4 Approach to Analysis

Noise impact analyses address potential changes to existing noise environments that would result from implementation of a proposed action. Potential changes in the noise environment can be beneficial (e.g., if they reduce the number of sensitive receptors exposed to unacceptable noise levels), negligible (e.g., if the total area exposed to unacceptable noise levels is essentially unchanged), or adverse (e.g., if they result in increased exposure to unacceptable noise levels).

3.3.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, the overflow channel system would not be constructed. No construction activity – or accompanying noise associated with the use of construction equipment – would occur. The project area would remain unchanged, and there would be no impacts to noise within the area.

Proposed Action

Under the Proposed Action, short-term noise impacts associated with construction activities would occur. The sensitive receptors closest in proximity to the project area are residences located within 50 ft of the construction site. Construction-related noise, estimated to last for most of the duration of the construction period (approximately 21 months), would be generated from equipment and vehicles. However, noise exposure from construction activities would not be continuous at any one location throughout the entire construction process and BMPs would be implemented to reduce or eliminate noise. Buffer zones between construction activities and residential areas would be created, and construction work would be limited to the hours between 7:30am and 3:30pm on weekdays.

In addition, sound barriers, mufflers, and other structures may be erected to reduce noise levels if they exceed Federal and State standards. Heavy truck and equipment staging areas will be located as far from noise sensitive properties as possible. As a result, short-term impacts from construction activities would be less than significant to the surrounding environment.

Upon completion, the Proposed Action would not be a source of any significant long-term noise generation. The only noise generated from the Proposed Action in the long-term would be from maintenance vehicles infrequently visiting the area, estimated at six times per year for grass cutting at the diversion weir, new berm, and access road and once every five years to clear the overflow channel and diversion weir of accumulated debris. However, the noise type and levels would be consistent with those already present in the Wailuku suburban environment. Therefore, long-term noise impacts are expected to be less than significant.

3.4 WATER RESOURCES

3.4.1 Definition of Resource

Water resources analyzed in this study encompass surface water, groundwater, floodplains, and wetlands. Surface water resources include lakes, rivers, and streams and are important for a variety of reasons including ecological, economic, recreational, aesthetic, and human health. Groundwater comprises subsurface water resources and is an essential resource in many areas as it is used for potable water, agricultural irrigation, and industrial applications. Floodplains are belts of low, level ground present on one or both sides of a stream channel and are subject to either periodic or infrequent inundation by floodwater.

The USACE defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Coastal wetlands are important to the ecosystem and provide a critical interface between terrestrial and marine habitats. They also provide various functions such as buffering the coastline, capturing sediment, and retaining and transforming nutrients (Bruland, 2008).

3.4.2 Regulatory Setting

The segment of Wailuku River discussed in this EA is classified as “Class 2 inland waters” by the State of Hawaiʻi. The objective of Class 2 waters is “to protect their use for recreational purposes, the support and propagation of aquatic life, agricultural and industrial water supplies, shipping, and navigation” (HAR §11-54-3(b)(2)). Kahului Bay is classified as “Class A marine waters” by the State of Hawaiʻi. It is the

objective of Class A waters "that their use for recreational purposes and aesthetic enjoyment be protected" (HAR §11-54-3(c)(2)). Further, uses must be compatible with the protection and propagation of fish, shellfish, and wildlife; and strict water quality standards have been set for the protection of these uses in Class A marine waters.

The CWA of 1977 (PL 95-217) expanded provisions related to pollutant discharges and applies regulatory and non-regulatory tools to reduce point source and non-point source pollution, in addition to setting standards for water quality. Section 303(d) of the CWA requires states to maintain a list of water bodies that do not meet, or are not expected to meet state water quality standards. States must obtain and review all readily available surface water quality data to compare against state standards, and then make a decision on the level of impairment for each water body. The listing applies to both point and non-point sources of pollution, and must include a listing of pollutants for which applicable standards are exceeded.

Section 404(b)(1) of the CWA is "to restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material." Consistent with the Section 404(b)(1) guidelines, adverse impacts to wetlands, streams and other special aquatic sites must be avoided or minimized to the full extent practicable. Any unavoidable impacts must be mitigated consistent with USACE regulations and policies.

EO 11988, *Floodplain Management,* requires the responsible Federal agency to evaluate the proposed action with respect to floodplain management and related controls. Development within the regulatory floodplain is not allowed unless proper provisions to minimize or eliminate flood damages are implemented.

EO 11990, *Protection of Wetlands*, aims to minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. To meet these objectives, this EO requires federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided.

3.4.3 Existing Conditions

Groundwater

The Proposed Action is located in the ʻĪao aquifer system of the Wailuku aquifer sector (Figure 3-3). An upper and lower aquifer underlie the Proposed Action, classified as 60102116 (22211)/60102121 (21113). The upper aquifer is basal (i.e., fresh water in contact with seawater), unconfined, has a sedimentary lithology, has a potential use for development, is ecologically important, of a low salinity (i.e., between 250-1,000 milligrams (mg) chloride (Cl^-)/liter (L)), is irreplaceable, and has a high vulnerability to

contamination. The lower aquifer is basal, confined, and has a flank basalt lithology. Further, the lower aquifer has a potential use for development, has a drinking water utility, is of a fresh salinity (i.e., less than (<) 250 mg Cl^-/L), is irreplaceable, and has a low vulnerability to contamination (Mink and Lau, 1990).

Surface Water

Wailuku River begins in the upper elevations of the 'Īao Valley and flows eastward towards the Pacific Ocean, discharging into Kahului Bay. The 'Īao watershed is subject to intermittent, high intensity rainfall, causing runoff from drainage basins for North and South Waiehu Streams.

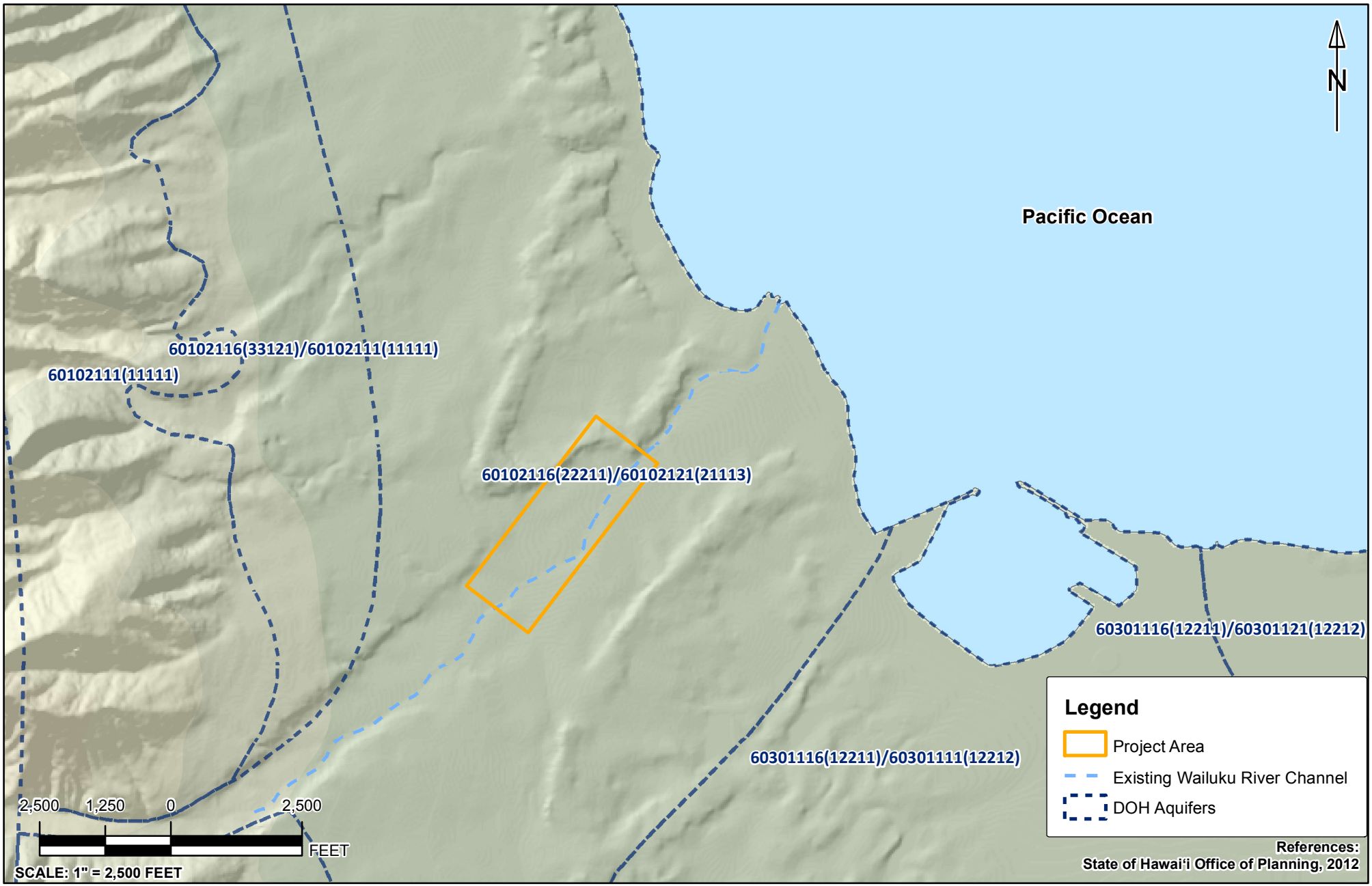
Wailuku River is about 12,000 ft in length from the sediment basin to the outlet into Kahului Bay, and about 30% is lined with existing concrete channels. The remaining portions of the stream are an alluvial channel where the stabilization problems occur. Levees are situated on the right bank to protect the town of Wailuku. Stream waters were historically diverted to agricultural areas via three diversion structures located below the 'Īao intake. Downstream of the diversions, stream flow in the past was absent 80 to 90% of the time, punctuated by infrequent high flows following intense rainfall events when stream discharge volume was sufficient to overtop the water diversion structures (USFWS, 2006b). On October 13, 2014, Wailuku Water Company began releasing 10 mgd of water into Wailuku River pursuant to the April 2014 Settlement Agreement in the Na Wai 'Eha Contested Case (see Section 3.14). Currently, there is continuous flow of water through the section of the proposed project area.

Water Quality

Wailuku River and the receiving waters of Kahului Bay are listed on the DOH list of impaired waters Category 3 and 5; the Total Daily Maximum Load (TMDL) Priority is listed as Medium (DOH, 2014). Wailuku River is designated as "impaired" based on the visual observations made between 2001 and 2004 indicating Hawai'i water quality standards for turbidity and trash were not met; Kahului Bay is listed based on data collected from harbor waters that did not meet Hawai'i water quality standards for turbidity, chlorophyll alpha (chl α), and ammonium (NH_4).

Floodplains

According to FEMA records, the project area is located within *Zone AE*, *0.2% Annual Chance of Flooding*, *Zone X*, and *Zone X (Protected by Levee)* (Figure 3-2). Zone AE is defined as "areas with a 1%(100-year flood) chance of flooding." The zone designated as the 0.2% Annual Chance of Flooding corresponds to the areas of 500-year flooding. Zone X designates areas outside of the 0.2% annual chance floodplain; Zone X (Protected by Levee) delineates areas that are "protected from the



ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻĪAO STREAM FLOOD CONTROL PROJECT

AQUIFER MAP
WAILUKU, MAUI, HAWAI'I

FIGURE 3-3

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1%-annual-chance or greater flood hazard by a levee system that has not been provisionally accredited" (FEMA, 2009a; FEMA, 2009b).

Wetlands

According to the *National Wetlands Inventory* (USFWS, 2006a), the Proposed Action occurs within and near areas designated as a freshwater emergent wetland (Figure 3-4), further classified as palustrine (i.e., nontidal wetlands dominated by emergents), and persistent (i.e., vegetation remains standing at least until the beginning of the next growing system).

3.4.4 Approach to Analysis

Impacts to water quality under the proposed alternative(s) were considered significant if the proposed alternative(s) would cause functional or chemical change to groundwater resources; or create significant sedimentation, pollution/runoff into surface water bodies, including any significant water body flow alteration. Impacts would be considered significant if they resulted in alteration, or incongruent development of a floodplain or wetland area. Significant impacts would occur if the proposed alternative(s) would result in non-compliance with applicable regulations and policies relating to water resources.

3.4.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, the Proposed Action would not be implemented and there would be continued significant impacts to the water quality of Wailuku River as well as nearshore waters in Kahului Bay due to continued erosion of the stream bank during storm events. Since there would be no reduction in sediment deposited into stream waters, there would be no improvement to water quality in the affected aquatic environment.

Proposed Action

Under the Proposed Action, there would be no anticipated impacts to groundwater. Given the estimated depth to groundwater of approximately 160 ft below ground surface (bgs) (USGS, 2011), and the shallow depth of planned surface grading, groundwater is not anticipated to be encountered. The existing floodplain would remain unlined, allowing for continued natural groundwater recharge.

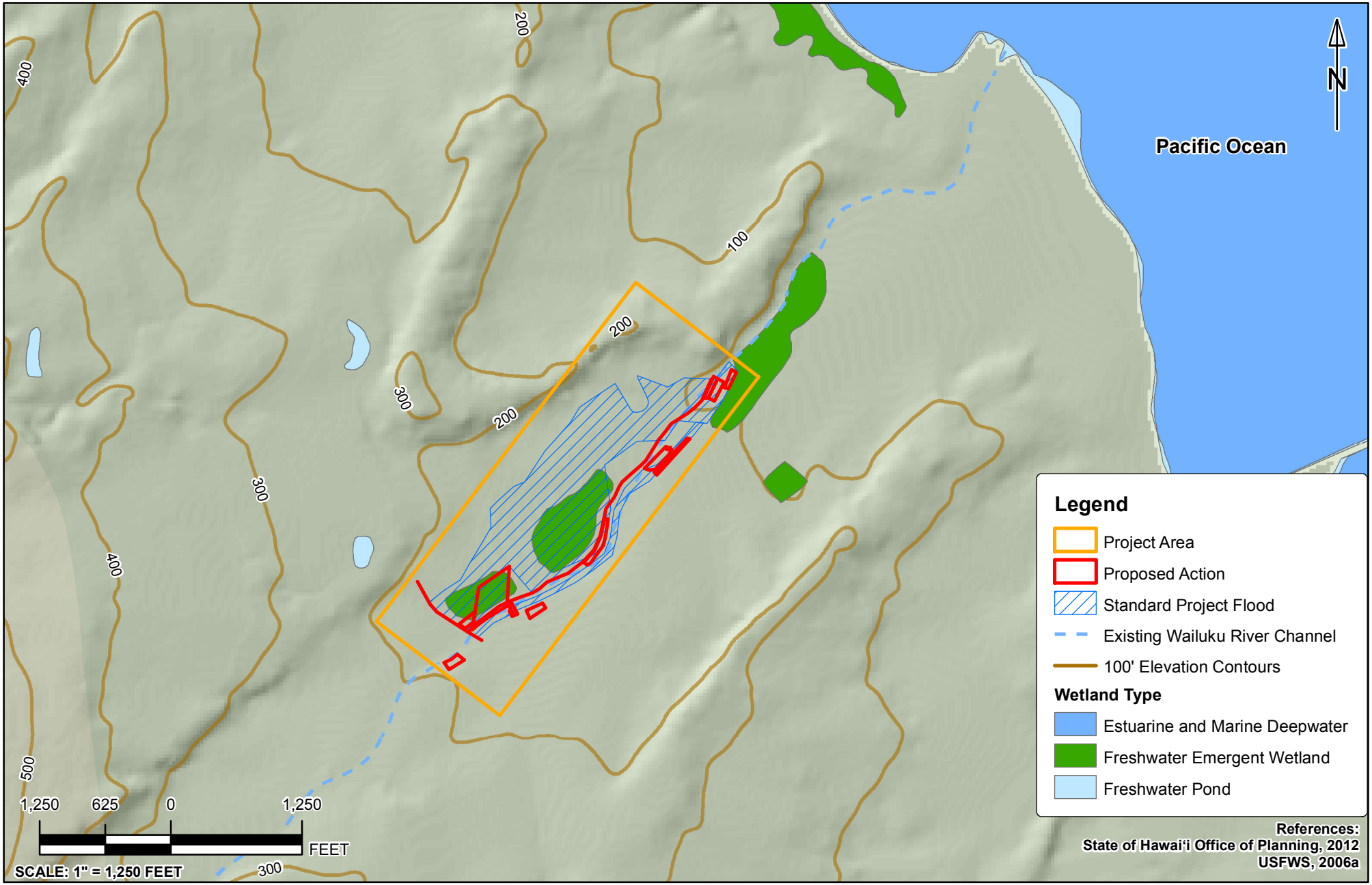
There would be less than significant impacts to surface water hydrology during the construction period. The stream flow would be slightly altered during construction/grading activities. However, BMPs that adhere to State and Federal regulations would be implemented to minimize sediment discharges and

alterations of stream flow. Once the diversion channel features are in place, during high-volume stream flow (i.e., during a flood event) the velocity of the water is expected to slightly decrease while flowing through the designated floodplain, as well as through the channelized portion of the stream. This would have the effect of reducing further erosion of the channel during such events and reduce sediment and nutrient loads entering Kahului Bay. The proposed 15-ft wide opening in the diversion weir would not impact the ability for an IIFS of greater than 5 mgd to remain in the channel through the project area and downstream to the stream mouth.

According to the hydraulic model for the Proposed Action (included as Appendix D of the EDR), flood events greater than the 10-year frequency event will overtop the Imi Kala Street bridge. Under existing conditions modeled, this bridge is theoretically overtopped during flood events greater than the 25-year frequency event. Downstream of Imi Kala Street bridge, additional flow would be diverted into the floodplain by the proposed overflow channel and diversion weir. In conjunction with natural overflow into the left bank upstream, the overflow channel and diversion weir would adequately divert enough flow during an SPF event to reduce the flow within the main channel downstream to less than the 10-year frequency event discharge. Table 3-3 includes the final predicted discharge values naturally overflowing into the floodplain, diverted by the overflow channel and diversion weir, and remaining in the channel for various flood frequency events.

Table 3-3: Steady Flow Approximation Model for Wailuku River

Percent Chance Exceedance	Frequency Event	Original Flow (cfs)	Floodplain Flows		Remaining Flow (cfs)
			Overflow at Imi Kala (cfs)	Diverted Flow (cfs)	
50%	2-year	3,300	0	550	2,750
20%	5-year	4,400	0	1,330	3,070
10%	10-year	6,100	0	2,620	3,480
4%	25-year	8,500	1,030	3,740	3,740
2%	50-year	11,000	1,370	4,960	4,670
1%	100-year	13,800	1,440	7,520	4,840
0.5%	200-year	16,000	2,400	8,320	5,280
0.2%	500-year	20,600	3,800	11,130	5,670
--	SPF	27,500	7,000	14,720	5,780



ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻĪAO STREAM FLOOD CONTROL PROJECT

WETLANDS MAP
WAILUKU, MAUI, HAWAI'I

FIGURE 3-4

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There would be less than significant impacts to surface water quality during the construction period. The Proposed Action would include soil excavation and stockpiling during grading activities. BMPs employed during construction (e.g., silt fencing, tarping/covering exposed and stockpiled soils, surface revegetation, etc.) would minimize/eliminate stormwater flow from the proposed construction site, and any associated degradation of water quality. The USACE would monitor the marine water quality at the mouth of the stream before, during, and after construction to assure water quality standards are not exceeded. BMPs will be strictly adhered to during construction.

The Proposed Action would be completed in accordance with State and Federal regulations, including Section 404 (b)(1) of the CWA, which would further minimize any impacts to water quality in Wailuku River and Kahului Bay. The 404 (b)(1) evaluation for the Proposed Action is included in Appendix C. In addition, since the Proposed Action may generate discharges to State waters during construction, a Section 401 water quality certification (WQC) would be required. A National Pollutant Discharge Elimination System (NPDES) permit may also be required if any discharge of pollutants to surface waters are anticipated during construction activities. These permits are addressed in detail in Section 4.

Although the floodplain and surrounding area is thought to have been historically used in agriculture production, it is not suspected to introduce significant concentrations of contaminants into the floodwaters since it has been unused for more than two decades and therefore any initial contamination is thought to have undergone natural attenuation (HDOA, 2003). Implementation of the Proposed Action would not result in changes to the current classification of Wailuku River as "Class 2 inland waters" by the State of Hawai‘i.

The Proposed Action would not significantly alter the existing floodplain and would be implemented in order to reduce flood risk within ʻĪao Valley downstream of the proposed overflow channel system. Therefore, the Proposed Action would have beneficial effects to flood patterns within the existing environment.

The Proposed Action would have less than significant impacts on wetlands. According to the *National Wetlands Inventory* (USFWS, 2006a), potential pockets of wetlands are present within the project area; however, none were identified during biological or stream surveys conducted along the stream (AECOS, 2016 and USFWS, 2006b; 2011a). A survey would be conducted prior to the start of construction activities to document the presence or absence of wetlands within the proposed construction area. Work practices during construction activities would be modified as needed to avoid or minimize any impacts to any identified wetlands.

3.5 BIOLOGICAL RESOURCES

3.5.1 Definition of Resource

Biological resources include native or naturalized plants and animals and the habitats in which they occur. Sensitive biological resources are defined as those plants and animal species listed as threatened or endangered, or proposed as such, by USFWS, the NMFS, the State of Hawai'i Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DFW), or DAR.

3.5.2 Regulatory Setting

The ESA was created in order to protect and recover imperiled species and the ecosystems upon which they depend. The ESA grants USFWS primary responsibility for terrestrial and freshwater organisms and NMFS primary responsibility for marine wildlife (USFWS 2013a).

The FWCA provides the basic authority for the USFWS's involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features and requires Federal agencies that construct, license, or permit water resource development projects to first consult with USFWS, NMFS, and state fish and wildlife agencies (e.g., DLNR, DFW, and DAR) regarding the impacts on fish and wildlife resources and measures to mitigate these impacts (USFWS, 2013b). USACE has been coordinating with USFWS per FWCA since conceptual design development began on the project design evaluated in the 2009 DEA; further, it was key input from USFWS and their concerns regarding potential impacts to biological resources in the project area that served as the impetus for the project reevaluation and redesign, and ultimate development of Alternative F, the Preferred Alternative.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) mandates the use of annual catch limits and accountability measures to end overfishing, provides for widespread market-based fishery management through limited access privilege programs, and calls for increased international cooperation. The MSA grants NMFS responsibility to implement both regional and national Congressionally-mandated deadlines.

EO 13089, *Coral Reef Protection* was enacted to preserve and protect the biodiversity, health, heritage, and ecological, social, and economic values of U.S. coral reef ecosystems and the marine environment. An interagency task force, the U.S. Coral Reef Task Force, was created in order to fulfill the EO's protection efforts. The task force works with state, territorial, commonwealth, and local government agencies, nongovernmental organizations, the scientific community, and commercial interests to develop

and implement measures to restore damaged coral reefs and to mitigate further coral reef degradation (EPA, 2012).

3.5.3 Existing Conditions

A Revised Draft FWCA Report (USFWS, 2006b) was prepared by the USFWS during the preparation of the Draft EA (2009) to describe existing conditions and assess potential resource impacts associated with the previous 'Īao Stream Flood Control Project. Sufficient documentation and information was available to characterize the existing terrestrial and riparian biological resources conditions within the project area, thus field surveys focused on qualitative characterization of the fish and wildlife resources within the stream. A review of previous reports prepared for the Wailuku River area was conducted to determine the presence of the individual terrestrial vegetation and wildlife species in the project area and the general vicinity. In addition, biological surveys of the project area were conducted by AECOS, Inc. (AECOS) in April 2012 and November 2016. The second survey in November 2016 was conducted to ascertain whether changes in biological resources had occurred since the return of stream flow in October 2014.

Terrestrial Flora

Table 3-4 lists the terrestrial flora observed in and around the project area. Additional riparian and terrestrial vegetation in and around the project area can be characterized as coastal dry forest and consists of at least nine plants species: Bermuda grass (*Cynodon*), bristly foxtail (*Setaria verticillata* L.), finger grass (*Chloris* L.), *kiawe* (*Prosopis pallida*), klu (*Acacia farnesiana* L.), lantana or *lakana* (*Lantana camara* L.), *koa haole* (*Leucaena leucocephala*), sand bur (*Cenchrus* L.; endemic), and natal red top (*Rhynchely trum repens* Wild.) (SCS/CRMS, Inc., 2003).

On April 4, 2012 and November 9, 2016, AECOS performed a botanical survey along the stream banks and stream channel of Wailuku River (Appendix G). A total of 110 species of ferns and flowering plants were observed within the project area combining the two surveys. Of these species, 81 species were observed within the stream channel (i.e. banks and levees). With a few exceptions, all of these plants are non-native species and most are common weedy species that have established in highly disturbed banks and sand/mud bars that form in the concrete channel. Nine native or early Polynesian introduced species were noted. These included three trees (*kukui*, *kou*, and *hau*) observed near the stream, one tree (*'ulu*) in the overflow channel area, two planted shrubs (*ki* and *naupaka kahakai*), a sedge (*Fimbristylis cymosa*), and two low growing herbs (wood sorrel or *'ihi'ai* and *kīpūkai*). These are common widespread species in the Hawaiian Islands. All of the plant species observed within the project area were widespread species. Appendix G includes a full list of plant species observed during the survey.

Table 3-4: Vegetation Observed in the Project Vicinity

Vegetation		
Sub-Region	**Scientific name**	**Common Name**
Coastal Lowlands	Not specified (ns) *Prosopsis pallida*	sugarcane *kiawe*
'Īao Valley entrance	*Persea americana* *Aleurites moluccana* *Eugenia cuminii* *Samanea saman* *Melia azedarach* *Mangifera indica* *Psidium guajava*	avocado *kukui* java plum monkeypod pride of India mango guava
Higher valley slopes	*Casuarina equisetifolia* *Leucaena sp.*	ironwood *koa haole*

ns = not specified
Source: SCS/CRMS, Inc., 2003

Terrestrial Wildlife Species

Table 3-5 lists the terrestrial wildlife species observed in and around the project area. Additional terrestrial wildlife species observed in the vicinity of the project area include introduced species such as cats, mice, rates, and mongoose. Game animals such as wild goats, pigs, and deer have been reported to occur in the forest reserve area, a mile upstream of the project site.

Aquatic Biota

During the preparation of the Draft EA (2009), USFWS personnel conducted a habitat characterization assessment of Wailuku River in the vicinity of the 'Imi Kālā Street Bridge (USFWS, 2006b). Based on an assessment of nine factors, the stream was assessed to have a total score of 83 out of 135 points, or a score of 61.5%. According to the grading matrix, this score puts Wailuku River in the category having habitat that is partially supportive of aquatic life.

Table 3-5: Wildlife Observed in the Project Vicinity

Wildlife		
Sub-Region	**Scientific name**	**Common Name**
Drainage basin	*Hemignathus virens* Himatione sanguinea *Cardinalis cardinalis* *Carpodacus mexicanus* *Passer domesticus* *Mimus polyglottos* *Acridotheres tristis* *Leiothrix lutea* *Zosterops japonicas* *Pluvialis fulva* *Arenaria interpres*	*amakihi* *apapane* Kentucky cardinal house finch house sparrow mockingbird mynah red-billed leiothrix white eye pacific golden plover ruddy turnstone
Upland	ns *Streptopelia chinensis* *Phasianus colchicus* ns	barr doves lace necked doves pheasants Franklin partridge
Lowland area and seashore marsh south of the project area	*Nycticorax nycticorax and* *Ardeidae* *Ardea alba* *Himantopus himantopus*	black-crowned night herons egrets Hawaiian stilt

ns = not specified
Source: SCS/CRMS, Inc., 2003

Aquatic species are sensitive to any modifications of the stream as they have an amphidromous life cycle. Native and indigenous freshwater gobies such as *Lentipes concolor*, *Sicyopterus stimpsoni*, and *Awaous guamensis* were observed in Wailuku River (Way, 1996). Along with the atyid shrimp and neritid snail, these stream-dwelling fauna require streams which flow continuously as eggs and larvae are washed into the ocean. Juveniles subsequently migrate back into Wailuku River and 'Īao Valley to mature, reproduce and spawn, although the project area itself is used for migration only, not breeding.

Three significant agricultural water diversion features, located upstream from or within the channelized portion of the stream, conveyed a significant amount of water away from the stream in the past for consumptive use, primarily sugarcane and other agricultural crops. This historic lack of continuous stream flow has been detrimental to populations of native organisms, due to stranding and desiccation of organisms during upstream and downstream migration (USFWS, 2006b). Recent changes to land use patterns in the vicinity of the stream have included the conversion of former sugarcane lands to other crops, as well as to commercial and residential real estate. The replacement crops require only a small fraction of the water required by sugarcane, yet the existing diversion infrastructure was maintained with no change to the amount of water diverted from the stream. Following implementation of the IIFS for Wailuku River in October 2014 following the settlement of the Na Wai 'Eha Contested Case, continuous flow has been restored to the stream, which is anticipated to facilitate upstream migration of the aquatic species and provide adequate level of stream flow required to maintain natural populations in the stream.

The FWCA report (USFWS, 2006b) identified the lower Wailuku River as belonging to Resource Category 2 (habitat to be impacted is of high value for selected evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section) due to the severe degradation of stream habitat across the north shore Maui landscape and statewide. The marine waters adjacent to the mouth of Wailuku River at Waiehu are also considered to be Resource Category 2 due to the presence of coral reef habitat throughout the area. The USFWS resource goal for Category 2 habitat is no net loss of in-kind habitat values. If losses are unavoidable, mitigation measures must be recommended to immediately rectify, reduce, or eliminate those losses (USFWS, 2006b).

An aquatic biota survey was conducted by AECOS, accompanied by a DAR biologist, on April 4, 2012. AECOS conducted an additional aquatic biota survey on November 9, 2016 to document conditions following the restoration of stream flow in October 2014. A full listing of aquatic species identified at Wailuku River during both surveys, which also includes earlier observations made by AECOS (2011), USFWS (2011a), and species reported in the Hawai'i Watershed Atlas (DAR, 2008), is included in Appendix G.

Typical estuarine fishes such as mullet (*Mugil cephalus*), *'āholehole* (*Kuhlia xenura*), *kūpīpī* (*Abudefduf sordidus*), and dusky frillgoby (*Bathygobius fuscus*) inhabit the estuarine reach located downstream of the project area. Two endemic amphidromous mollusks, *hīhīwai* (*Neritina granosa*) and *hapawai* (*Neritina vespertina*), also inhabit the estuarine reach of the stream. These two species are amphidromous animals that require stream flow for reproductive success and still attempted to migrate upstream even though the stream had been diverted for over 100 years and flow was interrupted throughout the middle reach.

Hīhīwai also inhabit the lower and middle reaches of the stream, but migration is slower and the historical diversions within the stream have made it nearly impossible for juvenile snails to migrate past the flood control channel. DAR has been implementing a program to collect *hīhīwai* from the estuary and release them within the stream at 'Īao Valley State Monument where continuous stream flow is present. Recruitment of *hihiwai* continued following the return of the stream flow; however, has not been conducted since the September 2016 storm event during which exceptionally heavy rains in the West Maui Mountain resulted in flash flooding of Wailuku River and overflowing of the banks.

Three native amphidromous *'o'opu* or gobies (*Awaous stamineus*, *Sicyopterus stimpsoni*, and *Lentipes concolor*) were found in the middle and upper reach of the stream (in a plunge pool upstream from Mokuhau Park and in 'Īao Valley State Monument) during the 2012 survey. During the 2016 survey, numerous *'o'opu nākea* (*Awaous stamineus*) were observed in the flood control channel. The total lengths of most of these *'o'opu* were less than 5 centimeters (cm) but some were up to 10 cm long. Other *'o'opu* species may have been present in the flood control channel; however, observations were limited due to construction activities causing turbid water in the area. Maintenance activities including heavy equipment working in the stream were being conducted within the flood control channel at the time of the survey to clear the debris caused by the September 2016 storm event.

In addition to those observed during the two surveys conducted by AECOS, two other *'o'opu* species, *Stenogobius hawaiiensis* and *Eleotris sandwicensis*, have been reported from the stream (DAR, 2008), though seemingly erroneously from the upper reach because these fishes are typically found in the estuary and lower reaches of streams. *'O'opu* species reported for the middle and upper reach of the stream are in low densities, and far greater densities of peociliid fishes (top-minnows) are present in the same reach of the stream (DAR, 2008).

The endemic *'ōpae kala'ole* (*Atyoida bisulcata*), has also been reported from the upper reach of the stream in high densities. Additionally, three endemic damselflies (*Megalagrion blackburni*, *M. hawaiiense*, and *M. nigrohamatum*) are listed in the Hawai'i Watershed Atlas as present in the stream (DAR, 2008).

According to recent observations made by DAR, species previously observed prior to implementation of the IIFS in October 2014 continue to be present within the stream; further, the enhanced flow has enabled additional species to occur in the stream. The presence of species such as the Pacific prawn (*Macrobrachium lar*) and *'opae 'oeha'a* (*Macrobrachium grandimanus)* in the lower stream appears to indicate that stream flow has been more consistent following implementation of the IIFS. In addition, the endemic species, *pipiwai (Theodoxus cariosus)* has been observed along with the *hīhīwai* and *hapawai*.

As the stream continues to experience more frequent continuous flow to the ocean, the number of each species currently present in the stream is expected to increase over time.

Marine Species

The Revised Draft FWCA report (USFWS, 2006b) noted the presence of coral reefs in the coastal ecosystem adjacent to the mouth of Wailuku River. The near shore coastal environment in Kahului Bay is also noted to support sport fisheries for jacks (*Carangidae*) including *Caranx melampygus* and *C. ignobilis* (called *omilu* or *ulua* as adults and *papio* as juveniles); *Selar crumenopthalmus* (called *akule* as adults and *halalu* as juveniles); and goatfish *(Mullidae*) such as *Mullodichthys vanicolensis* (called *weke* as adults and *oama* as juveniles).

Following the preparation of the Revised Draft FWCA report (USACE, 2006), a Phase I marine habitat characterization survey of the marine coastal area within the vicinity of the mouth of Wailuku River was conducted as an addendum (Appendix H). The evaluation methodology of the survey consisted of reviewing existing information, as well as conducting a survey using snorkeling and scuba gear to directly observe the coral reef community around the mouth of Wailuku River.

Existing information was collected from literature searches and through government agencies conducting work within the region. The majority of the existing data was collected from the latter, which included the Coral Reef Assessment and Monitoring Program (CRAMP), DAR Habitat and Fish Assessments, NOAA Coral Reef Ecosystem Division (CRED) surveys, NOAA's Shallow-Water Benthic Habitat Maps, Lidar imagery, and sea turtle disease and nesting. Information on sea turtles was also collected by direct communication with DAR and from unpublished data. These resources provide general information on habitat structure/classification, coral types, and percent coral cover within the vicinity of the mouth of Wailuku River as well as some offshore locations where survey has been conducted.

The marine survey was concentrated within 500 to 700 meters (m) (545 to 765 yards) of the mouth of Wailuku River, extending an additional 1,000 m (1095 yards) to the northwest and 450 m (490 yards) to the southeast. Three distinct reef areas were present within the survey area: an inshore reef, surf zone, and spur-and groove reef. The Phase I survey was not able to map resources within the surf zone due to high swells.

The inshore reef area consisted of a shallow bay immediately west of the mouth of Wailuku River. This area was fairly homogenous in habitat type, dominated by filamentous turf algae growing over small boulders and cobble. Coral was scarce (less than 10 % cover) and scattered across the area. Macroalgae were present but not in high abundance or biomass, varying from less than to greater than 10% coverage

depending on the area. Macro-invertebrates as well as a few surgeon fish were observed during the survey.

The benthos throughout the inshore reef area was covered with a fine layer of dark colored sediment, likely originating from the terrestrial environment. A semi-permanent turbid plume located perpendicular to shore in the central section of the shallow bay was observed during the survey. This plume in which visibility was low may represent the transport of suspended sediment out of the bay where waters from both Wailuku River and the adjacent Waiehu Stream enter and mix with marine waters. This plume can also be seen in Google imagery, and correlates with the area in the NOAA Benthic Habitat Maps where habitat designation is unknown due to high turbidity that obscures satellite interpretation.

The spur-and-groove reef area was located immediately offshore of the Wailuku River mouth outside of the surf zone and extended north-northwest and south-southeast along the coastline. The area consisted of ridges (spur) of carbonate structure and intervening sand channels (grooves) oriented parallel to the dominant wave-approach direction and perpendicular to shore. The habitat type within the area was fairly homogenous and dominated by coral with most of the area having approximately 10% to 80% coral cover.

Several coral species were observed during the survey. This included *M. patula*, *M. flabellata*, *P.stellata*, *Cyphastrea ocellina*, and *Leptoseris incrustans*. Although not observed during the survey, other corals including *Cyphastrea agassizi*, *Porites pukoensis*, and *Montipora dilitata*, may be present in the area. Crustose coralline algae (CCA) were observed mostly in encrusting form, and less commonly in discrete foliose form. CCA, macroalgae, and filamentous turf algae were present across all ridges. Macroalgae cover in the area was generally sparse, occasionally present in less than 10% cover. Invertebrates as well as several families of fishes were observed. In particular, lobsters of significant size (near terminal size) were observed on multiple occasions. Fine sediment (a mix of terrestrially derived fines and carbonate derived sand) was present in the area, with better visibility southward and more turbid in waters northward.

The FWCA addendum report concluded that the spur-and groove area located in the immediate vicinity of Wailuku River has a high abundance of coral by Hawai'i standards. The average coral cover in the Main Hawaiian Islands is approximately 22% according to the CRAMP. The area was observed to have generally low water visibility and signs of sedimentation. Since further increase in sedimentation and turbidity may contribute to coral reef decline within the area, USFWS gave recommendations to evaluate potential risk of increased sedimentation transport to nearshore areas during the alternatives formulation process.

Threatened & Endangered Species

None of the plant species recorded during the botanical surveys conducted by AECOS is listed as endangered or threatened, or proposed for inclusion as a listed species by federal or state agencies. A portion of the upper watershed has been designated as critical habitat for at least 45 threatened or endangered species of plants; however, this designated area is not within or in the vicinity of the boundary of the project area (Figure 3-5).

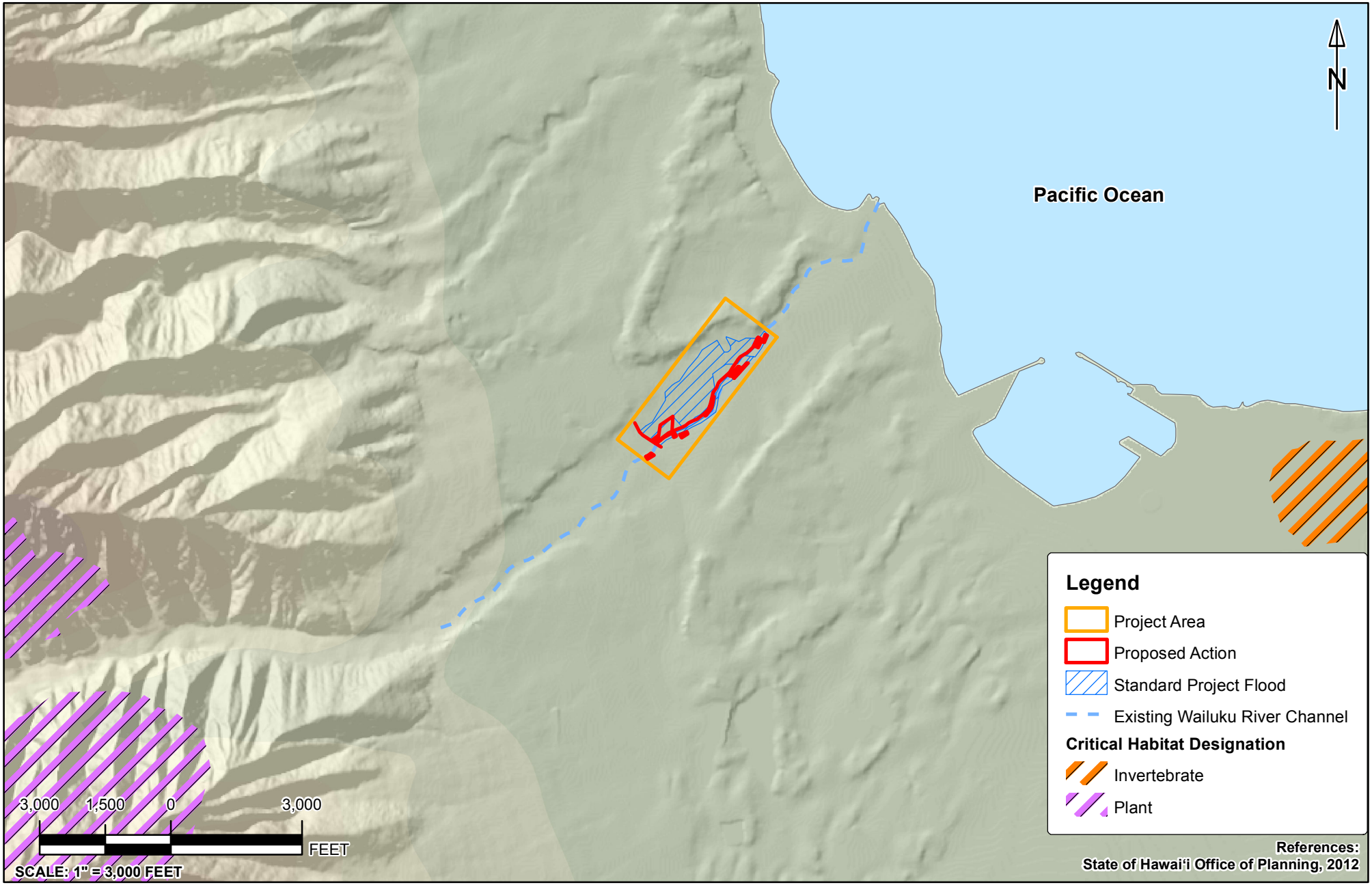
No aquatic species protected by the state, or federally listed endangered or threatened species were observed in Wailuku River during the aquatic biota surveys conducted by AECOS. The endangered Green Sea Turtles (*Chelonia mydas*) were sighted offshore during the Phase I marine habitat characterization survey conducted within the vicinity of the mouth of Wailuku River (USFWS, 2011b). These species are also known to nest on beaches in close proximity to Wailuku River.

3.5.4 Approach to Analysis

Determination of the significance of potential impacts to biological resources is based on 1) the importance (i.e., legal, commercial, recreation, ecological, or scientific) of the resource; 2) the proportion of the resource that would be affected relative to its occurrence in the region; 3) the sensitivity of the resource to proposed activities; and 4) the duration of ecological ramifications.

As defined under ER 1105-2-100 *Planning Guidance Notebook* C-3.d.(4)(a), the significance/importance of ecological resources are determined based upon their monetary and non-monetary values. Monetary value is based upon the contribution the resources makes to the Nation's economy; non-monetary value is based upon technical, institutional, and public recognition of the ecological, cultural, and aesthetic attributes of resources within the affected area.

Impacts to biological resources are significant if species or habitats of concern are adversely affected over relatively large areas, or if disturbances cause reductions in population size or distribution. Potential physical impacts such as habitat loss, noise, and impacts to water quality were evaluated to assess potential impacts to biological resources resulting from the Proposed Action.



ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻĪAO STREAM FLOOD CONTROL PROJECT

CRITICAL HABITAT MAP
WAILUKU, MAUI, HAWAI'I

FIGURE 3-5

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3.5.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, the Proposed Action would not be implemented and there would be continued significant impacts to the downstream marine ecosystem caused by sediment runoff originating from erosion of the stream bank upstream during storm events. Biological resources within the marine habitat within the vicinity of the stream mouth would continue to be impacted from sedimentation suspended in runoff waters.

Proposed Action

Implementation of the Proposed Action would result in less than significant short-term impacts on biological resources within the project area during the construction period. The two staging areas required for the construction of the overflow channel system as well as grading activities required for the construction of the overflow channel may result in temporary loss of vegetation and habitat for terrestrial species during the construction period. However, no threatened or endangered species, or critical habitat for any threatened or endangered species, occur within the project area, and terrestrial species that are known to occur in the project area are mostly widespread common species.

In addition, displaced terrestrial flora and fauna would be expected to return to the project area following completion of construction activities; therefore, the loss or disturbance of habitat within the project area during construction activities would be less than significant short-term impacts. No irrevocable loss of habitat, ongoing takes, or direct mortality of threatened or endangered species would occur due to the O&M of the proposed overflow channel system.

Although not observed within or in the vicinity of the proposed project area during the biological surveys conducted at the site, the endangered Hawaiian hoary bat or *ʻŌpeʻapeʻa* (*Lasiurus cinereus semotus*) has the potential to occur in the vicinity of the project area. Hawaiian hoary bats roost in both exotic and native trees. If any trees are removed during the bat breeding season, there is a risk of injury or mortality to juvenile bats. To minimize the potential for impacts to this species, site clearing will be timed to avoid disturbance to breeding Hawaiian hoary bats; woody plants greater than 15 ft (4.6 m) tall will not be disturbed, removed, or trimmed during the bat birthing and pup rearing season (June 1 through September 15).

In addition, although not observed within or in the vicinity of the proposed project area during the biological surveys conducted at the site, the state endangered Hawaiian short-eared owl or *Pueo* (*Asio flammeus sandwichensis*) has the potential to occur in the vicinity of the project area. *Pueo* are a

crepuscular species, most active during dawn and dusk twilights. To avoid potential impacts to this species, twilight pre-construction surveys will be conducted prior to any vegetation clearance. If *Pueo* nests are present, a buffer zone will be established in which no clearing occurs until nesting ceases and the DLNR Division of Forestry and Wildlife (DOFAW) will be notified.

Finally, state and federally listed waterbirds such as the Hawaiian duck (*Anas wyvilliana*), Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), and Hawaiian moorhen (*Gallinula chloropus sandvicensis*) are likely to occur in the vicinity of the proposed project area. These species have not been observed during the biological surveys conducted at the project site; however, as a precautionary measure, surveys for waterbirds by a qualified biologist will be conducted prior to any land clearing or excavation activities, and will be repeated if these activities are delayed more than three days. If a nest is discovered at any point, DOFAW staff will be contacted. In addition, if a bird is present during ongoing activities, then all activities within 100 ft (30 m) of the bird will cease, and the bird will not be approached. Work will continue after the bird has left the area of its own accord.

Although construction activities are anticipated to occur during the daytime, if any nighttime lighting is used, they will be fully shielded to minimize impacts to seabirds that may pass through the area.

Temporary increase in stream or marine sedimentation may occur as a result of construction activities. BMPs including silt fencing, wetting bare soil, covering soil, and post construction re-vegetation would be utilized to limit significant impacts on the stream and marine habitat. Concrete structures within the stream would be constructed in halves in order to avoid impediment of stream flow. The Proposed Action would also comply with Section 404 (b)(1) of the CWA, which regulates dredge and fill material deposited into U.S. waters. As a result, short-term impacts on biological resources due to stream or marine sedimentation would be considered less than significant.

Construction of the 15-ft wide gravel maintenance road along the stream channel would result in loss of vegetation along the proposed stretch of the road; however, the terrestrial species that are known to occur within the area are mostly widespread common species, thus no significant impacts to the biological resources within the area is expected. In the long-term, the Proposed Action is expected to have beneficial impacts on the biological resources within the stream and the nearshore marine environment. The overflow channel system would divert high-velocity and high-volume flood flows into the existing left-bank floodplain thereby reducing the main channel flow in the approximately 3,200-ft long reach of the stream. This would result in reduced erosion of the stream banks within the main channel, allowing for less sediment to be directly transported to the stream mouth and into the nearshore marine

environment. Improved water clarity and reduced sedimentation would have positive impacts on the coral species as well as the marine invertebrate species supported by the coral reef.

In addition, the overflow channel system would allow flood waters to be dispersed into the natural floodplain where sediment and other entrained constituents would be able to settle out instead of being directly channeled downstream and into the nearshore marine environment. A sedimentation study was conducted to assess the potential changes in sediment loads associated with the Proposed Action (Appendix I). The study focused on sediment loads resulting from channel erosion within the stream section from immediately upstream of the proposed overflow channel to the point where the diverted water reenters the main stream channel. The rate of sediment loss from this stream section without diversion is estimated at 1,044 metric tons per hour (Mg/hr) during a SPF flow event.

The study shows that diversion of stream waters at the overflow channel section alone would result in a reduced sediment loading rate of 288 Mg/hr or an estimated 72% reduction in total sediment lost during a SPF event. Bank stabilization included in the Proposed Action is expected to further reduce total sediment losses from the main stream channel.

In order to estimate the sediment yield from the overflow channel/floodplain during a SPF event, the same method used to estimate sediment loads resulting from erosion within the main channel was utilized with modifications to account for reductions in erosion potential due to the presence of vegetative cover within the overflow channel/floodplain. The majority of the floodplain is currently vegetated due to its use as pasture land and small agriculture production. The overflow channel would be grassed following grading of the area for erosion control. The rate of sediment loss originating from within the overflow channel area and floodplain during a SPF event for the current condition is estimated at 97 Mg/hr. Although diversion of flood waters would result in transport of sediment from the floodplain into the main channel to some extent, implementation of the Proposed Action would result in overall reduction in sediment load downstream of the proposed project area. The Proposed Action is expected to have a beneficial impact in respect to mitigating the suspended sediment load entering Kahului Bay.

Decrease in sedimentation and turbidity is expected to improve water clarity and the current condition of reef habitats within the nearshore environment. Improved water quality may also have positive impacts on the green sea turtles that nest on beaches within the vicinity of the mouth of Wailuku River.

The USFWS raised concerns regarding potential impacts to the endangered Hawaiian Stilts from the potential of "attractive nuisance" of ponding floodwaters within the floodplain during flood events. The length of time that floodwaters would remain in the floodplain is dependent upon the magnitude of the storm event; however, is not expected to be greater than nine hours. Based on this estimation, ponding

floodwaters in the floodplain may temporarily attract the Hawaiian Stilts but would not create a permanent nesting or foraging ground that may otherwise have potential impacts on the population distribution of the species. Considering that flood events large enough to create ponding in the floodplain would be sporadic, impacts to Hawaiian Stilts are anticipated to be less than significant.

Per ER 1105-2-100, *Planning Guidance Notebook* C-3.d.(3)(l), it is USACE's policy to "demonstrate that damages to significant ecological resources have been avoided or minimized to the extent practicable; that unavoidable damages to these resources have been compensated to the extent justified; and, that restoration opportunities for significant ecological resources have been given appropriate consideration during the project planning phase." ER 1105-2-100, C-3.e. states that USACE must "ensure that project-caused adverse impacts to ecological resources have been avoided or minimized to the extent practicable, and that remaining, unavoidable impacts have been compensated to the extent justified. The recommended plan and the NED plan, if not one in the same, shall contain sufficient mitigation to ensure that either plan selected will not have more than negligible adverse impacts on ecological resources (Section 906(d), Water Resources Development Act [WRDA] 1986)."

Native and indigenous freshwater gobies as well as shrimp and snail observed in Wailuku River are becoming increasingly rare, and are ecologically and culturally significant to the region. These aquatic species require continuous flow of the stream to complete their reproductive life cycle. Any impediment to stream water flow would significantly impact the survival of these species.

The Proposed Action would not impact the ability for an IIFS of greater than 5 mgd to remain in the channel through the project area and downstream to the stream mouth, and has been designed to facilitate fish passage by incorporating a 15-ft wide opening in the diversion weir. The invert of the diversion weir would be at or below the existing stream bed elevation to allow for the stream to flow continuously during low-flow conditions. Flow velocity through the opening would be controlled by the natural riffles and pools formed by the existing boulder stream bed both up and downstream of the diversion weir. Additionally, fully grouted riprap was selected as the best revetment type for the lateral overflow weir to accommodate high stream velocities and increased levels of turbulence resulting from changes in the stream flow direction. This type of revetment would conform to the existing stream bed and is anticipated to provide sufficient rugosity for migrating organisms to grasp and rest.

Flood control projects must balance enhancement of flood protections against degradation of the natural interaction between a stream and its watershed. In the natural process, the upper reaches of a stream are erosional, removing and transporting material down slope; the lower reaches are mostly depositional, depositing material outside or beyond the natural stream banks, or discharging material beyond the mouth

of the stream. The project area is located within a mostly urbanized portion of the watershed where the stream is isolated from the watershed to prevent overland flooding. The Proposed Action provides the opportunity, within a limited area, for the stream to return to its natural process of spreading across the floodplain during large storm events. The Proposed Action would not result in impediment of the continuous flow or the biological connectivity of the stream through Wailuku town and would not result in further isolation of the stream from the watershed; therefore, would not have any significant impacts to the watershed ecology. Furthermore, the Proposed Action is essentially incremental to the original flood control project implemented in 1981. Any cumulative impacts on the watershed derive from those already experienced since the initial project construction (see Section 3.14 for further discussion on cumulative impacts).

The Proposed Action would result in less than significant short-term impacts on biological resources during the construction period and would not result in significant direct, indirect, or cumulative impacts to the existing biological resources within and in the vicinity of the project area. Since the Proposed Action has been designed to avoid any significant impacts to the existing biological resources within the stream, mitigation measures are not required as part of the proposed project.

During the alternatives formulation process in the past, project design features intended to minimize environmental disturbance such as adding structural features within the stream to facilitate aquatic organism passage or creating shaded areas to provide reduced water temperatures for aquatic species were considered. Previous design alternatives included modification or disturbance to a larger section of the stream reach (as compared to the current Proposed Action) which would have resulted in significant impacts to biological resources; as such, those impacts required measures to mitigate impacts to biological resources and also included opportunities to construct design features that would support native aquatic species habitat function within the modified portions of the stream.

During a recent coordination meeting with the resource agencies (USFWS, EPA, NMFS, DAR, and COM) on September 17, 2014, USACE provided an overview of the Proposed Action and explained that mitigation measures would not be required since no channel hardening within the stream would be conducted and no significant impacts to biological resources would be anticipated. The resource agencies concurred with this determination and expressed support on the Proposed Action. The meeting minutes from this meeting are included in Appendix F.

3.6 HISTORICAL AND CULTURAL RESOURCES

3.6.1 Definition of Resource

Cultural resources represent and document activities, accomplishments, and traditions of previous civilizations, and link current and former inhabitants of an area. Depending on their conditions and historic uses, these resources may provide insight to living conditions in previous civilizations and may retain cultural and religious significance to modern groups.

Archaeological resources comprise areas where prehistoric or historic activity measurably altered the earth or deposits of physical remains (e.g., arrowheads, bottles). Architectural resources include standing buildings, districts, bridges, dams, and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for inclusion in the National Register of Historic Places (NRHP), an inventory of culturally significant resources identified in the U.S.; however, more recent structures, such as Cold War-era resources, may warrant protection if they have the potential to gain significance in the future. Traditional cultural resources can include archaeological resources, structures, neighborhoods, prominent topographic features, habitats, plants, animals, and minerals that Native Americans or other groups consider essential for the persistence of traditional culture.

3.6.2 Regulatory Setting

Several Federal laws and regulations have been established to manage cultural resources, including the NHPA of 1966, the Archaeological and Historic Preservation Act (1974), and the Archaeological Resource Protection Act (1979). In order for a cultural resource to be considered significant, it must meet one or more of the following criteria for inclusion on the NRHP:

"The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design setting, materials, workmanship, feeling, and association and: (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives or persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (d) that have yielded, or may be likely to yield, information important in prehistory or history" (CFR, Title 36, Part 60:4; 2004).

The DLNR State Historic Preservation Division (SHPD) works to preserve and sustain historical and cultural resources through three branches: History and Culture, Archaeology, and Architecture. The SHPD maintains the statewide inventory of Historic Properties and reviews development projects in order to lessen the effects of change on Hawaiʻi's historical and cultural assets. Administrative rules pertaining to historic preservation in Hawaiʻi can be found in HAR chapters 197-198, 275-284, and 300. Statutes pertaining to historic preservation in Hawaiʻi are found in HRS chapter 6E.

Traditional cultural practices acknowledged in the State of Hawaiʻi include rights of access and gathering. Traditional gathering rights have been codified in HRS 1-1 and 7-1, Article 12-7 of the Constitution of the State of Hawaiʻi, and affirmed in various legal decisions. In order to exercise traditional gathering rights in the State of Hawaiʻi, an individual must establish the following: he/she must qualify as "native Hawaiian"; he/she must establish that their claimed right is protected as a customary or traditional native Hawaiian practice; AND he/she must prove that the exercise of that right will occur on undeveloped or "less than fully developed property" (SOEST, 2014).

Articles IX and XII of the State Constitution of Hawaiʻi (Chapter 343, HRS) require government agencies to promote and preserve cultural beliefs, practices, and resources of native Hawaiian and other ethnic groups. The "Guidelines for Assessing Cultural Impacts", adopted by the Environmental Council of the State of Hawaiʻi (1997), identifies the protocol for conducting cultural assessments.

3.6.3 Existing Conditions

Regional and Local History

During the pre-Contact and early post-Contact periods ʻĪao Valley and the greater Wailuku area was a political and ceremonial center (Cordy 1981, 1996; Kirch 1985, as cited in PCSI, 2014). ʻĪao Valley and the surrounding area were home to many chiefs and a large population, making Wailuku a "chiefly center". The literal translation of ʻĪao is "cloud supreme" and was once a sacred burial place for chiefs. Numerous heiau were once present in the area, which indicates ʻĪao Valley was of ceremonial importance during the pre-Contact period. During the early historic period several famous battles were fought from the coast to the valley. Land Commission Awards granted in the mid-nineteenth century in lower ʻĪao Valley indicate a substantial population was once present in the area and that the land was agriculturally very important.

Background research on land use history indicates that the project area contained *loʻi* (taro) patches during the pre-Contact and early historic periods. Over a century of sugarcane farming in the area has undoubtedly impacted remnant evidence of traditional *loʻi* and associated pre-Contact or early historic

sites. The potential for encountering human burials or habitation sites is considered low due to previous disturbance by sugarcane agriculture, in addition to natural events that altered the landscape, such as the flood of 1916. Potential for other pre-Contact or early historic features associated with traditional agriculture is also considered low. However, if such features are extant in subsurface layers, they may be evidenced by stone and earthen terraces, alignments, walls, and *'auwai*. Associated artifacts may include lithic artifacts such as basalt cores, adzes, flakes, or poi pounders.

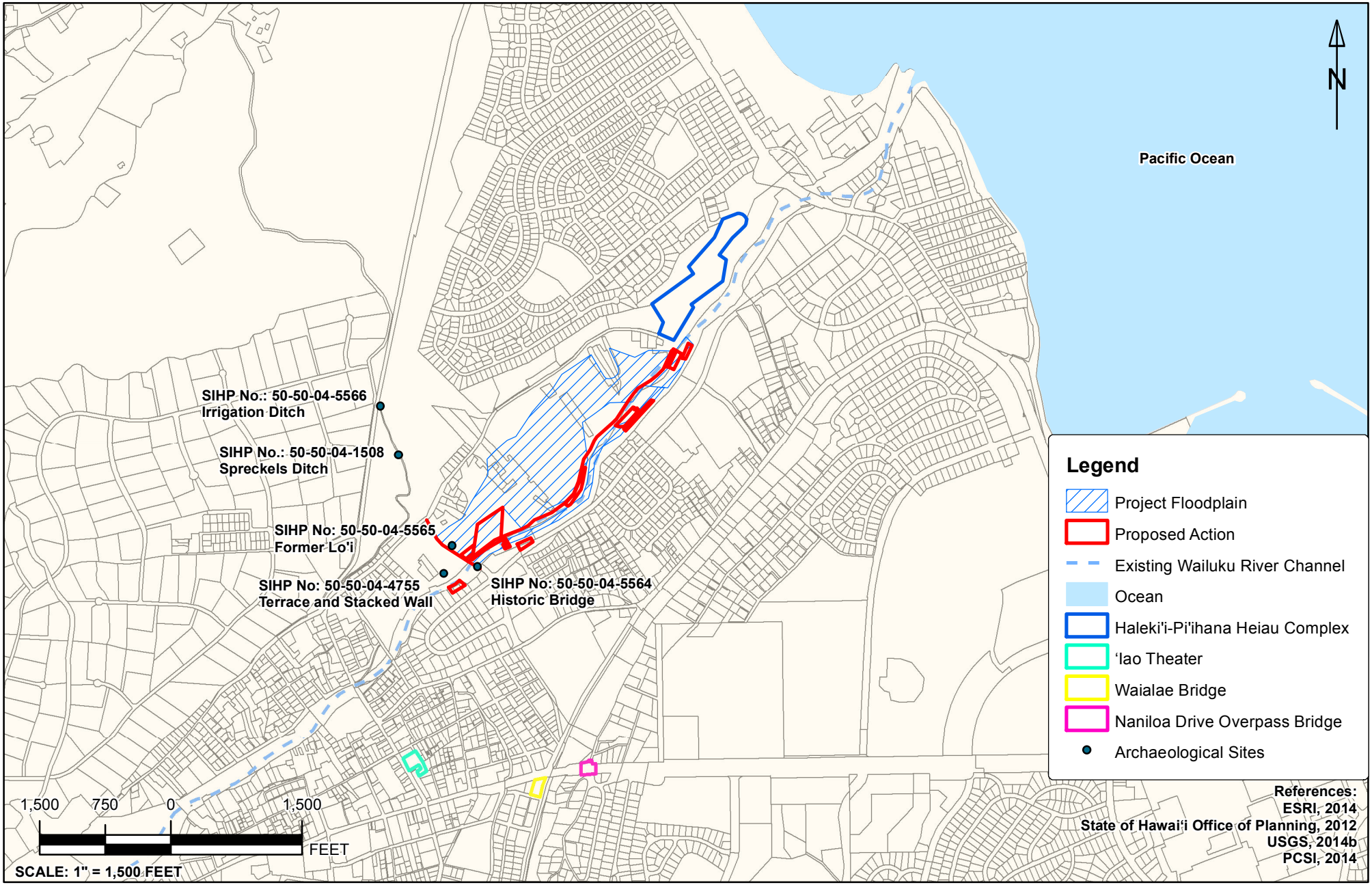
Based on historic information, the project area may contain evidence of temporary, small scale habitations associated with *lo'i* or sugarcane fields. Evidence of traditional camps may be lithic artifacts (adzes, flakes, etc.), faunal remains, and charcoal associated with imu (traditional underground oven). Historic period camp sites may additionally include historic artifacts (metal, ceramic, and glass assemblages).

Archaeology

Numerous archaeological investigations have been conducted in 'Īao Valley. Previous work has included archaeological assessments, archaeological surface survey, archaeological inventory survey, archaeological subsurface testing, and archaeological monitoring (PCSI, 2014). A few of these projects were carried out within or near the current project area. The following section focuses on projects conducted in the immediate vicinity of the project area in order to compare previous findings of land use.

In 1998, Scientific Consulting Services, Inc. (SCS) conducted an archaeological reconnaissance survey and subsurface testing for the 'Īao Stream Flood Control Project (Burgett and Spear, 2003). The reconnaissance survey that included the current project area revealed only one site (SIHP No. 50-50-04-4755) located in the vicinity but outside of the boundaries of the proposed overflow channel (Figure 3-6). The site comprises three features: a concrete foundation with concrete troughs, a soil-filled terrace and retaining wall, and wall remnant. These features were interpreted as a small historic habitation complex-activity area. The excavation of three test units at the site revealed historic and recent materials (modern debris). Historic materials were possibly associated with a post-Contact (late nineteenth or early twentieth century) agricultural site. According to local informants, the area of the find was formerly a piggery. Architectural and surface remains were minimal.

This site was initially assessed as significant under Criterion D, due to its potential to yield information important to research on the history in the area, but based on the information obtained from recordings and excavations at the site during the survey, the site was deemed to be no longer significant. No further work was considered necessary or recommended for the site (Burgett and Spear, 2003).



ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻĪAO STREAM FLOOD CONTROL PROJECT

HISTORICAL AND CULTURAL RESOURCES MAP
WAILUKU, MAUI, HAWAI'I

FIGURE 3-6

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An archaeological inventory survey (AIS) was carried out in 2004 by SCS for the proposed Imi Kala Street and Neki Place Extensions (Tome and Dega 2004). Eleven test trenches were excavated at various locations in the general project area, but outside the boundaries of the Proposed Action. The testing revealed that evidence of former *loʻi* is extant in the lower valley. Four archaeological sites were documented (Figure 3-6), one of which, Spreckels Ditch (SIHP No. 50-50-04-1508), was previously recorded. SIHP No. 50-50-04-5564 is the historic bridge constructed for Wailuku's sugarcane industry; SIHP No. 50-50-04-5565 is former loʻi used during the pre-Contact and early post-Contact periods; and SIHP No.50-50-04-5566 is a small, concrete-lined irrigation ditch constructed by the sugarcane industry and utilized by the more recent macadamia nut industry. A radiocarbon dated soil sample containing organic material yielded a calibrated date range of 1180 to 1290 AD (at 2 sigma) and 1231 to 1272 AD (at 1 sigma). No other traditional archaeological sites or features were identified.

An AIS was conducted by Pacific Consulting Services, Inc. (PCSI) in May 2014 to determine the presence/absence of significant cultural deposits within the project area. The AIS employed a parquet-style configuration of ten 20m-long and 1.2m-wide trenches distributed systematically across the proposed overflow channel area where ground-disturbing activities are being proposed.

The subsurface survey yielded no definitive evidence of pre-Contact/early post-Contact *loʻi* in the area, nor was there evidence of temporary pre-Contact occupation associated with *loʻi* or post-Contact occupation associated with sugar cane cultivation. There was no sign of subsurface features (pits, post molds, fire features, etc.) at the base of the sugar cane plow zone, or associated with layers below the plow zone. There were no buried *loʻi* walls present and no evidence of decomposing taro corms in any of the subsurface layers. The AIS report that includes the detailed results of the subsurface testing and soil analysis is included as Appendix J.

Section 106 Coordination and Consultation

Initial cultural resources coordination and consultation with the State of Hawaiʻi Historic Preservation Office (SHPO) was based on the earlier suite of alternatives evaluated in the Draft EA (2009), and included the assumption that construction efforts would be confined to the existing stream channel. Based on that initial suite of alternatives, no effects on historic properties or significant cultural resources were anticipated. The USACE summarized this finding of "no effect" in letters to the SHPO and Office of Hawaiian Affairs (OHA), as well as the County of Maui Cultural Resources Commission, the Central Maui Hawaiian Civic Club, and the President of the Association of Hawaiian Civic Clubs. The SHPO was contacted initially in 1996 and responded with concurrence in a letter to the USACE (Appendix F). A second set of letters was sent to both SHPO and OHA in 2005, and a response was received from OHA

requesting that archeological level survey work be conducted in the project area. The third round of letters was sent to SHPO, OHA, the County of Maui Cultural Resources Commission, the Central Maui Hawaiian Civic Club, and the President of the Association of Hawaiian Civic Clubs in 2007, requesting Section 106 consultation. The EA process was halted in 2009, however, and the consultation process was similarly halted.

The Proposed Action involves ground-disturbing activities outside of the existing stream channel, and thus the prior assumptions and results of consultation are no longer entirely applicable to this EA. USACE reinitiated scoping with the SHPO in late 2013. USACE staff met with the Maui SHPD during the week of December 2, 2013 to describe the Proposed Action and continued consultation with a site visit. SHPD noted concerns that a historical Native Hawaiian lo'i may be present within the affected portion of the project area.

It was decided during the meeting that a reconnaissance level AIS would be completed within the portion of the left bank overflow channel where ground-disturbing activities would take place during construction, but that no surveys would be required within the floodplain where stream waters would be diverted to until returning to the main channel downstream. The preliminary findings of the AIS conducted in May 2014 were forwarded to SHPD via email in June 2014 (Appendix F). In addition, a formal Section 106 consultation was initiated with submittal of the Final AIS report and a no adverse effect determination letter to SHPD and other Native Hawaiian Organizations including OHA, Hui Malama I Na Kupuna 'O Hawai'i Nei, and the Central Maui Hawaiian Civic Club. The Section 106 consultation letter sent (Appendix E) indicated that although no evidence of significant cultural deposits were identified during the AIS, because of the potential presence of cultural remains, archaeological monitoring by a qualified archaeologist, in accordance with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation, Professional Qualifications Standards, will be conducted during ground disturbing activities to ensure proper treatment of any possible subsurface historical, cultural, and/or archaeological resources encountered. SHPD indicated that they concur with the determination; however, a formal response has not been received to date from SHPD or the other consulted parties.

Historic/Cultural Resources

A total of 31 properties and historic districts are listed on the NRHP for Maui County. Of the 31 listed properties, two are located within 0.5 miles of the project area (Figure 3-6). The two properties located within 0.5 miles of the project area are the 'Īao Theater and the Waialae Bridge. The 'Īao Theater is

located approximately 0.42 miles from the project area on North Market Street and the Waialae Bridge is located approximately 0.48 miles from the project area on Waialae Road (SHPD, 2014).

The Hawaiʻi Register of Historic Places formally recognizes districts, sites, structures, buildings and objects and their significance in Hawaiʻi's history, architecture, archaeology, engineering and culture. A total of 64 properties and historic districts are listed on the Hawaiʻi Register of Historic Places for Maui County. Three of the 64 properties are located within 0.5 miles of the project area (Figure 3-6). Both the ʻĪao Theater and Waialae Bridge are included on the Hawaiʻi Register of Historic Places. In addition, the Naniloa Drive Overpass Bridge is located approximately 0.49 miles of the project area on Naniloa Drive (SHPD, 2014).

An oral history survey was conducted in November of 2003 by Social Research Pacific, Inc. (SRP), to obtain information regarding properties of cultural and historical significance from Hawaiian *kūpuna,* Hawaiian elders, that live on Maui. Along with interviews, information about traditional cultural properties (TCPs) was gathered from written and archival sources and incorporated in a Cultural Impact Assessment (CIA) in accordance with National Park Service guidance (Parker and King, 1995). Based on the research and interviews incorporated into the CIA, there are no known TCPs within the immediate vicinity of the project area, and traditional land uses of the project area have been discontinued. Area residents responded during interviews and at the public meeting with concerns about erosion, channelization of the stream, and impacts to native stream biota. The full report is provided in Appendix K, and key points are presented in more detail below.

The ʻĪao Valley, as with the remainder of the Wailuku ahupuaʻa, has unique significance to native Hawaiian culture. Changes in land ownership, military presence, sugar cane farming, and general urbanization have over time, however, dramatically altered the land uses within ʻĪao Valley. Remnants of old buildings and traditional land uses are being phased out by the influx of urban growth in the valley. Traditional practices had been discontinued even before the rise of sugar cane farming in the project location.

Even with the substantial change to this cultural landscape, vestiges of its highly significant past do remain and the Wailuku region retains its traditional significance. Oral history from Hawaiian *kūpuna* indicates there are three known TCPs in the vicinity of the project area but not within the boundaries of the Proposed Action:

- Halekiʻi-Piʻihana *heiau* complex (Figure 3-6).
- Fresh water spring (listed as *Waiola* by the CWRM), located on the Sevilla property.

- Burials along the sand dunes and at Mahalani Cemetery (Piʻihana side). The burials within the sand dunes are well known and recorded.

Possible cultural impacts were assessed using a questionnaire-based survey for existing residents within the project area. Thirty-two residents of the project area were surveyed. The majority of individuals interviewed have not witnessed severe floods, and expressed more concern over erosion than flood control. Although most of the interviewees rarely use the stream for recreational and/or social purposes, the community's concern is concentrated around social and recreational values of Wailuku River, including a concern that the proposed flood control measures will only lead to more inefficient water flow to further promote degradation of the natural stream.

The CIA also noted that the Halekiʻi-Piʻihana Heiau State Monument lies along the bank of Wailuku River, near the downstream limits of the project. Specifically, the report noted that continued erosion of the stream bank could lead to the land beneath the heiau being compromised.

The USACE sent a copy of the CIA to OHA summarizing the cultural study conducted for the project and including a "no adverse effect" determination. The OHA responded in a letter dated October 30, 2007 (Appendix F), that included an appreciation for the number of sources consulted in preparation of the CIS, but noted their concerns about the presence of numerous culturally significant sites and native Hawaiian practices in the vicinity of the project. These concerns were addressed in the Section 106 consultation letter sent to OHA in November 2007 and in the Section 106 consultation letter sent to OHA in December 2016 (Appendix F), which indicates USACE's commitment to archaeological monitoring during construction activities to ensure that subsurface cultural remnants are properly identified and its significance and proper disposition are evaluated and determined in consultation with OHA.

3.6.4 Approach to Analysis

Cultural resources are subject to review under both Federal and State laws and regulations. Section 106 of the NHPA empowers the Advisory Council on Historic Preservation to comment on Federally initiated, licensed, or permitted projects affecting cultural sites listed or eligible for inclusion on the NRHP.

Once cultural resources have been identified, significance evaluation is the process by which resources are assessed relative to significance criteria for scientific or historic research, for the general public, and for traditional cultural groups. Only cultural resources determined to be significant (i.e., eligible for the NRHP) are protected under the NHPA.

Analysis of potential impacts to cultural resources considers both direct and indirect impacts. Direct impacts may occur by 1) physically altering, damaging, or destroying all or part of a resource; 2) altering

the characteristics of the surrounding environment that contribute to resource significance; 3) introducing visual, audible, or atmospheric elements that are out of character with the property or alter its setting; or 4) neglecting the resource to the extent that it is deteriorated or destroyed.

Identifying the locations of proposed actions and determining the exact locations of cultural resources that could be affected can assess direct impacts. Indirect impacts primarily result from the effects of project-induced population increases and the resultant need to develop new housing areas, utilities services, and other support functions necessary to accommodate population growth. These activities and the subsequent use of the facilities can disturb or destroy cultural resources.

3.6.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, the overflow channel system would not be constructed. The project area would remain unchanged from current conditions and there would be no direct impacts to any potential archaeological, historic, or cultural resources within the project area. Under the No Action Alternative, there could be indirect impacts to cultural resources outside of the project area. The Halekiʻi-Piʻihana Heiau State Monument lies along the bank of Wailuku River, near the downstream limits of the project. The location of this *heiau* has been identified as a potentially high erosion area, and inadequate flood control measures may compromise the land on which the *heiau* is situated.

Proposed Action

Implementation of the Proposed Action would have less than significant short-term impacts on historic and cultural resources within the project area during the construction period. Archaeological and cultural resources have been encountered in ʻĪao Valley during prior investigations, but at this time no such resources are known to exist within the project area.

Although no evidence of pre-Contact use of the project area was found during the subsurface AIS conducted in May 2014, background and archival documentation indicate that pre-Contact or early historic *loʻi* agriculture occurred in the general region; therefore, archaeological monitoring by a qualified archaeologist, in accordance with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation, Professional Qualifications Standards, will be conducted during ground disturbing activities to ensure proper treatment of any possible subsurface historical, cultural, and/or archaeological resources encountered. An Archaeological Monitoring Plan (AMP) will be completed prior to the start of construction activities by a qualified archaeologist and submitted to the SHPD for review and comment before its finalization.

Implementation of the Proposed Action is not anticipated to have short- or long-term impacts on historic properties because no historic properties are located within or adjacent to the project area. In addition, implementation of the Proposed Action is not anticipated to have short- or long-term impacts on traditional or cultural practices at the project site. Based on written history, oral information from Hawaiian *kūpuna*, and a questionnaire-based survey, no immediate/direct changes are foreseen to known TCPs. The Proposed Action would not exacerbate any of the other main concerns raised by area residents: stream channelization or destruction of native stream habitat, and it would prevent further erosion. Public access to the project area would remain unchanged.

Once developed, the operation and maintenance of the Proposed Action would require clearing the overflow channel and diversion weir once every five years and grass cutting at the diversion weir, new berm, and access road six times a year. These activities are infrequent, cover a minimal footprint, do not involve ground-disturbing activities, and thus would not result in any irrevocable loss of historic or cultural resources. As a result, long-term impacts on historic or cultural resources would be less than significant.

3.7 LAND USE

3.7.1 Definition of Resource

Land use is comprised of natural conditions or human-modified activities occurring at a particular location. Human-modified land use categories include residential, commercial, industrial, transportation, communications and utilities, agricultural, institutional, recreational, and other developed use areas. Management plans and zoning regulations determine the type and extent of land use allowable in specific areas and are often intended to protect specially designated or environmentally sensitive areas.

3.7.2 Regulatory Setting

The CZMA requires direct Federal activities and development projects to be consistent with approved state coastal programs to the maximum extent practicable. Also, Federally-permitted, licensed, or assisted activities occurring in, or affecting, the State's coastal zone must be in agreement with the Hawaiʻi Coastal Zone Management (CZM) Program's objectives and policies. Federal agencies cannot act without regard for, or in conflict with, State policies and related resource management programs that have been officially incorporated into State CZM programs (15 CFR 930).

The State Land Use Law (HRS Chapter 205) established a framework of land use management and regulation in which all lands in the State of Hawaiʻi are classified into one of four land use districts. The

Land Use Commission (LUC) was established by the State legislature in order to administer the land use law.

The Maui County Planning Department offers technical advice to the Mayor, County Council, and commissions; proposes zoning legislation; drafts updates to the General Plan, Maui Island Plan, and Community Plans; presents reports and recommendations on development proposals; and oversees programs on cultural resources, census and geographic information, flood plain permits, and other special projects and permits (Maui County, 2014a).

According to the 2002 Wailuku-Kahului Community Plan, land use decisions for the Wailuku-Kahului district should be made with the intent to promote an attractive, well-planned community with a mixture of compatible land uses in appropriate areas to accommodate the future needs of residents and visitors. Those needs shall be met in a manner that provides for the social and economic well-being of residents and the preservation and enhancement of the region's environmental resources and traditional towns and villages (Maui County Council, 2002).

3.7.3 Existing Conditions

Land Use

The 'Īao Stream Flood Control Project is located within the Nā Wai 'Ehā Watershed on the north side of the island of Maui. The Wailuku River drainage basin is a 10 square mile area that begins at the boundary between the Lahaina and Wailuku Judicial districts and extends along the crests of the Kahoolewa and Kapilau Ridges to the Pacific Ocean. Land use activities surrounding the project area include residential, commercial, and public lands designated as either Urban or Agricultural, according to the State LUC district classifications. Residences are located immediately on the right bank of the stream where the raised berm is proposed to be constructed on the left bank of the stream. The closest residences to the proposed overflow channel system section are located approximately 250 ft to the southeast on the right bank of the stream. The floodplain on the left bank including the area where the overflow channel would be constructed was cleared of illegal tenants and encroachments by the County of Maui in 2013. The floodplain is currently covered with vegetation with no existing structures. None of the surrounding parcels are designated as Conservation land use districts (Maui County, 2014b).

Zoning

Under the Proposed Action, construction activities would involve eight parcels of land. In addition, 13 parcels of land totaling approximately 153 acres would be included within the designated floodplain. All land, easements, rights-of-way, relocation, and disposal areas (LERRD) required for the Proposed Action

is included in the Real Estate Plan (included as Appendix E of the EDR). The parcels within and surrounding the project area are designated as Urban or Agricultural, according to the State LUC district classifications (Figure 3-7). The project area does not include any Agricultural Lands of Importance to the State of Hawaiʻi (ALISH). The land parcel zoning information of the parcels located within the proposed construction area and designated floodplain are summarized in Table 3-6.

Coastal Zone Consistency

The entire island of Maui falls within the coastal zone, and is therefore under the jurisdiction of the CZM Program, which was established in compliance with the CZMA. The program is administered by the State of Hawaiʻi Office of Planning and is intended to provide for the effective management, beneficial use, protection, and development of the coastal zone (HRS 205A).

Tsunami Hazard Zones

The project area is located outside of the tsunami evacuation zone as determined by Maui County Department of Planning (Maui County, 2014b).

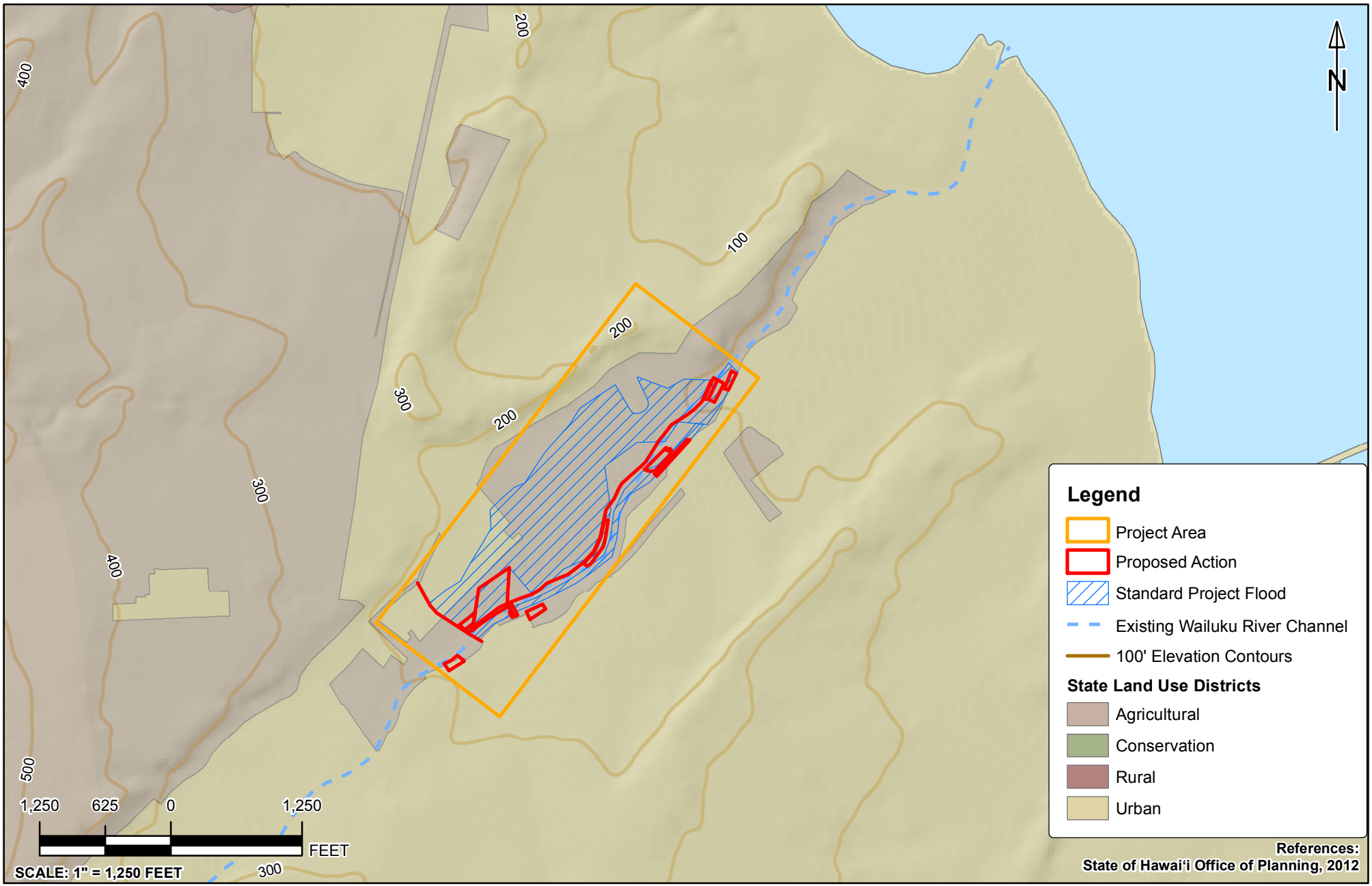
3.7.4 Approach to Analysis

Significance of potential land use impacts is based on the level of land use sensitivity in areas affected by a proposed action. In general, land use impacts would be significant if they would: 1) be inconsistent or noncompliant with applicable land use plans or policies; 2) preclude the viability of existing land use; 3) preclude continued use or occupation of an area; or 4) be incompatible with adjacent or vicinity land use to the extent that public health or safety is threatened.

3.7.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, the overflow channel system would not be constructed. The project area would remain unchanged from current conditions and there would be no changes to current land use within or surrounding the project area. There could be significant impacts to the residential and commercial areas located along the stream bank due to the inadequate flood control measures that currently exist.



ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻĪAO STREAM FLOOD CONTROL PROJECT

STATE LAND USE DISTRICTS MAP
WAILUKU, MAUI, HAWAI'I

FIGURE 3-7

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Table 3-6: Land Parcel Information

Tax Map Key (TMK) Number	Feature	Parcel Area (acres)	State Land Use District	Maui County Zoning Designation	Fee Owner	Lessee
(2) 3-4-032:001	Overflow Channel/ Maintenance Road/ Staging Area	100.0 acres	Urban and Agricultural	County's R-2 Residential District; County's Agricultural District; County's PD Project District	RCFC Piihana LLC	-
(2) 3-4-031:001	Raised Berm/ Floodplain Outflow/ Maintenance Road	46.97 acres	Agricultural	County's Agricultural District	Lindsey, Noenoe Marks; Haller, Michele Lee; Haller, Stephen Daniel	-
(2) 3-4-030:888	Concrete Diversion Weir/ Floodplain Outflow/ Slope Revetment/ Bank Stabilization	unknown	Agricultural	-	Maui County	-
(2) 3-4-030:020	Staging Area	2.91 acres	Agricultural	County's R-2 Residential District	KLD Holdings LLC	-

Tax Map Key (TMK) Number	Feature	Parcel Area (acres)	State Land Use District	Maui County Zoning Designation	Fee Owner	Lessee
(2) 3-4-030:002	Floodplain Outflow/ Maintenance Road	6.36 acres	Agricultural	-	Haller, Michele Lee; Sera, Sadao; Kishaba, Mildred; Lindsey, Noenoe Mark; Haller, Stephen Daniel; Kishaba, Richard R.; Kaailau, Kanae; Victor, Joseph Aiona; Sera, Agnes Mitsuko	-
(2) 3-4-020:044	Bank Stabilization	0.31 acres	Urban	County's M-1 Light Industrial	Laborers International	-
(2) 3-4-020:045	Bank Stabilization	0.30 acres	Urban	County's M-1 Light Industrial	Parker Plaza	-
(2) 3-4-020:046	Bank Stabilization	0.25 acres	Urban	County's M-1 Light Industrial	Cerizo	-
(2) 3-4-032:048	Designated Floodplain	0.26 acres	Urban	County's Agricultural District	Mukai, Tamio Trust; Suzuki, Clayton S.; Kaailau, Kanae; Gibo, Claire Trust; Mukai, Ruth Chiyoko Trust	-

Tax Map Key (TMK) Number	Feature	Parcel Area (acres)	State Land Use District	Maui County Zoning Designation	Fee Owner	Lessee
(2) 3-4-032:003	Designated Floodplain	1 acre	Urban	County's Agricultural District	Cockett, Winifred L 2006 Trust; Cockett, Gordon W 2006 Trust; Tom Sun, Mary; Cockett, Gordon; Tom Sun, Francis M	-
(2) 3-4-032:005	Designated Floodplain	0.09 acres	Urban	County's Agricultural District	Wailuku Agribusiness Co., Inc.	-
(2) 3-4-032:047	Designated Floodplain	0.90 acres	Urban	County's Agricultural District	Gibo, Claire C. Trust; Mukai, Ruth Chyoko Revoc LVG TR; Kaailau, Kanae; Mukai, Tamio Revoc Living Trust; Suzuki, Clayton S.	-
(2) 3-4-031:016	Designated Floodplain	0.375 acres	Agricultural	County's Agricultural District	Correia, Antonia G.; Joao, Marjorie Ann; Correia, Joseph Sylvester Jr.; Correia, Raynold; Correia, Abel M.	

Tax Map Key (TMK) Number	Feature	Parcel Area (acres)	State Land Use District	Maui County Zoning Designation	Fee Owner	Lessee
(2) 3-4-031:017	Designated Floodplain	1.14 acres	Agricultural	County's Agricultural District	Joao-Silva, Marjorie Ann; Correia, Joseph Sylvester Jr.; Correia, Raynold; Correia, Antonia; Correia, Abel M	
(2) 3-4-031:019	Designated Floodplain	0.54 acres	Agricultural	-	County of Maui	
(2) 3-4-031:008	Designated Floodplain	0.65 acres	Agricultural	County's Interim District	Cockett, Gordon W. Trust; Cockett, Winifred L. Trust	
(2) 3-4-031:015	Designated Floodplain	0.67 acres	Agricultural	County's Agricultural District	Masters, David R.	
(2) 3-4-031:023	Designated Floodplain	0.43 acres	Agricultural	-	County of Maui	

Source: Maui County, 2014b

Proposed Action

The Proposed Action would involve eight parcels of land (Figure 3-8). The first parcel (TMK [2] 3-4-032:001) is privately owned and contains a mix of agricultural and undeveloped land uses. The overflow channel would be located on approximately 116,060 square feet of area within this parcel. The portion in which the overflow channel would be located contains undeveloped land that is currently not in use. Therefore, no curtailment of beneficial use would take place due to construction activities. In addition, neither of the parcels located within the proposed construction area for the overflow channel are considered special access areas such as a beach, park, or scenic vista.

Additionally, the maintenance road and the temporary staging area would be located within the first parcel as part of the Proposed Action. The maintenance road within this parcel would connect Piʻihana Street to the overflow channel and would continue along the west bank following the stream eventually reaching the floodplain outflow downstream. The temporary staging area would be located adjacent to the overflow channel in the undeveloped area and would be present throughout the construction period (approximately 21 months). Due to the private ownership of the parcel, a perpetual channel improvement easement, a perpetual road easement, and a temporary work area easement would be acquired by the county as part of the Proposed Action.

The second parcel (TMK [2] 3-4-031:001) is privately owned and contains mostly unused cropland adjacent to the stream. The site maintenance road, raised berm, and a portion of the floodplain outflow would be constructed in the parcel. Due to the private ownership of the parcel, a perpetual road easement, flood protection levee easement, and channel improvement easement would need to be acquired by the county as part of the Proposed Action.

The third parcel (TMK [2] 3-4-030:888) is owned by the county and contains the entirety of the channelized portion of the Wailuku River flood control system. The concrete diversion weir as well as bank stabilization features, slope revetment modification, and a portion of the floodplain outflow wouldbe located within this parcel. Currently there is no public access to the channelized portion of the Wailuku River flood control system. Public access is restricted due to safety concerns arising from the periodic flooding of the stream channel.

The fourth parcel (TMK [2] 3-4-030:020) is privately owned where the second staging area on the right bank of the overflow channel section would be located. Due to the private ownership of the parcel, a temporary work area easement would need to be acquired by the county as part of the Proposed Action.

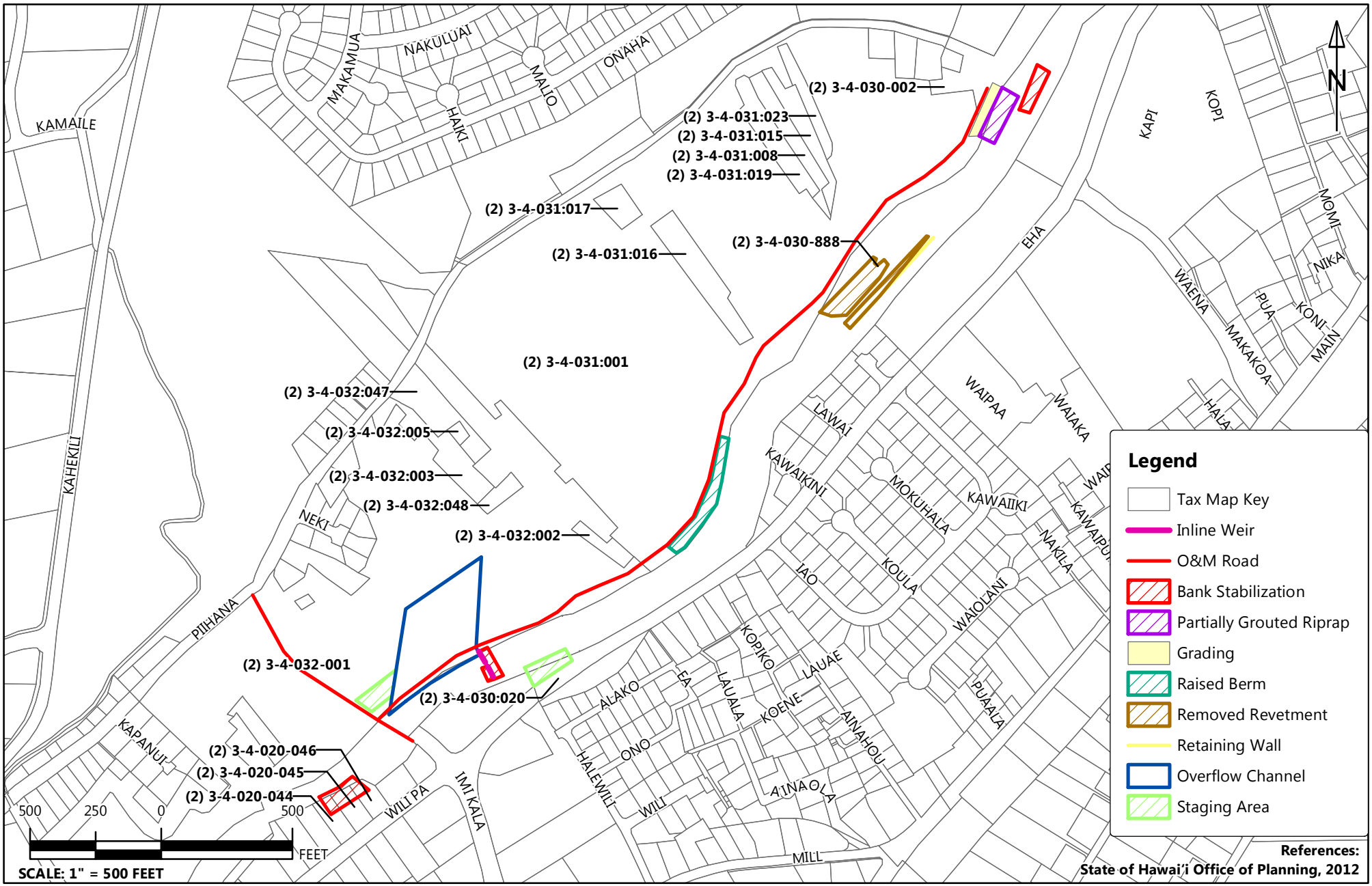
The fifth parcel (TMK [2] 3-4-030:002) is privately owned and contains currently fallow cropland. The floodplain outflow and maintenance road would be located on this parcel. Due to the private ownership of the parcel, a perpetual channel improvement easement and road easement would need to be acquired by the county as part of the Proposed Action.

The sixth, seventh and eighth parcels (TMK [2] 3-4-020:044, TMK [2] 3-4-020:045, and TMK [2] 3-4-020:046) are privately owned and located within the Millyard Industrial Park. The three parcels are improved with buildings but they are on the level upland above the stream. The proposed bank stabilization work would occur on the stream bank on land that has no utility to the ownerships. Due to the private ownership of the parcels, perpetual bank protection easements would need to be acquired by the county as part of the Proposed Action.

In addition to the proposed construction area, there are 13 privately owned parcels located within the designated floodplain. The parcels located within the designated floodplain contain a mix of undeveloped and agricultural land uses. Agricultural land located within the designated floodplain would be inundated during SPF events. However, all 13 parcels located within the designated floodplain have an existing flowage easement in place that was acquired by the county as part of the original flood control project. Further, lands that are currently used for agricultural purposes would not be taken out of cultivation. As a result, agricultural and undeveloped land use within the floodplain would not be significantly affected by construction of the overflow channel.

All permits and easements necessary for the Proposed Action would be acquired in accordance with federal, state, and local laws and regulations prior to construction activities. Therefore, all improvements related to the Proposed Action would be consistent with current land use and would not result in the long-term curtailment of beneficial land use in any of the parcels involved. Short-term impacts to land use due to construction activities under the Proposed Action are considered less than significant. In the long-term, the Proposed Action would have a beneficial impact on land use as it would help to reduce flood risk for properties currently affected by floodwaters from Wailuku River.

The Proposed Action is consistent with the goals, objectives, and policies of the Maui Island Plan (Maui County General Plan 2030) since it would not result in significant impacts to or changes in the current characteristics or identity of the affected area, including population distribution, heritage resources, economic and housing development, and infrastructure and public facilities. The Proposed Action would reduce the risk of flooding in the community of Wailuku and provide protection of life and property, which would benefit the economy and quality of life on the island, which is consistent with the objectives of the Maui Island Plan. Additionally, the Proposed Action would not result in expansion of the current



ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻĪAO STREAM FLOOD CONTROL PROJECT

TMK MAP
WAILUKU, MAUI, HAWAI'I

FIGURE 3-8

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urban areas in Wailuku, development of housing on vacant or underutilized agricultural lands, or curtail the use of rural/agricultural lands identified within the proposed project area. According to the Directed Growth Plan, the backbone of the Maui Island Plan, the Proposed Action lies within the Urban Growth Boundary and is also located within the 'Īao Cultural Corridor Park Protected Area which extends from the makai portions of Wailuku River and runs approximately ¾ miles upstream from Waiehu Beach Road flanking the stream. The area is intended to protect the remains of the Pihana Kalani Heiau and other important cultural resources, and is envisioned to incorporate trail systems, restroom facility and pedestrian linkages to provide lateral and mauka-makai access to the surrounding neighborhoods and business districts. As discussed in Section 3.6, the Proposed Action would not have any significant impacts to cultural resources in the area and does not include construction of any major structures that would impede the open-space corridor envisioned for the 'Īao Cultural Corridor Park Protected Area.

The Wailuku-Kahului Community Plan includes a general description of the Wailuku-Kahului region and identifies the major problems and opportunities specific to the region. The plan identifies "the balancing of urban development and agricultural/open space uses" as a "major challenge for long-range planning of the region." The Proposed Action is within areas designated as Agriculture ("AC") according to the community plan. The Proposed Action would be consistent with the current land use in the area and would not have significant impacts on the balance between urban development and agricultural/open space uses. In addition, the Proposed Action would not be in conflict with the goals, objectives, policies, and implementing actions identified in the plan since it would not result in significant changes to the existing social, economic, or environmental conditions within the area and would provide beneficial impacts to the community of Wailuku by providing reduced flood risks.

Once developed, the Proposed Action would be considered compatible, consistent and not in conflict with any of the objectives and policies of the CZM program (see Section 4.1.3). Development of the proposed overflow channel system would not impact coastal recreation opportunities; impede economic uses; increase coastal hazards; or conflict with development within the coastal zone. Nevertheless, the CZMA requires a formal consistency determination to evaluate Federal activities and development projects to ensure consistency with the Hawai'i CZM Program's objectives and policies to the maximum extent practicable. Federal agencies cannot act without regard for, or in conflict with, State policies and related resource management programs that have been officially incorporated into State CZM programs (15 CFR 930). A federal consistency determination was prepared in accordance with the requirements of applicable subparts of 15 CFR Part 930 and filed with the Hawaii State Office of Planning CZM Program on April 28, 2015. A response letter dated May 5, 2015 from the Office of Planning requesting additional details was received; USACE resubmitted the application package for the consistency determination with

the requested information on April 10, 2017. The public notice for the CZM review was published in the OEQC bulletin, The Environmental Notice, on May 8, 2017 for public review and comment. Comments received were addressed and incorporated into this Final EA. A concurrence letter from the State of Hawaii Office of Planning was received on June 2, 2017 stating that the office concurs with USACE's determination that the Proposed Action is consistent to the maximum extent practicable with the enforceable policies of the Hawaii CZM Program based on the conditions that the proposed activities will be implemented as represented in the CZM federal consistency determination and the EA. Correspondences for the federal consistency determination as well as the comments received during the public review period are included in Appendix F.

3.8 VISUAL AESTHETICS

3.8.1 Definition of Resource

Visual resources are defined as the natural and manufactured features that comprise the aesthetic qualities of an area. These features form the overall impressions that an observer receives of an area or its landscape character. Landforms, water surfaces, vegetation, and manufactured features are considered characteristic of an area if they are inherent to the structure and function of a landscape.

3.8.2 Regulatory Setting

According to the 2002 Wailuku-Kahului Community Plan, the visual appearance of the district is a major concern due to its role as the civic center and gateway to the island of Maui. Directives to improve visual aesthetics in the district include more aggressive litter control and enforcement; better maintenance of public park facilities, particularly those along the shoreline; enhancement of the streetscape along major public roads with tree planting; and in general, greater emphasis on the maintenance and upkeep of public areas (Maui County Council, 2002).

3.8.3 Existing Conditions

The project area is located within the Wailuku-Kahului district. The Wailuku-Kahului district is considered the industrial and financial center of Maui County with an urban core contained within an agricultural and open space landscape. According to the 2002 Wailuku-Kahului Community Plan, lands in the agricultural and conservation districts comprised over 90% of the total undeveloped lands in the district, and a substantial amount of the lands within the district were still used for agricultural production. Agricultural lands were believed to provide a buffer for urban development and to enhance the visual character of the region. The Community Plan noted that the balancing of urban development

with agricultural/open space uses was a major challenge for the long-range planning of the district (Maui County Council, 2002).

The project area is located along the Wailuku River approximately 1.4 miles from the shoreline within the channelized lower reaches of Wailuku River constructed during the 1981 ʻĪao Stream Flood Control Project. Due to the upstream diversion of water from the stream for agricultural uses in the past, in addition to the intermittent nature of the stream itself, the length of the stream located within the project area had historically been absent of water approximately 90% of the year. However, following implementation of the IIFS for Wailuku River mandated following the recent settlement of the Na Wai ʻEha Contested Case, continuous flow through the section of the stream within the project area has been restored. Riparian or terrestrial vegetation in and around the project area can be characterized as coastal dry forest. Vegetation surrounding the project area consists largely of non-native, weedy species that have established themselves in the highly disturbed banks and sand/mud bars that form in the concrete channel.

A mix of residential housing and commercial units surrounds the project area to the east and south. Agricultural and undeveloped lands surround the project area to the west and north. Residential properties along the east bank of Wailuku River makai of Imi Kala Street are separated from the stream by Eha Street. Commercial properties located along the east bank of Wailuku River mauka of Imi Kala Street are adjacent to the bank of the stream. Agricultural and undeveloped parcels located along the west bank of Wailuku River are adjacent to the bank of the stream. The project area is visible from surrounding parcels and roadways.

3.8.4 Approach to Analysis

Determination of the significance of impacts to visual resources is based on the level of visual sensitivity in the area. Visual sensitivity is defined as the degree of public interest in a visual resource and concern over adverse changes in the quality of that resource. In general, an impact to a visual resource is significant if implementation of the proposed action would result in substantial alterations to an existing sensitive visual setting.

3.8.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, the overflow channel system and bank stabilization features would not be constructed. Changes to the visual aesthetics of the project area would not occur as a result of

construction of the proposed flood control features; however, there would be potential for levee failure and subsequent visual aesthetic changes under this alternative.

Proposed Action

Under the Proposed Action, short-term, less than significant impacts to visual and aesthetic resources within the project area during construction activities are expected to occur. These impacts would be due to the presence of construction equipment within and around the project area. The Wailuku-Kahului district is considered the industrial and financial center of Maui County with an urban core contained within an agricultural and open space landscape. The project area itself is surrounded by a mix of residential housing and commercial land uses on the east bank of the channelized stream. Agricultural and undeveloped land uses are located on the west bank of the channelized stream.

The presence of construction equipment would be limited to the proposed construction area and staging areas located adjacent to the commercial and residential parcels on the east bank and undeveloped land on the west bank of the channelized stream. Construction activities associated with the Proposed Action would not cause a significant disturbance to the surrounding visual environment and would be temporary. Additionally, construction equipment would not be placed in a special use area such as a park, beach, or scenic vista. As a result, short-term impacts to visual and aesthetic resources within the project area are considered to be less than significant.

The Proposed Action is expected to have less than significant long-term impacts to visual and aesthetic resources. Once construction is completed, the presence of the overflow channel and other proposed features along Wailuku River would represent a small permanent visual change in the area. With the exception of a 6-ft tall (maximum height) earthen berm along the west bank of Wailuku River, the overflow channel and other proposed features under the Proposed Action would be completed at grade. As a result, the proposed features would blend in to the existing environment as a low-lying public water management feature and would not contrast with the mix of residential, urban, and agricultural aesthetic of the project area. In addition, the Proposed Action would be compatible with the Wailuku-Kahului Community Plan which calls for the balancing of urban development with agricultural/open space uses.

Construction activities would take place on parcels of land currently developed as a channelized stream or on undeveloped lands. The undeveloped and agricultural parcels to be located within the designated floodplain would maintain their current agricultural/open space aesthetic. Therefore, the balance of urban development and agricultural/open space uses would be maintained within the surrounding project area. In addition, the overflow channel and other proposed features would be constructed largely of rock and concrete and would not be a new source of light or glare for nearby properties. As a result, long-term

impacts to visual and aesthetic resources due to the operation of the Proposed Action are considered less than significant.

3.9 RECREATIONAL / RESOURCE USE

3.9.1 Definition of Resource

Recreation is comprised of terrestrial- and water-based activities associated with the local population or visitors to the island. Recreation may consist of aquatic activities such as swimming, windsurfing, surfing, fishing, jet skiing, kayaking, snorkeling, scuba diving, and water skiing. Terrestrial recreational activities may consist of shopping, indoor shooting ranges, restaurants, hiking trails, biking, jogging, and golfing. Resource use includes any commitment of natural resources such as aggregate for concrete and petroleum products to fuel construction equipment needed to construct the Proposed Action, as well as to operate and maintain it.

3.9.2 Regulatory Setting

The Maui County Department of Parks and Recreation operates and maintains the County's numerous parks, recreation areas and recreational service programs for the residents of Maui County. The Department also coordinates with other County departments on enforcement of rules and regulations for parks and recreation facilities and their use, and countywide beautification. The parks located within the project area are managed by the Recreation and Support Division, Central District (Maui County, 2014c).

3.9.3 Existing Conditions

Proposed Project Site

Under the Proposed Action, construction activities would take place on land currently developed as a flood control system and undeveloped land currently not in use. Public access to the flood control system is already not allowed due to pre-existing safety concerns. As a result, it is unlikely that recreational use currently takes place at the proposed construction area.

In addition, 13 parcels of land would be included within the designated floodplain. The 13 parcels of land to be included in the designated flood plain contain a mix of undeveloped and agricultural land uses. These land uses would be maintained under the Proposed Action.

Surrounding Area

The 2002 Wailuku-Kahului Community Plan details the goals and objectives concerning recreational and community facilities within the region. According to the Community Plan, the growth of Maui's

population over time has increased the demands on existing recreational and community facilities in the region. The Community Plan calls for the development and maintenance of an efficient and responsive system of public services which promotes a safe, healthy and enjoyable lifestyle, accommodates the needs of the young, elderly, disabled, and disadvantaged persons, and offers opportunities for self-improvement and community well-being (Maui County Council, 2002).

There are multiple Department of Parks and Recreation facilities located in the Central District. Papohaku Park is located on Waena Street, approximately 0.7 miles east of the project area. Papohaku Park provides a softball field, a basketball court, parking, and restrooms. Honolii Park is located approximately 0.9 miles southwest of the project area. Honolii Park provides parking and a picnic area with tables and benches.

Keopuolani Park is located on Kanaloa Avenue, approximately 1.6 miles southeast of the project area. Keopuolani Park is the largest park in the Maui County parks system. The park is adjacent to the Maui Arts and Cultural Center and the War Memorial Complex. Keopuolani Park provides a track and field venue, amphitheater, gymnasium, aquatics arena, three baseball fields, two soccer fields, a skate park, locker room facilities, picnic areas, parking, and public restrooms (Maui County, 2014d).

The annual Maui County Fair is located at the War Memorial Complex situated on Kanaloa Avenue adjacent to Keopuolani Park. The fair features multi-cultural food, entertainment, horticulture, bonsai, livestock, homemaking, photo and art exhibits, and competitions. The Maui County Fair was started in 1916 and has a mission of giving back to the community while upholding the traditions of Maui. The 2017 Maui County Fair will be held from 5 October to 8 October (Maui Fair, 2017).

The Maui Ocean Center is located on Maalaea Road, approximately 7.6 miles south of the project area. Maui Ocean Center was opened in March 1998 and averages over 400,000 visitors annually. The center provides interactive displays, outdoor touch pools, and an acrylic tunnel through a 750,000 gallon exhibit containing 2,000 fishes. The center is open 365 days a year from 9:00 am to 5:00 pm (Maui Ocean Center, 2013).

The Streamside Trail at the ʻĪao Valley State Park is located 3.8 miles west of the project area. The trail crosses the upper reaches of Wailuku River and winds through a tropical forest, small waterfalls, and natural pools (Trails.com, 2014a).

The mouth of Wailuku River empties into Kahului Bay, approximately 1.4 miles east of the project area. Kanaha Beach Park is located within Kahului Bay, approximately 4.7 miles east of the project area. The park is a popular area for picnics due to its large grassy area and long strip of white sand beach. The

steady trade winds that frequent the area make the park a popular windsurfing beach (Trails.com, 2014b). In addition to windsurfing, Kanaha Beach and Kahului Bay provide a large number of recreational activities including kiteboarding, surfing, fishing, diving, swimming, paddling, kayaking, and camping.

3.9.4 Approach to Analysis

The significance of potential impacts on recreational activities and resource due to the Proposed Action will be assessed. The significance of potential impacts will be determined by considering the direct effects of the proposed action on the beneficial use of recreational activities and natural resources. Substantial secondary impacts such as population changes or effects on public facilities will also be considered.

3.9.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, the overflow channel system would not be constructed. There would be no use of additional recreational areas or resources. Therefore, there would be no impact to recreational or resource use within the project area.

Proposed Action

Under the Proposed Action, no impacts to short-term recreational use in the project area are expected. Construction activities would be restricted to the proposed construction area and staging areas located adjacent to the commercial and residential parcels on the right bank and undeveloped land on the left bank of the channelized stream. Public access to the existing flood control system is already not allowed due to pre-existing safety concerns. Construction activities located on the west bank of Wailuku River would take place on undeveloped land currently not in use. As a result, no recreational activities are believed to take place within the proposed construction area.

The terrestrial- or water-based recreational activities located closest to the project area are Papohaku Park, the ʻĪao Valley State Park Streamside Trail, and Kanaha Beach Park. None of these recreational activities are located adjacent to the project area and no impacts to recreational use of these sites are expected as a result of construction activities. As a result, short-term recreational use in the project area is not considered to be impacted by construction activities.

The Proposed Action is not expected to have any direct long-term impacts on recreational uses within the project area since lands located within the proposed construction area are not utilized for recreational use. Proposed construction activities would take place on parcels of land currently developed as a flood

control system and undeveloped land that are not currently in use. Undeveloped and agricultural parcels to be located within the designated floodplain would maintain their current agricultural / open space aesthetic. No beneficial use of recreational areas would be curtailed. As a result, the Proposed Action is not considered to have direct long-term impacts on recreational use within the project area.

Less than significant impacts to short-term resource use in the project area are expected due to construction activities. The Proposed Action would require the commitment of natural resources such as aggregate for concrete, rock for riprap, and petroleum products to fuel construction equipment. However, the amount of resources needed to complete the proposed overflow channel system would not represent a significant commitment of resources in the project area. Therefore, short-term impacts on resource use in the project area due to construction activities would be considered less than significant.

Less than significant long-term impacts to resource use in the project area are also expected. The overflow channel would need to be cleared regularly of debris. Additional maintenance activities would be limited to minor repair of the overflow channel and other features due to regular wear or acute flooding events. However, these maintenance activities would not represent a significant impact on resource use in the project area. As a result, long-term impacts to resource use would be considered less than significant.

3.10 SOCIOECONOMICS

3.10.1 Definition of Resource

Socioeconomics are defined as the basic attributes and resources associated with the human environment, particularly population and economic activity. Human population is affected by regional birth and death rates as well as net in- or outmigration. Economic activity typically comprises employment, personal income, and industrial growth. Impacts on these fundamental socioeconomic indicators can also influence other components such as housing availability and public services provision.

Socioeconomic data in this section are presented at the County, State, and national levels to analyze baseline socioeconomic conditions in the context of regional, State, and national trends. Data have been collected from previously published documents issued by Federal, State, and local agencies and from State and national databases (e.g., U.S. Bureau of Economic Analysis [BEA] Regional Economic Information System).

3.10.2 Regulatory Setting

In 1994, EO 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations, was issued to focus attention of Federal agencies on human health and environmental

conditions in minority and low income communities and to ensure that disproportionately high and adverse human health or environmental effects on these communities are identified and addressed.

Because children may suffer disproportionately from environmental health risks and safety risks, EO 13045, Protection of Children from Environmental Health and Safety Risks, was introduced in 1997 to prioritize the identification and assessment of environmental health risks and safety risks that may affect children and to ensure that Federal agencies' policies, programs, activities, and standards address environmental health risks and safety risks to children.

3.10.3 Existing Conditions

Social Factors and Community Identity

According to the 2010 census, the total population of Wailuku census designated place (CDP) is estimated at 15,313, which comprises 9.9% of the total population of Maui County, estimated at 154,834 (U.S. Census Bureau, 2014). The median age of Wailuku CDP is 40.8 years old with 23.5% of the total population being under 18 years old and 14.4% over 65 years old.

Socioeconomics

The median household annual income for Wailuku CDP was $69,281 for the years 2008 to 2012, slightly higher than the mean household income for the State of Hawai‘i, which was at $67,492 for the same time period (U.S. Census Bureau, 2014). Wailuku is the county seat and commercial center of Maui County, where numerous family businesses, many of which have been in operation for generations, are located. Many of the historical and cultural attractions in the town, including Ka‘ahumanu Church, the Bailey House, Pihana Kalani Heiau, and the ʻĪao Theater, built in 1927, make Wailuku one of the main tourist destinations on the island. Because of its natural beauty and historical significance, ʻĪao Valley is also a popular tourist attraction. The project area, located upstream of Wailuku town, is characterized by concentrated residential houses.

Environmental Justice

To comply with EO 12898, ethnicity and poverty status in the vicinity of the project area were examined and compared to regional, State, and national data to determine if any minority or low-income communities could potentially be disproportionately affected by implementation of the Proposed Action.

For the years 2008-2012, the percentage of population in Wailuku CDP below the poverty level was 10.1%, which is lower than the Maui County (10.3%), State of Hawai‘i (10.8%), and national (14.9%) percentages (U.S. Census Bureau, 2014).

The percentage of minority residents in Wailuku CDP (79% in year 2010) is comparable to the percentage of minority residents for Maui County (64.1% in year 2012) and State of Hawai'i (73.9% in year 2012) but significantly greater than the nation (22.1% in year 2012) (U.S. Census Bureau, 2014).

Protection of Children

To comply with EO 13045, the number of children under age 18 in the vicinity of the project area was examined and compared to County, State, and national levels. Additionally, locations where populations of children may be concentrated (e.g., child care centers, schools, and parks) were determined to address potentially disproportionate health and safety risks to children that may result from implementation of the Proposed Action.

There are approximately 3,599 children under the age of 18 in Wailuku CDP, comprising 23.5% of the overall population. This is comparable to 23.1% for Maui County, 22.3% for the State of Hawai'i, and 24% for the nation (U.S. Census Bureau, 2014).

The State of Hawai'i Department of Education (DOE) has a total of eight school districts and 320 public schools statewide. Children living in the vicinity of project area attend schools in the Baldwin-Kekaulike-Maui Complex, including Wailuku Elementary School, ʻĪao Intermediate School, and Baldwin High School (DOE, 2014). Wailuku Hongwanji Mission, a day care center, and the War Memorial Stadium complex, the largest sports and recreational facility in the Maui Parks system, are also located in the vicinity of the project area.

3.10.4 Approach to Analysis

Significance of population and expenditure impacts are assessed in terms of their direct effects on the local economy and related effects on other socioeconomic resources (e.g., housing). The magnitude of potential impacts varies depending on the location of a proposed action; for example, an action that creates 20 employment positions may be unnoticed in an urban area, but may have significant impacts in a more rural region. If potential socioeconomic impacts would result in substantial shifts in population trends, or adversely affect regional spending and earning patterns, they would be significant.

3.10.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, the overflow channel system would not be constructed. There would be no change to the existing conditions at the project site. There would be no significant impacts to the regional population structure or social characteristics; however, extensive damage to residential and

commercial properties is expected under the No Action Alternative. According to the economic analysis prepared for the project (included as Appendix F of the EDR), the total expected annual damage (EAD) under the No Action Alternative is $1,952,400. This estimate is based on the structure inventory composed of all residential, commercial, and public buildings within the 0.2% exceedance probability floodplain of Wailuku River.

Proposed Action

The Proposed Action is expected to have a short-term beneficial impact to the local economy by creating temporary employment opportunities and materials spending during the construction phase of the project. O&M required for the structures built under the Proposed Action is also expected to create additional employment opportunities, contributing to the local economy.

The demographics of the project area do not comprise disproportionately high concentrations of minority or low-income populations. Construction activities are expected to be contained within the project area and would not disproportionately affect any specific racial, ethnic, or socioeconomic group living within the vicinity of the project area. In addition, because of their temporary nature, construction activities associated with the Proposed Action are not expected to result in any significant impacts to the local housing or demographics in the long-term.

Construction activities are not expected to increase the hazard or risk to children in the project area since the construction area would be fenced and inaccessible to the public. In addition, none of the off-site areas where significant concentration of children may gather would be impacted by project activities.

Once completed, the Proposed Action is expected to result in beneficial socioeconomic impacts. Residences currently affected by increased flood hazards due to the potential of failure of the existing flood control structures would benefit from the Proposed Action due to reduction in flood risk. The Proposed Action is expected to reduce the total EAD to $600, resulting in an expected annual benefits (EAB) of $1,951,800. In addition, the implementation of the Proposed Action could have the indirect effect of potentially increasing property values in and around the project area as a result of the reduced flood risk.

No short- or long-term impacts under EO 12898 or EO 13045 are anticipated under the Proposed Action.

3.11 PUBLIC INFRASTRUCTURE AND UTILITIES

3.11.1 Definition of Resource

Public infrastructure and utilities comprise functional services provided to a facility by public agencies or by a facility to the community. Such services may include police and fire protection, water and solid waste service, sanitary sewer and wastewater treatment, and recreational facilities. Utilities include infrastructure services that support facility operations, including electricity, natural gas, or telecommunications. On-site utility production, such as power generation or wastewater treatment, occurs at some facilities.

3.11.2 Regulatory Setting

The State of Hawai‘i Public Utilities Commission (PUC) regulates all franchised or certificated public service companies operating in the State. Franchised or certified public service companies operating under PUC regulation include:

- electric providers;
- telecommunication providers;
- motor and water carriers; and
- privately owned water and sewage treatment utilities.

The PUC’s primary purpose is to ensure that regulated companies efficiently and safely provide their customers with adequate and reliable services at just and reasonable rates, while providing regulated companies with a fair opportunity to earn a reasonable rate of return.

3.11.3 Existing Conditions

Hawaiian Electric Company (HECO) and its subsidiaries, Hawai‘i Electric Light Company (HELCO) and Maui Electric Company (MECO), provide electricity for 95% of Hawai‘i’s residents. MECO serves the island of Maui and, as a result, the project area receives its electrical service from MECO (HECO, 2013).

Water resource and distribution systems for the project area are managed by the Maui County Department of Water Supply. The Department of Water Supply provides water to approximately 35,700 services on Maui and Molokai. According to the 2002 Wailuku-Kahului Community Plan, the growth of Maui’s population has increased demands on water in the region, threatening the sustainability of the region’s water (Maui County Council, 2002).

Sewer services for Maui County are directed and overseen by the Maui County Department of Environmental Management Wastewater Reclamation division. The Wastewater Reclamation division is composed of the Administration and Operation elements. The Operations element is responsible for the management, operation, installation, maintenance, and repair of all Maui County wastewater and pumping facilities (Maui County, 2014e).

The Maui Police Department (MPD) serves as the primary law enforcement agency for Maui County, which includes the islands of Maui, Molokai, and Lanai. Maui County is divided into six police districts and the project area is located within District I Wailuku (Maui Police Department, 2012).

The Department of Fire and Public Safety provides emergency and non-emergency services for the islands of Maui, Molokai, Lanai, and Kahoolawe and the surrounding waters. The Department has 14 fire stations throughout the County of Maui. There are 10 fire stations on the island of Maui, three fire stations on the island of Molokai, and one fire station on the island of Lanai. Wailuku Fire Station is located on Kinipopo Street, approximately 0.6 miles south of the project area (Maui County, 2014f).

According to the 2002 Wailuku-Kahului Community Plan, projected future growth of the region is expected to pose challenges to the existing public infrastructure. The challenges include improving and expanding the roadway system network; locating and delivering new sources of potable water; wastewater treatment and methods of effluent disposal; and public and private partnerships for the development and financing of public infrastructure (Maui County Council, 2002).

Under the Proposed Action, construction activities would take place on land currently developed as a flood control system and undeveloped land that is currently not in use. With the exception of the flood control system there are no known utilities present at the proposed construction area.

The ʻĪao Stream Flood Control Project was originally completed in 1981. The project was authorized under Section 203, Flood Control Act of 1968, as amended. The original improvements included a debris basin, diversion levees, and channel improvements along the lower 2.5-mile portion of the Wailuku River (USACE, 2014).

In addition, 13 parcels of land would be included within the designated floodplain. The 13 parcels of land to be included in the designated flood plain contain a mix of undeveloped and agricultural land uses. These land uses would be maintained under the Proposed Action. Building permits for the different parcels indicate that electric, water, and sewer utilities may be present within parcels located in the designated floodplain.

3.11.4 Approach to Analysis

Significance of public services or utilities systems impacts are assessed in terms of their direct effects on the public service or utility providers. The magnitude of potential impacts varies depending on the location of a proposed action; for example, an action that alters existing utility systems infrastructure may be unnoticed in an urban area but may have significant impacts in a more rural region. If potential public service and utility systems impacts would result in substantial shifts in the amount of services provided, or substantial changes to the utility systems infrastructure, the action would be significant.

3.11.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, the overflow channel system would not be constructed. There would be no change to public infrastructure and the existing demand on public services and utilities in the project area would remain the same. Therefore, there would be no impact to public infrastructure and utilities, with the exception of flood control infrastructure. Under implementation of the No Action Alternative, undermining of the existing flood control system – and its ability to protect lives and property from flood events – would continue.

Proposed Action

Under the Proposed Action, no short-term impacts on public services or utilities systems are expected during construction activities. The proposed construction area includes parcels of land currently developed as a flood control system or undeveloped land currently not in use. With the exception of the flood control system there are no known utilities present at the proposed construction area.

Construction work would be completed in approximately 21 months and would be conducted during no or low flow periods. In addition, construction of the concrete structures would take place in halves in order to avoid impediment of stream flow. Therefore, during construction the existing flood control system would continue to operate/function as it currently does and no change to the existing functionality of the flood control system would occur in the short-term. As a result, there would be no short-term impacts on public services or utility systems due to construction activities.

Once completed, the operation and maintenance of the overflow channel system would not require the use of any public services or utilities. The overflow channel would need to be cleared regularly of debris. Additional maintenance activities would be limited to minor repair of the overflow channel and other features due to regular wear or acute flooding events. However, these maintenance activities would not represent a significant impact on public services in the project area. Further, the Proposed Action is

designed to address periodic flooding that causes damage to private property and public infrastructure located adjacent to the channelized portion of Wailuku River. As a result, the long-term impacts of the Proposed Action on public infrastructure and utilities are considered beneficial.

3.12 TRAFFIC AND CIRCULATION

3.12.1 Definition of Resource

Traffic and circulation refer to the movement of vehicles throughout a road or highway network. Primary roads are principal arterials, such as major interstates, designed to move traffic and not necessarily to provide access to all adjacent areas. Secondary roads are arterials, such as rural routes and major surface streets, provide access to residential and commercial areas, hospitals, and schools.

3.12.2 Regulatory Setting

State of Hawai‘i Department of Transportation’s (HDOT) Highway Manual for Sustainable Landscape Maintenance, Chapter 4, Section 645: Work Zone Traffic Control describes the following procedures for:

- Furnishing, installing, maintaining, and subsequently removing work zone traffic control devices and personnel. Work zone traffic control shall include providing flaggers and police officers.
- Keeping roads for public traffic open and in passable condition; providing and maintaining temporary access crossings for trails, businesses, parking lots, garages, residences, farms, parks, and other driveways; taking necessary work precautions for the protection, safety, and convenience of the public; should pedestrian facilities exist, taking necessary measures for the safe and accessible passage, with route information and Americans with Disabilities Act of 1990 Accessible Guidelines (ADAAG) compliance, for pedestrians traveling through or near work zone.
- Taking safety and precautionary measures, such as illuminating roadway obstructions during hours of darkness, in accordance with HRS Chapter 286; Title 19, Subtitle 5, Chapters 127, 128, and HAR 129; Manual on Uniform Traffic Control Devices (MUTCD).

Regulations for necessary signs, barricades, traffic delineators, cones, lane closures, advisory signs, and advertisement needed for construction activity shutdowns described in HDOT Section 645 would be adhered to if needed, and a Traffic Control Plan (TCP) would be drafted if construction work extends into the public roadway.

3.12.3 Existing Conditions

The portion of Wailuku River within the project area runs approximately parallel with Eha Street to the southeast, Kaae Road to the northwest near the mouth of the stream, and is crossed near its mouth by Highway Route 340 (also known as Kahekili Highway). The auxiliary roads nearest to the project area, from upstream to downstream, are Imi Kala Street (which crosses Wailuku River), Halewii Street, Alako Street, Ea Street, Kopili Street, ʻĪao Loop, Kawaikini Place, Lawai Place, and ʻĪao Place. All are part of a residential roadway network with normal residential traffic flow.

3.12.4 Approach to Analysis

Potential impacts to traffic and circulation patterns are assessed with respect to anticipated disruption or improvement of current transportation patterns and systems, deterioration or improvement of existing levels of service, and changes in existing levels of transportation safety. Beneficial or adverse impacts may arise from physical changes to circulation (e.g., closing, rerouting, or creating roads), construction activity, introduction of construction-related traffic on local roads, or changes in daily or peak-hour traffic volumes created by installation workforce and population changes. Adverse impacts on roadway capacities would be significant if roads with no history of exceeding capacity were forced to operate at or above their full design capacity.

3.12.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, the overflow channel system would not be constructed, and no short-term construction vehicular traffic would be generated. The project area would remain unchanged, and there would be no impacts to traffic and circulation in the area.

Proposed Action

Implementation of the Proposed Action would result in less than significant, short-term impacts to traffic and circulation during the construction period. These impacts would be less than significant, provided that HDOT construction traffic control measures, such as a TCP, would be implemented as necessary. All construction activity would occur in the streambed area. Therefore, no disruption to traffic patterns requiring traffic management planning associated with the Proposed Action is anticipated. Furthermore, negligible direct impacts to local roads resulting from additional vehicle trips to and from the project site by construction workers and contractors as well as by haul trucks required to dispose of excavated material or import material to the project site would occur during the construction phase. The number of

haul trips required to dispose of the soil excavated to construct the overflow channel is estimated to be 390 trips using a 20-cubic yard (CY) dump truck. Although some of the excavated soil removed to create the overflow channel would be reused to construct the raised berm downstream, any excess material would be disposed of at the Maui Demolition and Construction Landfill in Māʻalaea (approximately 6 miles from the project site). In addition, 10 haul trips would be required to import topsoil material for the raised berm. The estimated haul trips to mobilize/demobilize equipment to and from the site are estimated to be 10 trips each. Haul trips to transport material and equipment to and from the site would be distributed over the timeframe of the construction period and would be temporary; therefore, no significant direct impacts to the local roadway traffic are anticipated.

Indirect impacts may include decreased parking availability on Eha Street, Kawaikini Place, Lawai Place, ʻĪao Place, or other residential streets in the near proximity of the project area, due to construction worker and contractor parking. If possible, the number of parked vehicles would be reduced through the implementation of vanpooling. Direct and indirect short-term impacts would be less than significant.

Upon completion, the Proposed Action is not expected to generate any additional traffic and would have no long-term impacts on traffic or parking. The only long-term effects on traffic and circulation would be from periodic visits from maintenance vehicles commuting to and from the project site to clear debris from the proposed diversion channel. Traffic and circulation inhibitors, caused by potential flooding, may even be decreased with the implementation of the Proposed Action, as the Proposed Action is designed to decrease flood hazards. The overall long-term effect on traffic and circulation in the area would be considered less than significant.

3.13 SOILD AND HAZARDOUS MATERIAL AND WASTES

3.13.1 Definition of Resource

Solid Materials are defined as substances that do not have strong physical properties of ignitability, corrosivity, reactivity, or toxicity. *Solid Wastes* are defined as solid waste that does not pose a substantial present or potential hazard to human health or to the environment.

Hazardous materials are defined as substances with strong physical properties of ignitability, corrosivity, reactivity, or toxicity, which may cause an increase in mortality, serious irreversible illness, incapacitating reversible illness, or pose a substantial threat to human health or to the environment. *Hazardous wastes* are defined as any solid, liquid, contained gaseous, or semisolid waste, or any combination of wastes that pose a substantial present or potential hazard to human health or to the environment. Examples of

hazardous wastes include toxic or hazardous substances such as polychlorinated biphenyls (PCBs), asbestos, pesticides, and radiation sources.

Issues associated with hazardous materials and wastes typically center on underground storage tanks, aboveground storage tanks, and the storage, transport, and use of pesticides and fuel. When such resources are improperly used, they can threaten the health and well-being of wildlife species, botanical habitats, soil systems, water resources, and people.

3.13.2 Regulatory Setting

Solid Waste management regulations are specified in HAR 11-58.1, with the intent to:

- prevent pollution of the drinking water supply or waters of the State;
- prevent air pollution;
- prevent the spread of disease and the creation of nuisances;
- protect the public health and safety;
- conserve natural resources; and
- preserve and enhance the beauty and quality of the environment.

Hazardous Waste Management regulations are specified in EPA State-specific Universal Waste Regulations and in CFR Title 40, Chapter 1.

3.13.3 Existing Conditions

There are six sites within a 0.25-mile radius of the project area that have been identified as possible environmental risk sites by Federal and State databases, according to an Environmental Data Resources, Inc. (EDR) Radius Map analysis performed on April 16, 2014 (Appendix L). There is one EDR Exclusive Historic Dry Cleaners site (Maui's Quality Dry Cleaning), one Resource Conservation and Recovery Act (RCRA) Conditionally Exempt Small Quantity Generator (CESQG) site (Browning-Ferris Industries), one State Hazardous Waste Site (SHWS) (Wailuku Sugar Company Pesticide Mixing Area), and three EDR Exclusive Historical Auto Station sites (Big Al's Auto Service, Auto Tech, and Maui Automotive Center).

Maui's Quality Dry Cleaning is the sole site within a 0.25-mile radius of the project area that is classified as an EDR Exclusive Historic Dry Cleaners Site. Sites on this list may pose environmental concerns, but no environmentally concerning incidences have occurred at this site to date. Maui's Quality Dry Cleaning is located 0.2 miles south of the project area at 210 Imi Kala Street.

There is one SHWS within a 0.25-mile radius of the project area. SHWS records are the states' equivalent to Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database in Envirofacts. Wailuku Sugar Company Pesticide Mixing Area is located at 250 Imi Kala Street, approximately 400 ft southwest from the project area. In 2011, a Removal Action Report identified two of four decision units that had minimal concentrations (563 and 767 milligrams per kilogram [mg/kg]) of petroleum hydrocarbon as motor oil exceeding residential use environmental action levels (EALs) of 500 mg/kg for gross contamination. However, there were no signs of soil staining or petroleum odor, and the case was closed with a No Further Action Letter stating Unrestricted Residential Use. Another No Further Action Letter was written in March 2013 to identify potential pesticide and metal contamination. It was concluded that "soils did not pose a threat to human health or the environment based on three factors: the low concentrations relative to our unrestricted action levels, the small area impacted, and the presence of clean soils above and below the impacted soils". The site is now classified as non-hazardous.

Browning-Ferris Industries is classified as a CESQG and is located at 280 Imi Kala Street, approximately 0.1 miles west of the project area. CESQGs are defined as entities that generate less than 100 kilograms (kg) of hazardous waste, or less than 1 kg of acutely hazardous waste per month. No violations have been found at this site.

There are three EDR Exclusive Historical Auto Stations located within a 0.25-mile radius of the project area. Big Al's Auto Service is located at 395 Neki Place, approximately 0.1 miles northwest in relation to the project area. Auto Tech is located approximately 0.2 miles to the south at 1720 Wili Pa Loop, and Maui Automotive Center is 0.2 miles south-southeast of the project area at 1726 Mill Street. Although all three sites pose potential risks in EDR's opinion, there have been no environmentally threatening incidences reported to date (EDR, 2014).

3.13.4 Approach to Analysis

Numerous local, Federal, and State laws from regulate the storage, handling, disposal, and transportation of hazardous materials and wastes; the primary purpose of these laws is to protect human health and the environment. The significance of potential impacts associated with hazardous substances is based on their toxicity, reactivity, ignitability, and corrosivity. Impacts associated with hazardous materials and wastes would be significant if the storage, use, transportation, or disposal of hazardous substances substantially increased the human health risk or environmental exposure.

3.13.5 Potential Impacts and Mitigation

No Action

Under the No Action Alternative, the overflow channel system would not be constructed, thus temporary use of construction equipment would not occur. The project area would remain unchanged, and there would be no hazardous materials used and no solid or hazardous wastes generated in the area. As a result, there would be no impacts to hazardous materials and wastes at the project site.

Proposed Action

Solid Waste

The Proposed Action would require infrequent solid waste disposal to clear the overflow channel and diversion weir, in accordance with applicable regulations. In the short-term, during the construction of the Proposed Action, there may be solid waste generated from vegetation clearance in the project area. The contractor would be responsible for such solid waste disposal. Implementation of the Proposed Action is expected to have a less than significant impact on solid waste in the affected environment.

Hazardous Wastes

During construction of the Proposed Action, there may be the potential of petroleum spillage associated with construction vehicles and equipment. To minimize this hazard, all applicable County of Maui Spill and Prevention Control BMPs would be implemented to ensure that accidental releases are minimized and contained. For example, vehicles and equipment would be regularly inspected for leaks and performance, and maintained accordingly. In the long-term, there is potential for petroleum spillage from maintenance vehicles that may be brought in to maintain the overflow channel and other proposed features under the Proposed Action. All applicable County of Maui Spill and Prevention Control BMPs (County of Maui, 2014) would be implemented to avoid and minimize potential releases from such vehicles as well. Implementation of the Proposed Action is expected to have a less than significant impact on hazardous materials and wastes.

3.14 CUMULATIVE IMPACTS

Cumulative impacts on environmental resources result from incremental impacts of the Proposed Action that, when combined with other past, present, and reasonably foreseeable future projects in an affected area, may collectively cause more substantial adverse impacts. Cumulative impacts can result from minor, but collectively substantial, actions undertaken over a period of time by various agencies (Federal, State, or local) or persons. In accordance with NEPA and the CEQ memorandum of "Guidance on the

Consideration of Past Actions in Cumulative Effects Analysis," a discussion of cumulative impacts resulting from projects which are proposed, under construction, recently completed, or anticipated to be implemented in the near future is required.

Past Actions

The original 1981 'Īao Stream Flood Control Project was implemented after a NEPA-compliant EIS was completed with identified mitigation measures following interagency concurrence and approval of that EIS' Record of Decision. The completed project consists of a debris basin located 2.5 miles upstream from the stream mouth, channel improvements extending 3,500 ft downstream from the debris basin, levees along the right bank, levees and floodplain management along the left bank for 6,950 ft of natural stream; and stream realignment with channel improvements for a reach of 1,730 ft that extends to the downstream limit of the project located near the shoreline.

A flood occurred during the construction phase in January 1980 that caused extensive erosion of the sacrificial berm and undermined portions of the completed levees. As a result, the streamside slope of the levees was extended with a concrete riprap slope lining into the streambed. As provided in the project design document (USACE 1976), the toe of the cutoff walls was embedded 5 ft in depth.

Shortly after project completion, stream flows caused erosion of the stream bottom along an approximately 7,000-ft reach between the concrete channel and the Waiehu Beach Road. The erosion undermined the project levee with scour depths extending to a maximum of 6 ft below the existing boulder concrete slope lining. Corrective work to address this issue was completed in November 1983 under the Productive Employment Appropriation Act of 1983 and authorized under Section 205 of the Flood Control Act of 1948 (Public Law 80-858), as amended. The stream channel has since eroded as much as 6 to 8 ft below the 1983 repair.

Although being successful in preventing an estimated $49.6 million in flood damage (as of FY 2013) since its original construction, numerous large storm events have caused progressive damage to the existing flood control structures and subsequent changes to the stream dynamic. In addition, numerous activities have occurred within the streambed during the past 30 years, including ongoing upstream water diversion for agricultural uses, changes in the streambed dynamic due to natural processes, and upstream watershed use/development. Rapid expansion of urban development particularly within the lower watershed as well as agricultural expansion throughout the watershed has most likely caused extensive changes in the current dynamic of the 'Īao stream as compared to conditions at the time of the original construction of the flood control structures.

The Proposed Action is designed to divert flood waters to the existing natural floodplain on the left bank thereby reducing flows within the main channel. This is expected to reduce the rate of erosion of the existing levees and stream bank downstream. The Proposed Action would reduce the possibility of further damage to the existing flood control structures and would not cause additional erosion or damages to the existing flood control structures or subsequent changes to the stream dynamic. No additional concrete channel lining or change in the alignment of the stream are proposed under the Proposed Action; therefore, no changes to the dynamic of Wailuku River in addition to those caused by the construction of flood control structures in the past are anticipated. Additionally, the Proposed Action is intended to restore the original function of the existing floodplain on the left bank, and no changes to the stream dynamic in addition to those that have occurred in the past due to rapid urban and agricultural expansion throughout the watershed are anticipated as a result of implementation of the Proposed Action. Since the Proposed Action would not cause additional environmental impacts to the stream, it would not contribute incrementally, as past actions have, to further deterioration of stream functions; therefore, would not cause significant cumulative impacts.

Present Actions

In April 2014, the Commission on Water Resource Management issued an order establishing an IIFS, the minimum required flow, of 10 mgd (approximately 15.5 cfs) for Wailuku River near Kepaniwai Park. Additionally, no water may be diverted at the Waihe'e/Spreckels Ditch intake located upstream of the proposed project area, except when the stream flow is adequate to satisfy the IIFS of 5 mgd (approximately 7.7 cfs) at the mouth of Wailuku River (Osher, 2014). The IIFS was implemented in October 2014 following this court order. As discussed earlier in Section 2.4, the proposed 15-ft wide opening in the diversion weir would not impact the ability for an IIFS of greater than 5 mgd to remain in the channel through the project area and downstream to the stream mouth. In addition, the Proposed Action is designed to disperse approximately 21,800 cfs of the total SPF peak discharge (27,500 cfs) across the floodplain, which would accommodate the IIFS and provide adequate protection against SPF events following implementation of the IIFS. In conjunction with natural overflow into the left bank upstream, the diversion weir and lateral overflow channel would adequately divert enough flow during an SPF event to restrict the flow downstream of the diversion weir to less than a 10-year frequency event discharge. The diversion weir would have a 15-ft wide opening to preserve low flow conditions within the channel for fish passage. The Proposed Action would not impede the stream flow following implementation of the IIFS, and would not cause significant cumulative impacts associated with the IIFS.

Future Actions

There are no major public infrastructure or development projects planned within proximity to the project area at this time. There are various small private residential construction and renovation projects that are ongoing within the surrounding residential, commercial, and agricultural parcels. These projects are subject to Maui County zoning and permitting regulations, including the Maui County Rules for the Design of Storm Water Treatment Best Management Practices (Maui County, 2014g). As a result, these projects would not represent significant incremental impacts that would contribute to significant cumulative impacts.

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4.0 RELATIONSHIP TO PLANS, POLICIES, AND CONTROLS

While this EA has been prepared pursuant to NEPA, the document also addresses and discusses several laws, regulations, and Executive Orders. Some of these authorities pertain directly to USACE management of water resource development projects, while others establish regulatory compliance standards for environmental resources or provide guidance for planning for management of environmental resources. Reliance on these authorities results in effective project management and sound environmental stewardship. This section summarizes those statutory authorities that could apply to the Proposed Action and were considered during the NEPA process. Required permits are identified where applicable and also summarized at the end of the section.

4.1 REGULATORY REQUIREMENTS

4.1.1 Clean Water Act

The CWA establishes the basic structure for regulating discharges of pollutants into the waters of the U.S. and regulating quality standards for surface waters. Section 404 of the Federal CWA prohibits the discharge of dredged or fill material into waters of the U.S. without authorization from the USACE.

Since the Proposed Action would include work in a stream that could result in potential discharge of fill and/or dredge material into an aquatic ecosystem, provisions of Section 404 (b)(1) of the CWA would apply. Therefore a 404 (b)(1) analysis has been prepared for the Proposed Action and is included as Appendix C of this EA.

Discharge of pollutants into surface waters of the U.S. are controlled under the NPDES program, pursuant to Section 402 of the Clean Water Act. This program is administered by the DOH under HAR Title 11, Chapter 55 Water Pollution Control (October 29, 1992). This chapter requires submission of a NPDES application or a Notice of Intent (NOI) for NPDES General Permit coverage, for discharges of regulated pollutants, or for substantially altering the quality of any discharge, or for substantially increasing the quantity of discharge.

Since the Proposed Action would include the construction of an overflow channel that would retain sediment and particulates conveyed in the main channel stream flow, it would not include a point source discharge of pollutants, and an NPDES permit would not be applicable under Section 402 of the CWA. However, the NPDES program requires construction site operators to obtain coverage under a NPDES permit for clearing, grading, and excavating activities that disturb an area of 1 acre or more to prevent any discharges associated with construction activities from entering the stream. Since the Proposed Action

involves disturbance to an area greater than 1 acre, an NPDES permit would need to be obtained prior to the start of construction activities. The NPDES permit application process would be initiated during the design phase of the project.

The Federal Clean Water Act and HRS Chapter 342D, along with their supporting rules (HAR Title 11, Chapter 54), require that a WQC be obtained to support federal permits or approvals for which proposed construction or operation may result in discharges to State waters (e.g., Section 404 permit from the USACE). Since the proposed project may generate discharges to State waters during construction, a Section 401 WQC would be required. DOH, the state approving agency, would only issue a conditional WQC during the design phase. The final WQC would be issued to the contractor, upon receipt of acceptable BMPs. The application would be filed with the Clean Water Branch of the DOH at least 180 days before the date the WQC is needed (i.e., start of construction). As part of the application package, the EA will be forwarded to DOH for their review and concurrence, whereupon a letter of concurrence with the Proposed Action pending review and approval of the final WQC application will be provided by DOH. The letter of concurrence will identify critical project issues related to water quality that need to be addressed as input to the design phase of the project. During construction of the Proposed Action, BMPs to minimize or eliminate discharges to State waters would strictly be implemented to avoid any significant impacts to water quality.

4.1.2 Clean Air Act

The Federal CAA (42 U.S.C. 7401) requires the adoption of national ambient air quality standards to protect public health, safety, and welfare from known or anticipated effects of air pollution. The CAA places most of the responsibility to achieve compliance with NAAQS on individual states. To this end, EPA requires each state to prepare an SIP. An SIP is a compilation of goals, strategies, schedules, and enforcement actions that will lead the state into compliance with all NAAQS.

Areas not in compliance with a standard can be declared *nonattainment* areas by EPA or the appropriate state or local agency. In order to reach *attainment*, NAAQS may not be exceeded more than once per year. A *nonattainment* area can reach *attainment* when NAAQS have been met for a period of ten consecutive years. During this time period, the area is in *transitional attainment*, also termed *maintenance*.

Under the CAA, a conformity analysis is used to determine if a Federal action would result in the generation of air emissions that would exceed conformity threshold levels of pollutants for which an air basin that is designated as a *nonattainment* or *maintenance* area under the NAAQS, or if emissions from

the action are deemed regionally significant. A conformity analysis must demonstrate that the project emissions would conform, and thus would not degrade air quality in the impacted air basin. A conformity analysis would not be required for the Proposed Action since the island of Maui is in attainment for all criteria pollutants, and emissions from project development would not be considered regionally significant.

4.1.3 Coastal Zone Management Act

The CZMA of 1972, as amended (16 U.S.C. 1451 et seq.), is administered in Hawai‘i by the State of Hawai‘i Office of Planning. Federal consistency is the CZMA requirement where Federal agency activities that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone (also referred to as coastal uses or resources and coastal effects) must be consistent to the maximum extent practicable with the enforceable policies of a State's Federally approved coastal management program. The CZM program objectives and policies are to provide coastal recreational opportunities; preserve and protect historic, scenic and coastal ecosystem resources; provide economic uses; reduce coastal hazards; improve public awareness in coastal zone management; and manage development within the coastal zone. In accordance with CZMA, USACE submitted the application for federal consistency review to the State Office of Planning. The public notice for the CZM review was published in the OEQC bulletin, The Environmental Notice, on May 8, 2017 for public review and comment. Comments received were addressed and incorporated into this Final EA. A concurrence letter from the State of Hawaii Office of Planning was received on June 2, 2017 stating that the office concurs with USACE’s determination that the Proposed Action is consistent to the maximum extent practicable with the enforceable policies of the Hawaii CZM Program based on the conditions that the proposed activities will be implemented as represented in the CZM federal consistency determination and the EA (Appendix F).

The entire State of Hawai‘i is located within the coastal zone. The Proposed Action is located more than 0.7 miles inland from the coastline and is intended to reduce flood water flow within the main channel during storm events and subsequently reduce downstream / coastal sedimentation. Implementation of the Proposed Action would not have any significant impacts on coastal resources or the use of coastal resources; rather it would result in beneficial impacts to the coastal resources. Formal consultation with the State of Hawai‘i Office of Planning will be conducted within the provisions outlined in 15 CFR 930.39-Federal Consistency with Approved Coastal Management Programs, as well as the guidelines established in HRS, Chapter 205A-Coastal Zone Management. Through the CZM Program promulgated by HRS Chapter 205A, each County is required to establish a special management area (SMA) and

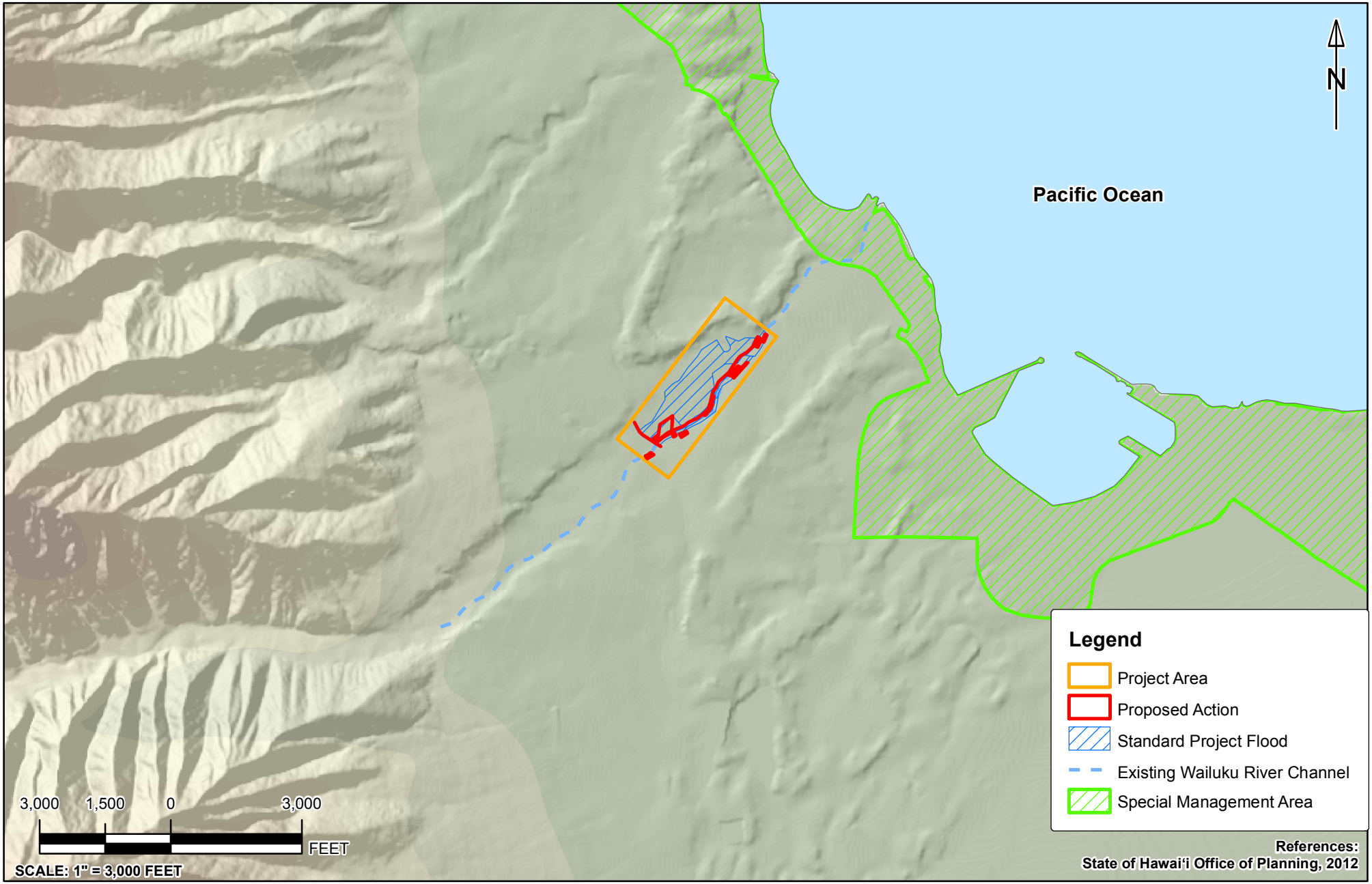
shoreline setbacks within which permits are required for development. The proposed construction area is not located within the SMA, as defined by the State of Hawaiʻi (Figure 4-1). Therefore, it is not anticipated that a SMA permit would be necessary for the Proposed Action. The following sections include an assessment on how the Proposed Action conforms to the CZM objectives and its supporting policies.

Recreational Resources

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

Policies:

- *Improve coordination and funding of coastal recreational planning and management; and*
- *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;*
  - *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;*
  - *Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*
  - *Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;*
  - *Ensuring public recreational uses 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;*
  - *Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;*
  - *Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and*



ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ʻĪAO STREAM FLOOD CONTROL PROJECT

SPECIAL MANAGEMENT AREA MAP
WAILUKU, MAUI, HAWAI'I

FIGURE 4-1

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– *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.*

Discussion:

The objective of the Proposed Action is to provide the community with flood protection; therefore, providing coastal recreational opportunities accessible to the public would be out of the scope of the proposed project. Nevertheless, the intent of the project to divert sediment-laden floodwaters to an existing and natural inland floodplain would result in beneficial impacts to water quality in the coastal zone (by diverting the flood flows and enabling natural deposition of sediments prior to reaching the coastal zone). As such, floodwater-related turbidity and water quality deterioration during flood events would decrease in the coastal zone as a result of this project and would benefit associated recreational resources and opportunities.

The Proposed Action would involve construction activities within the approximately 0.8 miles stretch of Wailuku River located approximately 0.7 miles upstream from the coastline (at the closest location) and does not involve work within the coastal area; thus, would not have any significant impacts on or hinder public access to shoreline parks or other recreational facilities located along the coastline or recreational use of coastal waters such as fishing or surfing.

BMPs would be implemented during construction (e.g., silt fencing, tarping/covering exposed and stockpiled soils, surface revegetation, etc.) of the Proposed Action to minimize/eliminate stormwater flow from the proposed construction site and any associated degradation of water quality of surface waters or coastal waters within the vicinity of the proposed project area.

Historic Resources

Objective: *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:

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

Discussion:

An AIS was conducted within the portion of the left bank of Wailuku River where ground-disturbing activities would take place during construction of the Proposed Action to address concerns that an historical Native Hawaiian *loʻi* may be present within an affected portion of the proposed project area.

Although no evidence of pre-Contact use of the project area was found during the subsurface AIS conducted in May 2014, background and archival documentation indicate that pre-Contact or early historic *loʻi* agriculture occurred in the general region; therefore, archaeological monitoring by a qualified archaeologist, in accordance with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation, Professional Qualifications Standards, will be conducted during ground disturbing activities to ensure proper treatment of any possible subsurface historical, cultural, and/or archaeological resources encountered. An AMP will be completed prior to the start of construction activities by a qualified archaeologist and submitted to the SHPD for review and comment before its finalization.

Scenic and Open Space Resources

Objective: *Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.*

Policies:

- *Identify valued scenic resources in the coastal zone management area;*
- *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;*
- *Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and*
- *Encourage those developments that are not coastal dependent to locate in inland areas.*

Discussion:

The Proposed Action would have negligible long-term impacts to visual and aesthetic resources. Once construction is completed, the presence of the overflow channel and other proposed features along Wailuku River would represent a small permanent visual change in the area; nevertheless, this change would be consistent with the channelized nature of the stream. With the exception of a 6-ft tall (maximum height) earthen berm along the west bank of the Wailuku River (approximately 473 linear feet

along the bank), construction of the overflow channel and other proposed features would be completed at grade. As a result, the proposed project elements would blend in to the existing environment as a low-lying public water management feature and would not contrast with the mix of residential, urban, and agricultural aesthetic of the project area. Undeveloped and agricultural parcels located within the designated floodplain would maintain their current agricultural/open space aesthetic.

Coastal Ecosystems

Objective: *Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.*

Policies:

- *Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*
- *Improve the technical basis for natural resource management;*
- *Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;*
- *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*
- *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.*

Discussion:

Implementation of the Proposed Action would result in improvement to the coastal water ecosystem by effective regulation and modification of existing stream channelization. The Proposed Action would have an indirect beneficial impact to the coastal ecosystem of Kahului Bay located downstream of the proposed project area. The overflow channel system would divert high-velocity and high-volume flood flows into the existing left-bank floodplain thereby reducing the main channel flow in the approximately 3,200-ft long reach of the stream. This would result in reduced erosion of the stream banks within the main channel, allowing for less sediment to be directly transported to the stream mouth and into the nearshore marine environment. The overflow channel system would also allow flood waters to be dispersed into the natural floodplain where sediment and other entrained constituents would be able to settle out instead of

being directly channeled downstream and into the nearshore marine environment. Improved water clarity and reduced sedimentation would have positive impacts on the coral species, marine invertebrate species supported by the coral reef, and other benthic habitat.

The Proposed Action would include soil excavation and stockpiling during temporary grading activities and work in stream that could result in potential discharge of fill and/or dredge material into an aquatic ecosystem. BMPs would be implemented during construction of the Proposed Action (e.g., silt fencing, tarping/covering exposed and stockpiled soils, surface revegetation, etc.) to minimize/eliminate prevent runoff from entering stream waters during construction activities. The USACE would monitor the marine water quality at the mouth of the stream before, during, and after construction to ensure water quality standards are not exceeded.

The Proposed Action would be completed in accordance with State and Federal regulations, including Section 404 (b)(1) of the CWA, which would establish and implement mechanisms to minimize any significant impacts to water quality in the Wailuku River channel and Kahului Bay. In addition, a CWA Section 401 WQC and a NPDES permit would be obtained prior to construction activities to establish and implement mechanisms intended to prevent potential discharge of pollutants to state waters. With the implementation of BMPs and by adhering to applicable state and federal regulations, there would be no significant impacts to the water quality of coastal waters within the vicinity of the proposed project area during construction.

According to the USFWS National Wetlands Inventory, potential pockets of wetlands are present within the project area; however, none were identified during biological or stream surveys conducted along the stream. A survey would be conducted prior to the start of construction activities to document the presence or absence of wetlands within the proposed construction area. Work practices during construction activities would be modified as needed to minimize any impacts to any identified wetlands.

Economic Uses

Objective: *Provide public or private facilities and improvements important to the State's economy in suitable locations.*

Policies:

- *Concentrate coastal dependent development in appropriate areas;*
- *Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry 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

- *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:*
  - *Use of presently designated locations is not feasible;*
  - *Adverse environmental effects are minimized; and*
  - *The development is important to the State's economy.*

Discussion:

The objective of the Proposed Action is to provide enhanced flood protection for the community of Wailuku; estimates for potential economic losses from significant flood events could exceed $1.4 million annually. Implementation of the Proposed Action would decrease the flood risk and pre-emptively address such catastrophic economic loss.

The parcels within and surrounding the project area are designated as Urban or Agricultural according to the State LUC district classifications. The Proposed Action would occur within currently undeveloped land and would not result in permanent change of the current land use within and adjacent to the proposed project area. No structures or coastal dependent developments are being proposed.

Coastal Hazards

Objective: *Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.*

Policies:

- *Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;*
- *Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards;*
- *Ensure that developments comply with requirements of the Federal Flood Insurance Program; and*
- *Prevent coastal flooding from inland projects.*

Discussion:

The Proposed Action is intended to reduce hazard to life and property from stream flooding. According to FEMA records, the project area is located within Zone AE (areas with a 1% [100-year flood] chance of flooding); 0.2% Annual Chance of Flooding; Zone X (areas outside of the 0.2% annual chance floodplain); and Zone X, Protected by Levee (protected from the 1%-annual-chance or greater flood hazard by a levee system that has not been provisionally accredited). The Proposed Action would be located approximately 0.7 miles upstream from the coastline (at the closest location) and would consist of features intended to reconnect the main channel of Wailuku River with the existing floodplain on the left bank to reduce damaging flows along the main channel and right bank levees to provide the authorized level of reduced flood risk to the town of Wailuku. The Proposed Action would not involve structures or buildings that are subject to development requirements for flood prone areas and would not be related to prevention of coastal flooding from inland projects.

Managing Development

Objective: *Improve the development review process, communication, and public participation in the management of coastal resources and hazards.*

Policies:

- *Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;*
- *Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and*
- *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.*

Discussion:

Procedures implemented to date related to this project have complied with all applicable aspects of established development review, communication, and public participation processes. As required by NEPA and HRS 343, public involvement and agency consultation have been conducted at various stages of the development of the EA process. Availability of the draft EA was announced in the OEQC Environmental Notice publication on June 23, 2015 to initiate the required 30-day public review period.

A public informational meeting was held on July 1, 2015 to discuss the draft EA and the Proposed Action. All comments received on the draft EA were addressed in this final EA.

The Proposed Action requires a Section 404 (b)(1) Evaluation, a Section 401 WQC, and a NPDES permit under the provisions of the CWA. The Section 404 (b)(1) Evaluation has been prepared as part of the EA. The Section 401 WQC and NPDES permit applications will be submitted to the appropriate approving agencies during the design phase of the proposed project and approved prior to the start of construction of the Proposed Action.

Public Participation

Objective: *Stimulate public awareness, education, and participation in coastal management.*

Policies:

- *Promote public involvement in coastal zone management processes;*
- *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*
- *Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.*

Discussion:

Procedures intended to stimulate public participation has been an integral element of the environmental review process for this project. Availability of the draft EA for the Proposed Action was announced in the OEQC Environmental Notice publication on June 23, 2015 for a required 30-day public review period. A public informational meeting was held on July 1, 2015 to discuss the draft EA and the Proposed Action. A public notice was circulated prior to the scheduled meeting to notify the public of the time and place. Workshops and additional community meetings will be scheduled as necessary to address community concerns if any are raised.

Beach Protection

Objective: *Protect beaches for public use and recreation.*

Policies:

- *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;*

- *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;*
- *Minimize the construction of public erosion-protection structures seaward of the shoreline;*
- *Prohibit private property owners from creating a public nuisance by inducing or cultivating the private property owner's vegetation in a beach transit corridor; and*
- *Prohibit private property owners from creating a public nuisance by allowing the private property owner's unmaintained vegetation to interfere or encroach upon a beach transit corridor.*

Discussion:

The Proposed Action neither involves development of new structures within the shoreline setback nor involves construction of private or public erosion-protection structures seaward of the shoreline.

Marine Resources

Objective: *Promote the protection, use, and development of marine and coastal resources to assure their sustainability.*

Policies:

- *Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;*
- *Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;*
- *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;*
- *Promote research, study, and understanding of ocean processes, marine life, and other ocean resources to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and*
- *Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

Discussion:

The Proposed Action is consistent with the state's ocean resources management plan, particularly as it relates to stewardship in the protection of coastal resources (namely benthic ecosystems and associated species) through the diversion of sediment-laden waters from reaching the ocean.

The Proposed Action has been evaluated in this EA to ensure that it does not result in any irrevocable impacts to the marine/coastal resources in the vicinity of the proposed project area and that it is environmentally sound and economically beneficial. A marine habitat characterization survey of the marine coastal area conducted within the vicinity of the mouth of Wailuku River concluded that the spur-and groove area located in the immediate vicinity of the stream has a high abundance of coral by Hawaiʻi standards. Improved water clarity and reduced sedimentation as a result of the Proposed Action would have positive impacts on the coral species as well as the marine invertebrate species supported by the coral reef.

4.1.4 Endangered Species Act

Section 7 of the ESA requires Federal agencies to ensure, in consultation with USFWS and NMFS, that actions they fund, authorize, or carry out will not jeopardize the continued existence of any species listed as threatened or endangered under the ESA ("listed species") or result in the destruction or adverse modification of any habitat of such species that has been designated as critical ("critical habitat").

The USFWS has jurisdiction over endangered and threatened terrestrial flora, fauna, and birds in the State of Hawaiʻi. NOAA, through the NMFS, has jurisdiction over marine mammals, turtles (while in water), fish, and coral species.

Consultation with USFWS has been ongoing throughout the project planning process. There are no known state or federally listed endangered or threatened biota and their respective critical habitats within the project area, and based on the analysis of potential impacts of the Proposed Action on biological resources within the project area and in the vicinity of the project area (Section 3.5.5), no significant impacts to threatened or endangered species as a result of implementation of the Proposed Action are anticipated.

4.1.5 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (U.S.C. 703–711) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to

Federal regulations. The migratory bird species protected by the Act are listed in 50 CFR 10.13. Since the Proposed Action would only include limited short-term disturbance of the affected environment during the construction period, and since close coordination with the USFWS would assure that the Proposed Action would not result in significant impacts to any migratory bird habitat, the Proposed Action would comply with the provisions of the MBTA.

4.1.6 Fish and Wildlife Coordination Act

The FWCA and its amendments require Federal agencies to consult with and give equal consideration to other water resources development programs regarding the fish and wildlife impacts of projects that propose to impound, divert, channel, or otherwise alter a body of water. Subsection 2(h) of FWCA exempts surface water impoundments less than 10 acres. However, the surface water impoundment area under the Proposed Action would be greater than 10 acres. As a result, the Proposed Action would need to comply with the FWCA. Coordination with USFWS, NMFS, and DAR has been ongoing throughout the project planning process, including issuance of a Planning Aid Letter (PAL) (Appendix F) by USFWS to USACE. Coordination has been conducted to ensure that the Proposed Action would not significantly impact important fish and wildlife habitat identified within the intermittent stream. During a recent coordination meeting with the resource agencies (USFWS, NMFS, and DAR) on September 17, 2014, the agencies agreed that the Proposed Action would not significantly impact the existing fish and wildlife habitat within and in the vicinity of the project area and that the Proposed Action is a preferred alternative as compared to other alternatives considered in the past. Documentation of this concurrence is included in Appendix F of this EA.

4.1.7 Magnuson-Stevens Fishery Conservation and Management Act

The MSA mandates that federal agencies conduct an essential fish habitat (EFH) consultation with NOAA Fisheries regarding any of their actions authorized, funded, or undertaken that may adversely affect EFH. The proposed action is located within Wailuku River waters and stream bank; approximately 0.8 to 1.6 miles upstream from the river mouth. There are no EFH within or adjacent to the proposed project area and there would be no adverse effect on EFH as a result of implementing the Proposed Action; therefore, EFH consultation is not required.

4.1.8 National Historic Preservation Act

Section 106 of the NHPA seeks to accommodate historic preservation concerns with the needs of Federal endeavors through consultation among the agency official, SHPD, and other parties with an interest in the effects of the project on cultural, archaeological and historic resources and properties. The purpose of

consultation is to seek comments and input on significant cultural, archaeological and historic resources and properties potentially affected by project implementation, and seek ways to avoid or minimize any impacts on significant resources.

USACE staff met with SHPD, Maui during the week of December 2, 2013 to describe the Proposed Action and conduct a site visit. SHPD noted concerns that an historical Native Hawaiian loʻi may be present within an affected portion of the project area. It was decided during the meeting that a reconnaissance-level AIS would be completed within the portion of the left bank floodplain where ground-disturbing activities would take place during construction, but that no surveys would be required in the area where the diverted water leaves the floodplain and returns to the channel.

The AIS determined that no historical resources were present in the project area; therefore, implementation of the Proposed Action would not significantly affect historic properties or any other historical resources. USACE forwarded the End-of-Field report to SHPD in June 2014 to notify them that no historical resources were found during the AIS; therefore, there will be no effect to historic properties. A formal Section 106 consultation was initiated with submittal of the Final AIS report and a no adverse effect determination letter to SHPD and other Native Hawaiian Organizations including OHA, Hui Malama I Na Kupuna ʻO Hawaiʻi Nei, and the Central Maui Hawaiian Civic Club. The Section 106 consultation letters sent (Appendix F) indicated that although no evidence of significant cultural deposits were identified during the AIS, because of the potential presence of cultural remains, archaeological monitoring by a qualified archaeologist, in accordance with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation, Professional Qualifications Standards, will be conducted during ground disturbing activities to ensure proper treatment of any possible subsurface historical, cultural, and/or archaeological resources encountered. SHPD has indicated that they concur with the determination; however, a formal response has not been received to date from SHPD or the other consulted parties.

4.1.9 EO 11988 – Floodplain Management

EO 11988 requires Federal agencies to avoid to the extent possible the long-and short-term adverse impacts associated with the occupancy and modification of flood plains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the

natural and beneficial values served by flood plains in carrying out its responsibilities" for the following actions:

- acquiring, managing, and disposing of Federal lands and facilities;
- providing Federally-undertaken, financed, or assisted construction and improvements; and
- conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

According to FEMA records, the project area is located within Flood Zone AE, 0.2% Chance of Flooding, Zone X, and Zone X (Protected by Levee). Flood Zone AE is defined as "the flood insurance rate zone that corresponds to the 100-year floodplains." The zone designated as the 0.2% Chance of Flooding corresponds to the areas of 500-year flooding. Zone X designates areas outside of the 0.2% annual chance floodplain; Zone X (Protected by Levee) delineates areas that are "protected from the 1%-annual-chance or greater flood hazard by a levee system that has not been provisionally accredited" (FEMA, 2009a; FEMA, 2009b).

The Proposed Action would include construction in an area prone to flooding. However, the Proposed Action consists of an overflow channel and other features designed to reconnect the main channel with the floodplain that would be consistent with current land use as a flood control system. Further, the Proposed Action would divert high-velocity and high-volume flood flows into the existing left-bank floodplain thereby reducing the main channel flow in the approximately 3,200-ft long reach of the stream. This would result in a reduced risk of flooding during high-flow/flood events. Diversion of stream waters would also reduce erosion of the stream banks, which would prevent further damage to the existing flood control systems and increase its reliability. Therefore the Proposed Action would be in compliance with EO 11988.

4.1.10 EO 11990 – Protection of Wetlands

EO 11990 states that each Federal agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for: (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

The Proposed Action occurs within and near areas designated as a freshwater emergent wetland, further classified as palustrine and persistent (USFWS, 2006a). Part of the project area would be cleared of vegetation and graded in order to construct the overflow channel system. However, since the existing palustrine wetland within the project area does not include any critical wetland habitat, and since the existing wetland flora and fauna would return following the construction period, there would be no significant long term impacts to wetlands. Further, since the Proposed Action would not significantly impact the existing stream function, the Proposed Action would comply with EO 11990.

4.1.11 EO 12898 – Environmental Justice in Minority Populations and Low-Income Populations

EO 12898 states that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental impacts of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Northern Mariana Islands." The Proposed Action would include a public infrastructure project that would not result in any unacceptable human health or environmental impacts to either the general population at large or specifically to minority populations or low-income populations.

4.1.12 EO 13045 – Protection of Children from Environmental Health and Safety Risks

EO 13045 applies to economically significant rules under EO 12866 that concern an environmental health or safety risk that EPA has reason to believe may disproportionately affect children. Environmental health risks or safety risks refer to risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest (such as the air we breathe, the food we eat, the water we drink or use for recreation, the soil we live on, and the products we use or are exposed to) (EPA, 2014a). During the construction period of the Proposed Action, access to the construction site would be restricted to the general public as a safety measure. Further, no locations of concentration of children (e.g., schools, playgrounds, daycare centers) are located near the project area; therefore, the Proposed Action is not expected to disproportionately affect the health and safety of children.

4.1.13 EO 13089 – Protection of Coral Reefs

EO 13089 states that "all Federal agencies whose actions may affect U.S. coral reef ecosystems shall: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) use their programs and authorities to

protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund or carry out will not degrade the conditions of such ecosystems."

The Proposed Action consists of an overflow channel and other features designed to divert high-velocity and high-volume flood flows into the existing left-bank floodplain thereby reducing the main channel flow in the approximately 3,200-ft long reach of the stream. This would result in a reduced risk of flooding during high-flow/flood events. Diversion of stream waters would also reduce erosion of the stream banks, allowing for less sediment to be directly transported to the stream mouth and into the nearshore marine environment. Improved water clarity and reduced sedimentation would have positive impacts on the coral species as well as the marine invertebrate species supported by the coral reef.

There would be no projected significant impacts to coral reef ecosystems under the Proposed Action since the construction activities would adhere to applicable BMPs and regulations, such as the CWA. Therefore, since the Proposed Action may enhance the conditions of coral reef ecosystems, its implementation would be compliant with EO 13089.

4.1.14 State Conservation District Use

Since 1964, the Board of Land and Natural Resources has adopted and administered land use regulations for the Conservation District pursuant to the State Land Use Law (Act 187) of 1961. Act 187 defined Conservation as meaning the protection of watersheds and water supplies; preserving scenic areas; providing park lands, wilderness and beach reserves; conserving endemic plants, fish, and wildlife; preventing floods and soil erosion; forestry; and other related activities.

DLNR, Office of Conservation and Coastal Lands (OCCL) requires that a Conservation District Use Application (CDUA) be filed to apply for land use(s) within the State of Hawaii Conservation District. All land uses, pursuant to Title 13 Chapter 5, HAR, must be an identified land use and require that a CDUA be filed with the Department and approved by the Board of Land and Natural Resources prior to its initiation. These rules and regulations identify land uses that may be allowed by discretionary permit as well as impose fines for violations. An application is not considered accepted for processing until the Department has found it complete. The Proposed Action does not occur within the State of Hawaii Conservation District (Figure 3-7). Therefore, it is not anticipated that a CDUA would be necessary for the Proposed Action.

4.1.15 Stream Channel Alteration Permit

Pursuant to Chapter 174C Hawaii Revised Statutes, and Chapter 13-169 HAR, the DLNR Commission on Water Resource Management's Stream Protection and Management (SPAM) Branch requires a permit for

any temporary or permanent activity within the stream bed or banks that may: 1) obstruct, diminish, destroy, modify, or relocate a stream channel; 2) change the direction of the flow of water in a stream channel; or 3) remove any material or structure from a stream channel. Since the Proposed Action requires work to be conducted within the stream channel, a Stream Channel Alteration Permit would be required; however, such in-stream activity would be temporary in nature. Once construction activities are completed, no other in-stream disturbance is anticipated. Further, long-term stream dynamics would mirror natural stream channel dynamics and floodplain / flood conditions.

4.1.16 Farmland Protection Policy Act

The purpose of the Farmland Protection Policy Act (FPPA) (7 U.S.C. 4201 et seq., implementing regulations 7 CFR Part 658, of the Agriculture and Food Act of 1981, as amended) "is to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses, and to assure that Federal programs are administered in a manner that, to the extent practicable, will be compatible with State, unit of local government, and private programs and policies to protect farmland." The Proposed Action does not include any activities, including new construction or acquisition of undeveloped land, which could potentially convert one land use to another. Land use within the affected area would remain unchanged; therefore, the Proposed Action is in compliance with the FPPA.

4.2 STATE LAND USE PLANS AND POLICIES

4.2.1 Hawai'i State Plan

The Hawai'i State Plan, Chapter 226, HRS identifies themes, goals, objectives, and policies that serve as guidelines for the future long-range development of the state and provides a basis for prioritizing and allocating the limited resources within the state such as public funds, services, human resources, land, energy, and water. The following sections include analyses on whether the Proposed Action conforms to applicable objectives and policies of the State Plan.

§226-11 Objectives and policies for the physical environment: land-based, shoreline, and marine resources

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 Hawaii's land-based, shoreline, and marine resources; (2) Effective protection of Hawaii's unique and fragile environmental resources.

Polices of the State to achieve these objectives include:

- *Exercise an overall conservation ethic in the use of Hawaii's natural resources.*
- *Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.*
- *Take into account the physical attributes of areas when planning and designing activities and facilities.*
- *Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.*
- *Consider multiple uses in watershed areas, provided such uses do not detrimentally affect water quality and recharge functions.*
- *Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.*
- *Pursue compatible relationships among activities, facilities, and natural resources.*

Discussion:

As discussed in this EA, the Proposed Action is not anticipated to significantly alter the current environmental conditions of the project site and its surrounding area. The Proposed Action would not result in irreparable environmental damage and would provide a solution to the ongoing flood hazards associated with Wailuku River by utilizing the existing floodplain to divert stream waters during high-flow conditions associated with large storm events. The design of the Proposed Action replicates, to the extent practical, the natural hydrological pattern of an alluvial floodplain that existed within the area prior to modern development. Native aquatic species habitat function within the stream would not be impacted since the Proposed Action does not involve substantial modification to the existing stream alignment nor does it involve any concrete lining of the stream channel. No threatened or endangered species or critical habitat for any threatened or endangered species that could be affected by the construction activities or operation of the Proposed Action occur within the project area. Therefore, the Proposed Action is consistent with the state plan's objectives.

§226-12 Objective and policies for the physical environment: scenic, natural beauty, and historic resources

Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaii's scenic assets, natural beauty, and multi-cultural/historical resources.

Policies of the State to achieve this objective include:

- *Promote the preservation and restoration of significant natural and historic resources.*
- *Provide incentives to maintain and enhance historic, cultural, and scenic amenities.*
- *Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.*
- *Protect those special areas, structures, and elements that are an integral and functional part of Hawaii's ethnic and cultural heritage.*
- *Encourage the design of developments and activities that complement the natural beauty of the islands.*

Discussion:

An AIS was conducted at the proposed project area to determine whether any significant cultural deposits exist within the area where ground-activities are being proposed. The subsurface survey yielded no definitive evidence of cultural or archaeological resources within the area. Although no historic properties are located within or adjacent to the proposed project area, archaeological monitoring by a qualified archaeologist, in accordance with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation, Professional Qualifications Standards, will be conducted during ground disturbing activities to ensure proper treatment of any possible subsurface historical, cultural, and/or archaeological resources encountered.

Additionally, once completed, the proposed action would represent a small permanent visual change in the area. With the exception of a 6-ft tall (maximum height) earthen berm along the west bank of the Wailuku River, the overflow channel and other proposed features under the Proposed Action would be completed at grade. As a result, the proposed features would blend in to the existing environment as a low-lying public water management feature and would not contrast with the mix of residential, urban, and agricultural aesthetic of the project area. Therefore, the Proposed Action is consistent with the state plan's objectives.

§226-13 Objective and policies for the physical environment: land, air, and water quality

Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives: (1) Maintenance and pursuit of improved quality in Hawaii's land, air, and water resources; (2) Greater public awareness and appreciation of Hawaii's environmental resources.

Policies of the State to achieve this objective include:

- *Promote the proper management of Hawaii's land and water resources.*
- *Promote effective measures to achieve desired quality in Hawaii's surface, ground, and coastal waters.*
- *Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawaii's people.*
- *Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.*
- *Encourage design and construction practices that enhance the physical qualities of Hawaii's communities.*
- *Foster recognition of the importance and value of the land, air, and water resources to Hawaii's people, their cultures and visitors.*

Discussion:

Implementation of the Proposed Action would reduce the threat to life and property from erosion and flooding during large storm events. Dispersion of stream waters to the existing floodplain would enhance groundwater recharge and result in overall improvement of water quality in the stream as well as within the nearshore waters adjacent to the stream mouth by allowing suspended sediment and other entrained constituents to settle out. Temporary increase in fugitive dust and vehicle emissions during construction activities are anticipated; however, there would be no long-term impacts to air quality as a result of the Proposed Action. Therefore, the Proposed Action is consistent with the state plan's objectives.

4.3 SUMMARY

The following is a summary of the permits and approvals required for the Proposed Action:

- CWA Section 404(B)(1) Evaluation;
- NPDES permit;
- WQC;
- CZMA federal consistency review; and
- Stream Channel Alteration Permit.

5.0 FINDINGS AND DETERMINATIONS

In accordance with the provisions set forth in Chapter 343, HRS, this EA has evaluated the potential direct, indirect, short-term, long-term, and cumulative impacts associated with the Proposed Action. Based on this evaluation, it has been determined that the Proposed Action will not have significant impacts on the environment. As such, a Finding of No Significant Impact (FONSI) is being issued for the Proposed Action.

A review of the "Significance Criteria" used as a basis for the above determination is presented below. An action is determined to have a significant impact on the environment if it meets any one of the following thirteen (13) criteria:

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

The Proposed Action is not anticipated to involve construction activities that would lead to loss or destruction of any natural or cultural resource. The project area has been subject to an Archaeological Inventory Study (AIS) which revealed the absence of any resource that may potentially be impacted as a result of construction activities. Archaeological monitoring by a qualified archaeologist, in accordance with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation, Professional Qualifications Standards, will be conducted during ground disturbing activities to ensure proper treatment and documentation of any possible subsurface historical, cultural, and/or archaeological resources encountered.

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

Implementation of the Proposed Action would not curtail the range of beneficial uses of the environment as no permanent changes to the current use of land parcels located within and surrounding the project site are anticipated. Construction activities would take place within undeveloped land that is currently not in use; therefore, no curtailment of beneficial use would take place during construction activities.

(3) Conflicts with the State's long term environmental policies or goals and guidelines as expressed in Chapter 343, HRS; and any revisions thereof and amendments thereto, court decisions, or executive orders:

The Proposed Action would be in conformance with the Chapter 343 HRS State Environmental Policy, to conserve the natural resources and enhance the quality of life. Construction activities proposed under the

Proposed Action are not expected to have any significant impacts to the surrounding natural resources and would be planned to minimize any temporary impacts.

(4) Substantially affects the economic or social welfare of the community or State:

The Proposed Action would generate short-term economic vitality for the community by providing temporary construction opportunities for the duration of the construction phase of the project. No significant long-term impacts on the economic or social welfare of the community or the State are anticipated under the Proposed Action.

(5) Substantially affects public health:

The Proposed Action would result in temporary impacts to noise and air quality levels during the construction period; however, these potential impacts are not anticipated to substantially affect public health. No significant long-term impacts to public health are anticipated as a result of implementing the Proposed Action.

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

The Proposed Action is expected to have beneficial impacts to the community of Wailuku by reducing the risk of flooding in the area. No population changes or effects on public facilities are anticipated.

(7) Involves a substantial degradation of environmental quality:

The Proposed Action is not anticipated to involve a substantial degradation of environmental quality. During construction activities, BMPs adhering to all applicable regulations will be implemented in order to prevent excess runoff and other potential degradation of the surrounding natural environment.

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

The Proposed Action is not anticipated to result in significant cumulative effects and would not require a commitment to larger actions.

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

No threatened or endangered species or critical habitat for any threatened or endangered species that could be affected by the construction activities or operation of the Proposed Action occur within the project area. Ponding floodwaters in the floodplain may temporarily attract the endangered Hawaiian Stilts but would not create a permanent nesting or foraging ground that would otherwise may potentially

have impacts on the population distribution of the species. Native aquatic species habitat function within the stream would not be impacted since the Proposed Action does not involve substantial modification to the existing stream alignment nor does it involve any concrete lining of the stream channel.

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

Construction activities for the Proposed Action could potentially impact air, water quality, and ambient noise levels at the project site; however, these impacts would be temporary and are not anticipated to be significant. All construction activities would comply with applicable regulations and appropriate mitigation measures/BMPs as necessary. Following completion of construction activities, the Proposed Action would not have any significant impacts on air, water quality, or ambient noise levels at the project site.

(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:

The Proposed Action is intended to reconnect the main channel with the floodplain in order to reduce damaging flows along the main channel and right bank levees of Wailuku River. The Proposed Action would restore the function of the existing floodplain as a temporary storage area for storm/flood waters and would not significantly affect the existing floodplain. The Proposed Action is not anticipated to have significant impacts on any other environmentally sensitive areas.

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

The Proposed Action would not significantly affect the visual aesthetics of the areas identified in the county or state plans and studies. Temporary construction-related visual impacts (i.e., the presence of construction equipment in and around the project area) are expected; however, once construction is completed, the proposed features would represent a small permanent visual change in the area and would be compatible with the existing visual setting of the project area.

(13) Requires substantial energy consumption:

The construction or operation of the Proposed Action would not require substantial energy consumption.

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6.0 AGENCIES AND ORGANIZATIONS CONSULTED

The following is a list of agencies and organizations to which notices of the availability of the draft EA for review were sent. Appendix B includes a summary of the comments and feedbacks received as well as the individual comment letters.

Table 6-1: List of Agencies and Organizations Consulted

	Consulted Agency or Organization	Draft EA Public Response Received
Federal Agencies	EPA - Pacific Islands Contact Office	
	USFWS	X
	USFWS - Maui Nui Field Station	
	USGS Hawai‘i Water Science Center	
	United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)	
	NMFS - Pacific Islands Regional Office	
State Agencies	Department of Accounting and General Services	X
	Department of Agriculture	
	Department of Business, Economic Development and Tourism (DBEDT)	
	Department of Defense	X
	Department of Education	
	Department of Hawaiian Home Lands , Hawaiian Homes Commission	
	Department of Health	X
	Department of Human Services	X
	Department of Labor and Industrial Relations	
	DLNR - Land Division	X
	DLNR - Commission on Water Resource Management	
	DLNR - Division of Aquatic Resources	X
	DLNR - Office of Conservation and Coastal Lands	
	DLNR State Historic Preservation Division	
	Department of Transportation	X
	OEQC	X
	Office of Hawaiian Affairs	X
	Office of Planning, Hawaii CZM Program	X
	University of Hawai‘i Environmental Center	
County of Maui	Department of Environmental Management	X
	Department of Fire and Public Safety	
	Department of Housing and Human Concerns	
	Department of Parks & Recreation	
	Department of Planning	X
	Department of Public Works	X
	Department of Transportation	
	Department of Water Supply	
	Office of the Mayor	
	Police Department	
Utilities	Hawaiian Telecom	

	Hawaiian Electric Company	
	Oceanic Time Warner	
Libraries	Hawaii State Public Library	
	University of Hawai'i Maui College Library	
Organizations/Individuals	Aquanimity Now	
	Earthjustice	X
	Hawaiian Commercial & Sugar Company	
	Hui O Nā Wai ʻEhā	X
	Linsey's LLC	
	Maui Coastal Land Trust	
	Maui Tomorrow Foundation	
	North Shore at Waiehu, LLC	
	The Civic Clubs Maui Council	
	Wailuku Main Street Association	
	Mr. Zoltan Rudolics	
	Ms. Elaine Wender	
	Mr. Ed Lindsay	
	Mr. Tom Stevens	
	Mr. Mark Tracey	
	Mr. David Ixy	
	Mr. Daniel Ornellas	
Elected Officials	US Senator - Mazie K. Hirono	
	US Senator - Brian Schatz	
	US Representative - Tulsi Gabbard	
	State Senator (District 5) - Gilbert S.C. Keith-Agaran	
	State Representative (District 8) - Joseph M. Souki	
	County Council Representative - Michael Victorino	
News Media	The Maui News	X

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8.0 LIST OF PREPARERS

Sonia Shjegstad, Environmental Division Manager, GSI Pacific, Inc.

B.S. Biology; Environmental Science and Policy, Duke University

M.S. Biology, University of Guam

Aaron Goldschmidt, Senior Technical Reviewer, AMEC

B.A., Geography

M.A., Geography

Miya Akiba, Project Manager, GSI Pacific, Inc.

B.S. Global Environmental Science, University of Hawai‘i

Max Solmssen, Environmental Planner, GSI Pacific, Inc.

B.A., English, University of Hawai‘i

M.A. Urban and Regional Planning (Pending), University of Hawai‘i

James Terry, Environmental Scientist II, GSI Pacific, Inc.

B.S. Environmental Science, Hawai‘i Pacific University

Christian Briggs, Environmental Scientist II, GSI Pacific, Inc.

B.S., Environmental Geoscience, Michigan State University

M.S., Hydrogeology, University of Nevada, Reno

Taylor Chock, Environmental Scientist I, GSI Pacific, Inc.

B.A., Biology, Whitman College

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Appendix A:

March 2009 Draft Environmental Assessment (EA)

Draft Environmental Assessment

ʻIao Stream Flood Control Project

Wailuku, Maui, Hawaiʻi



US Army Corps of Engineers, Honolulu Engineering District

County of Maui, Department of Public Works

March 2009

ʻIao Stream Flood Control Project

DRAFT ENVIRONMENTAL ASSESSMENT

SUBMITTED PURSUANT TO:
National Environmental Policy Act, 40 CFR 1500-1508; ER 200-2-2 and Chapter 343, Hawaiʻi Revised Statutes

by the

U.S. Army Corps of Engineers, Honolulu Engineering District

and

County of Maui
Department of Public Works

Date of Approval

Regional Administrator, USACE

Date of Approval

Director
Department of Public Works

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AAQS	Ambient Air Quality Standards
ALISH	agricultural lands of importance to the State of Hawai‘i
APC	Air Pollution Control
APE	Area of Potential Effects
AR	Army Regulation
BMPs	Best Management Practices
CAA	Clean Air Act
CDUA	Conservation District Use Application
CDUP	Conservation District Use Permit
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIA	Cultural Impact Assessment
COM	County of Maui
CRM	concrete rubble masonry
CWA	Clean Water Act
CWRM	Commission on Water Resource Management
CZM	Coastal Zone Management
dBA	decibels
DAR	Department of Aquatic Resources
DLNR	Department of Land and Natural Resources
DNL	day-night sound levels
EA	Environmental Assessment
EDR	Engineering Documentation Report
EO	Executive Order
EPA	United States Environmental Protection Agency
ER	Engineer Report
ERDC	Army Engineer Research and Development Center
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
fps	feet per second
ft	feet
FWCA	Fish and Wildlife Coordination Act
FWPCA	Federal Water Pollution Control Act
GEC	Gulf Engineers and Consultants
GIS	geographical information system
HAR	Hawai‘i Administrative Rules
HDOA	State of Hawai‘i Department of Agriculture
HDOH	State of Hawai‘i Department of Health
HEC-FDA	Hydrologic Engineering Center Flood Damage Analysis
HEC-RAS	Hydrologic Engineering Center River Analysis System
HRS	Hawai‘i Revised Statutes
HSOP	State of Hawai‘i Office of Planning
HTRW	hazardous, toxic, and radioactive waste
HUD	Department of Housing and Urban Development
H:V	height to volume

IaA	ʻĪao silty clay, 0 to 3 percent slopes
IbB	ʻĪao cobbly silty clay, 3 to 7 percent slopes
IWR	Institute for Water Resources
JcC	Jaucas sand, saline, 0 to 12 percent slopes
LER	land, easements and/or rights-of-way
MGD	million gallons per day
msl	mean sea level
MVN	New Orleans District of the Corps of Engineers
N	nitrogen
NAAQS	National Ambient Air Quality Standards
NED	National Economic Development
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
ns	not specified
O&M	operation and maintenance
OHA	Office of Hawaiian Affairs
OSHA	Occupational Safety and Health Administration
pH	potential of hydrogen
PL	Public Law
PtA	cobbly clay loam, 0 to 3 percent slopes
PW	Department of Public Works
PZUE	Puuone sand, 7 to 30 percent slopes
P&G	Principles and Guidelines (for the WRPA)
P&S	Principles and Standards (for the WRPA)
rSM	stony alluvial land
RCC	roller compacted concrete
SCAP	Stream Channel Alteration Permit
SCS/CRMS, Inc.	Scientific Consultant Services/Cultural Resource Management Services, Inc.
SFRs	single family residential structures
SHPO	State of Hawaiʻi Historic Preservation Officer
SMP	Special Management Area Use Permit
SPF	Standard Project Flood
sq. mi.	square miles
SRP, Inc.	Social Research Pacific, Inc.
TCPs	Traditional Cultural Properties
TMDL	total maximum daily load
TMK	tax map key
USACE	United States Army Corps of Engineers
USC	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
WSEL	Water Surface Elevation
WQC	Water Quality Certification
WRPA	Water Resources Planning Act
%	percent

EXECUTIVE SUMMARY

The United States Army Corps of Engineers (USACE) is conducting an Environmental Assessment (EA) for the modification of the existing 1981 'Īao Stream Flood Control Project in Wailuku, Maui, Hawai'i. Under the legislative authority of the Flood Control Act of 1948, Section 205, Public Law (PL) 80-858, as amended, 33 United States Code (USC) 701s; PL 93-251, as amended; PL 97-140 and PL 99-662, the USACE is authorized to implement flood damage reduction improvements to the 'Īao Stream that meet or exceed Standard Project Flood (SPF) requirements to protect the existing Wailuku community.

Proposed Action. Under the "Modification to Completed Projects" Program, a total of five alternatives and a no action alternative are presented. One of the alternatives is recommended based on environmental feasibility and project ability to meet or exceed SPF requirements. The project was designed for SPF protection with a peak design discharge of 27,500 cubic feet per second (cfs) downstream of Station 84+42 (near the 'Imi Kālā Street Bridge, see Figure 3-8) and 26,000 cfs downstream of Station 92+02 (near Spreckles Ditch, see Figure 3-8).

Purpose and Need.

Purpose: The 'Īao Stream channel was originally modified by the USACE from 1968 through 1981. This original Flood Control Project, completed in October of 1981 has since experienced repeated erosion events that have damaged existing levees, causing undermining and a gradual collapse (Figures 4-4 and 4-5). High stream flows resulted in downcutting of the natural streambed and erosion of the base of the east bank levee structure at the approximate mid-point of the straightened stream channel segment, 1,700 m upstream of the stream mouth (See Section 2.0 for more details). Several residential and commercial structures along the right bank are in danger of being undercut if streambank erosion continues, as is the heiau along the lower reach of the left bank. Erosion caused by high flow events has been partially repaired with concrete rubble masonry (CRM), however these repairs have subsequently suffered from additional erosion. The purpose of the proposed 'Īao Stream Flood Control Project is to correct deficiencies associated with the existing Flood Control Project constructed in 1981. Frequent repairs have proved to be costly and do not adequately address the problem.

Need: Modifications to the 1981 Flood Control Project are needed to prevent further property damage resulting from undermining of stream bank and levee locations, and to protect Wailuku town from flood damage. In addition, levee certification that the completed project can withstand a 100-year frequency flood is required by the Federal Emergency Management Agency (FEMA) by February 2009; otherwise, the area protected by the project will revert to a flood hazard area in the Fall of 2009. A government agency responsible for levee construction or a Registered Professional Engineer must provide this

certification. In its present condition, the project cannot be certified as providing 100-year flood protection because the project is deficient as outlined in this report. Therefore, the USACE has analyzed five alternatives and a no action alternative to modify the existing ʻĪao Stream Flood Control Project and prevent further high levels of streambed erosion, loss of life, and property damage during flood seasons.

Alternatives. The proposed alternatives are: I) Trapezoidal Concrete-Lined Channel, II) Rectangular and Compound Channel, III) Roller Compacted Concrete (RCC) and Boulder Invert Channel Following Existing Alignment, IV) Levee Reconstruction, V) Removal of Flood Control Improvements, and VI) No Action. Alternatives II and IV do not meet the project objectives and were not carried on for further analysis. Although Alternative VI is not a possible solution, it will be discussed throughout the document to provide a view of the "without project" scenario.

In response to public comment during the scoping phase of the Draft EA, the USACE will be working with the local sponsor of the project, the County of Maui (COM) Department of Public Works (PW), to look into recreational possibilities to be incorporated with the chosen alternative, such as jogging and walking paths along the levees.

Recommended Alternative. Alternative III is the recommended plan, as it would best resolve the project's design deficiency with the least amount of negative fiscal and environmental impacts and greatest net benefits. It includes RCC lining of 7,200 ft of stream and raising the existing levee using CRM (See Section 3.0). A recharge basin and diversion levee were considered for incorporation into the project approximately 1,100 ft upstream of Market Street to address the public comments concerning existing drought conditions on Maui, but were dropped from consideration following the recommendation of United States Fish and Wildlife Services (USFWS) and Department of Land and Natural Resources (DLNR) Department of Aquatic Resources (DAR) personnel that these features' presence would have negative impacts on aquatic organisms. Alternative III also includes a low-flow channel that is also designed to facilitate upstream and downstream migration of native organisms during periods of low water flow. Mitigation measures agreed upon by the USACE, USFWS, and the COM include alignment of the low-flow channel along vegetated stream banks to allow existing overhanging vegetation to shade the channel and reduce water temperatures, and a retrofit of improved portions of the channel that are currently lacking low-flow design elements or that pose a challenge to migrating aquatic organisms.

Affected Environment and Potential Impacts. Potential negative impacts include short-term, long-term, and cumulative impacts of Alternatives I, III and V, although the negative impacts for Alternative III have been minimized by the incorporation of several mitigation measures. The majority of the concerns regarding potential negative environmental impacts were raised by the USFWS in its 2(b)

report. During subsequent discussions between the USFWS and the USACE, these concerns were addressed by collectively devising mitigation measures which have been agreed to by the USFWS in a revised mitigation recommendation letter (Appendix J). Alternative VI represents the current scenario, and thus would result in no new significant environmental impacts due to no action being taken. The current levels of erosion and sedimentation would continue, however, along with the risk of flooding to the community.

Geology and Soils. While some degree of sedimentation is natural for any stream system, the 'Īao Stream in its current state is experiencing extreme streambank erosion (i.e., 6 to 8 ft below the 1983 repairs) that leads to excessive sedimentation during high water flow storm events. Alternatives I and III would effectively eliminate the excessive erosion and associated sedimentation, while Alternative V would exacerbate the current situation. All three alternatives would have short-term sedimentation impacts during construction, although these can be mitigated through the incorporation of best management practices (BMPs) by the construction contractor. Alternative VI would allow the continued streambank erosion and sedimentation of 'Īao Stream because no action would be taken.

Oceanography, Hydrology, and Flooding. Alternatives I and III would effectively eliminate potential flood damage to the Wailuku community and surrounding areas. Implementation of either alternative is not expected to adversely affect oceanographic characteristics of the area, adjacent beaches, or the inshore water circulation patterns. Alternative I could negatively impact groundwater recharge due to its elimination of the existing flood plain and hardening of an additional 7,200 ft of channel. Alternative III also hardens the 7,200 ft of channel, but mitigates this by incorporating weepholes in the RCC and keeping the existing flood plain. As a direct result of water diversion features upstream from the project area, the stream basin is currently characterized by an absence of water 80 to 90 % of the time. Alternative III's invert channel is designed to collect and facilitate groundwater movement during periods of low water flow.

Alternative V would return the stream to its natural condition prior to 1981, facilitating groundwater recharge but allowing further streambank erosion as well as the possibility of major flooding to occur. Alternative VI would take no corrective action on the current state of the stream and streambank erosion would continue to occur. While some degree of streambank flooding is natural for any stream system, in the case of the 'Īao Stream this flooding can lead to a loss of life and property.

Water Quality. A short-term increase in turbidity is inevitable if water is flowing in the stream during construction for all proposed alternatives. The general contractor is required to use silt containment devices and other effective methods to control turbidity to the maximum extent practicable. The USACE

will monitor the marine water quality at the mouth of the stream before, during, and after construction to assure water quality standards are not exceeded.

Sampling and analysis was performed at four locations in the near shore ocean off of the mouth of the ʻĪao Stream. Turbidity and potential of hydrogen (pH) were similar at all stations. Near shore waters in the sampling area were turbid with very limited visibility due to strong winds and large waves caused by consistent northeasterly trade winds and currents. While some level of sedimentation is natural for any stream system, current levels of sedimentation in the stream are likely elevated following storm events due to the excessive level of streambank erosion experienced during storm events, which may lead to an increase in sedimentation of Kahului Bay if sufficient water is flowing continuously to the ocean. Alternatives I and III would reduce the increased sedimentation that results from stream bank erosion during high water flow or flood events. Alternatives V and VI would not only continue the current amount of sedimentation in the stream during storm events, but would exacerbate the erosion of streambanks and in turn increase the sedimentation of Kahului Bay if sufficient water were flowing continuously through the stream to the ocean.

Terrestrial and Aquatic Biological Resources. The proposed alternatives will subject terrestrial and riparian species to minimal adverse impacts. The stream is currently used by aquatic organisms that undergo upstream and downstream migration for breeding and metamorphosis. Under current conditions (Alternative VI), a limited number of upstream migrating fish and invertebrates successfully ascend thorough the channel to middle and upper reaches of the stream. The number of successfully migrating organisms is limited due to the lack of water in the stream 80 to 90% of the time. Aquatic species are susceptible to changes in stream flow due to their amphidromous life cycle. Alternative I would negatively impact the aquatic fauna with the proposed smooth concrete channel. Alternative III would have some negative impacts to aquatic species habitat, although these have been mitigated to the maximum extent practicable by incorporating a low flow boulder channel to replicate a more natural stream and design elements to facilitate the movement of aquatic organisms through the modified channel area. Alternative III mitigation measures currently under discussion between the USACE, USFWS, and the COM include alignment of the low-flow channel along vegetated stream banks to allow overhanging vegetation to shade the channel and reduce water temperatures, and a retrofit of improved portions of the channel that are currently lacking low-flow design elements or that pose a challenge to migrating aquatic organisms.

Alternative V would revert the stream back to its natural state and might enhance the aquatic fauna, however it would also lead to flooding of the community. Contaminants could be introduced into the stream during storm and flooding events.

The draft FWCA report noted the presence of coral reef ecosystems within Kahului Bay, near the mouth of the ʻĪao Stream. Coral ecosystems are sensitive to excessive sedimentation. Short-term construction for all alternatives could result in an increase in turbidity in ʻĪao Stream as well as a potential increase in sedimentation of Kahului Bay, although this would be mitigated with engineering controls and BMPs. Alternatives I and III would provide a long-term reduction in sedimentation by eliminating the current excessive streambank erosion occurring within the ʻĪao Stream during high rainfall and flood events, while Alternative V would most likely not eliminate the excessive erosion problem.

Wetland maps maintained by the USFWS indicate the potential presence of wetlands in the vicinity of the proposed project, particularly on the flood plain, which is currently used for agricultural and residential use. These potential wetlands have not been field verified or jurisdictionally delineated. Alternative I would open the flood plain up for development, while Alternatives III and V retain the flood plain in a natural state. Any development of the floodplain would first require an investigation of whether any wetlands do indeed exist. Alternative III's project modifications are designed to take place within the existing flood control project limits, thus no wetlands issues have been identified with this alternative.

Threatened and Endangered Species. The USFWS and National Marine Fisheries Service (NMFS) have concurred with the USACE's determination that no known federally listed endangered or threatened biota or their critical habitats occur within the study area. Formal consultation under Section 7 of the Endangered Species Act is therefore not required. The USFWS stated that there is a potential existence of two candidate species of insects in the project area, although this has not been confirmed by field studies.

Historic and Cultural Resources. Studies indicate that there are no significant archaeological sites or traditional cultural properties within the Area of Potential Effects (APE). No further archaeological investigation is necessary. As a mitigation measure, the USACE will include monitoring by a qualified archaeologist during construction associated with the widening of the stream to accommodate the proposed improvement of the ʻImi Kālā Street Bridge.

Implementation of any available alternatives will not impact known historic or cultural resources. Interviews conducted during a cultural impacts assessment in 2003 found that any proposed flood control related projects create concern for residents regarding possible water diversion, erosion, and adverse impacts to the natural environment. Possible cultural impacts include potentially negative reactions from the Wailuku community to Alternatives I and III, and a positive reaction to Alternative V. A public

scoping meeting was held on August 12, 2003 to address these public concerns. Consultation with resource agencies has been pursued throughout the course of this project, and will continue throughout the design and construction phases of the project to ensure all environmental concerns are being addressed and mitigated to the maximum extent practicable. This will be conveyed to the Wailuku community.

Section 106 consultation has been initiated with the State of Hawaiʻi Historic Preservation Office (SHPO), the Office of Hawaiian Affairs (OHA), the County of Maui Cultural Resources Commission, the Central Maui Hawaiian Civic Club, and the President of the Association of Hawaiian Civic Clubs. The USACE sent a letter to these parties indicating that a "no adverse effect" determination had been made. Consultation is ongoing. Any further developments will be addressed and included in the final EA.

Land Use and Visual Resources. Short term land use impacts may be generated from construction activities limiting access to and from public areas. USACE will work closely with local police and fire authorities and provide early planning for alternate routes, as well as traffic control. With the exception of Alternative V, no adverse land use impacts are expected, as Alternatives I and III do not encroach into developed areas of the Wailuku community. Alternatives V and VI will result in long-term erosion and private property damage to key parcels of land along the stream.

Aesthetic impacts differ depending on the alternative chosen. Alternatives I and III would remove 70% of the remaining natural alluvial channel of the stream, adversely impacting the aesthetic quality of the stream. Alternative III mitigates this to the maximum extent practicable by providing a more visually appealing low-flow channel and maintaining stream-side vegetation, though the RCC channel walls and levee raises will impact the existing aesthetic natural quality of the stream. Alternative V would effectively remove all man-made flood control improvements since 1981. With time, the stream would be restored to a completely natural condition which could potentially become more aesthetically pleasing than its current state. With no flood control protection however, local residents and businesses would be subject to flood damage to properties and potential loss of life. Alternative VI would make no changes to the current conditions of ʻĪao Stream.

The flood plain is designated agricultural lands by the State of Hawaii, and current uses of this area are a mix of residential and agricultural use. Alternatives III and V retain the flood plain, while Alternative I would allow the flood plain to be used for development.

Land use in the area has transitioned from primarily sugarcane agriculture to alternative crops as well as commercial and residential development. As a result, there may not be a need to divert the same amount of water from the ʻĪao Stream as was necessary to support sugarcane growth.

Hazardous, Toxic, and Radioactive Waste (HTRW). The HTRW initial assessment was conducted under the USACE regulations (Engineer Report (ER) 1165-2-132) in 1997. The results of the report have indicated that there are no existing or previous HTRW activities located in the project area. The 'Īao Stream basin has not been designated as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) action site, and no spills or other HTRW activity has been known to have affected the project area in the past. All available alternatives, with the exception of Alternative VI, will consist of excavation of materials from the stream channel and its margins. As the project area does not contain HTRW materials, the excavated material is not deemed hazardous. Excess quantities of the excavated materials will be subject to testing and evaluation for suitability of disposal in accordance with the United States Environmental Protection Agency (EPA) before disposal in the COM landfill. Therefore, no potentially damaging impacts will befall the surrounding environment.

Noise. Noise levels will be temporarily increased during construction for all proposed alternatives due to the operation of heavy construction equipment. Implementation of BMPs and compliance with applicable Federal, state, and local laws as indicated in Section 5.8 will mitigate construction noise levels to acceptable levels. Prior to construction activities, a permit will be obtained from the State of Hawai'i Department of Health (HDOH) for operation of construction equipment, power tools, and vehicles which will emit noise levels in excess of the allowable limits. Alternative VI would result in continued short-term construction noise during continuous repair activities. There are no foreseeable long-term noise issues with any of the proposed alternatives and noise studies were not conducted for this project.

Air Quality. For all available alternatives, short-term dust and vehicle exhaust emissions will be present in the project area due to construction activities. These effects are temporary, however, and only affect the area within the vicinity of the project so long as the contractor is required to strictly adhere to implementing all necessary measures to ensure containment of dust on the construction site. Mitigation measures include the use of BMPs as well as strict adherence to Hawai'i Administrative Rules (HAR) Title 11, Chapter 59 and 60.1 for Ambient Air Quality Standards (AAQS) and Air Pollution Control (APC) respectively. On-site emissions generated from construction equipment emit nitrogen oxides and carbon monoxide. Standards for nitrogen dioxide set by the National Ambient Air Quality Standards (NAAQS) are on an annual basis, and short-term construction is not likely to violate set annual standards. Carbon monoxide emissions will be very low and should be insignificant compared to normal vehicular emissions.

Traffic. The proposed alternative designs, with the exception of Alternative VI, consist of modifications to the existing flood channel and do not consist of new land uses, structures, or developments that would

require additional infrastructure needs. Therefore the available alternatives will not affect existing traffic conditions. COM, in cooperation with a private developer, is planning to replace the ʻImi Kālā Street bridge and extend ʻImi Kālā Street to connect to Kahekili Highway. This will likely change the traffic patterns in the vicinity of the ʻImi Kālā Street Bridge. As there are no foreseeable impacts to existing traffic conditions from the alternatives however, a study was not conducted for this purpose. Alternative VI would have no impact of the current traffic conditions.

Recreation and Resource Use. Alternative I would create adverse impacts on the natural quality of the ʻĪao stream, impacting existing recreational resources along the stream in the long term. Alternative III also would create some impacts to the natural quality of the stream, although these impacts have been mitigated somewhat by the incorporation of RCC and stream-side vegetation. In response to public comments during the public scoping period, the USACE is currently working with the PW to look into recreational possibilities to be incorporated with the chosen alternative, such as jogging and walking paths along the levees, similar to the Kawainui Marsh in Kailua, Oahu. Alternative V would remove all man-made improvements and allow ʻĪao Stream to return to a completely natural state and might enhance the recreational quality of the stream area. However, the lack of flood control devices could limit recreational activities for safety reasons. Alternative VI would not change any of the current conditions. Over the long-term, the accessibility to ʻĪao Stream would be impacted due to inadequate flood control.

Economic and Social Resources, and Environmental Justice. All available alternatives will generate short-term economic vitality for the island by providing temporary construction jobs. Alternative I would provide long term positive economic prosperity to the growing community of Wailuku by mitigating flood events and eliminating ongoing stream bank erosion. As part of this alternative, the existing left flood plain area may be utilized for future development opportunities by COM.

Alternative III is designed to provide a SPF level of protection by constructing a new low-flow channel, hardening the existing banks with RCC, raising levees, and incorporating the existing flood plain as is. In the long term, these measures will prevent damages to life and property, allow for development and growth of the community with minimal modifications, and will remain less intrusive to the existing environment. The proposed concrete channel lining for Alternatives I and III may negatively impact the visual quality of ʻĪao Stream. This may detract potential visitors, although this is unlikely considering the well-known ʻĪao Valley tourist attraction is located approximately 2 miles from the top of the project area.

Alternative V would effectively remove all man-made flood control improvements since 1981, and the Wailuku community would be provided a flood-warning system in place of flood control improvements.

This alternative does not provide tangible flood control for the community and may hinder future development in the area. Loss of life would be possible and damage to property would be inevitable.

Alternative VI would not change any of the current conditions, and the area would return to a Flood Hazard Area in the fall of 2009. Alternative VI would be a fiscal strain on the government to provide flood related assistance. This alternative does not provide tangible flood control for the community and may hinder future development in the area. Loss of life would be possible and damage to property would be inevitable.

An assessment of possible adverse impacts resulting from implementation of any of the available alternatives indicates there are no disproportionate negative impacts toward minority and low-income populations (Executive Order (EO) 12898).

Accessibility for Maintenance. In its current state, the 'Īao Stream requires regular channel repair by bulldozers, particularly after every storm event. Eroded material is also removed from the concrete channel located under the Waiehu Beach Road Bridge. Alternative VI would leave 'Īao Stream in this current condition. The need for maintenance would be lessened if Alternative I or III were implemented.

Alternative I would be the easiest to maintain, while Alternative III would be more difficult due to the grouted boulder invert channel and potential vegetative growth. Alternative V would return the stream to a natural state, and thus would not require maintenance. However, this alternative does not meet the project objectives of flood and erosion control.

Cumulative Impacts. Alternative I would modify the existing flood channel system to prevent inevitable project failure, the loss of life, and extensive property damage. Positive cumulative impacts created by these modifications including social/economic growth without hindrance from seasonal flooding. Government fiscal resources would not be strained to provide repairs and emergency support for flood damage to persons and properties. Alternative I, however, would adversely impact the aquatic fauna of the 'Īao Stream by removal of the natural streambed, leading to long-term deterioration of the existing aquatic fauna as well as adverse impacts to the scenic quality of the 'Īao Stream. This may in turn affect tourism and the economy.

Alternative III has the least adverse impacts as the proposed grouted boulder invert channel will follow the existing stream alignment, use RCC side slopes, and retain streambank vegetation. This will provide a more habitable area for existing aquatic fauna, but will still cause some degree of visual impact. Mitigation measures proposed by the USACE include alignment of the low-flow channel along vegetated stream banks to allow overhanging vegetation to shade the channel and reduce water temperatures, and a

retrofit of improved portions of the channel that are currently lacking low-flow design elements (refer to Section 3, Appendix I, and Appendix J for a more detailed description of retrofit mitigation measures proposed). In the long-term, this alternative provides a means of enabling upstream migration of aquatic organisms, preserving streambank vegetation, and using grouted boulders to replicate a more natural looking stream. Although this alternative represents an alteration of a natural stream system to a concrete-lined channel, the design elements mitigate the impacts to the maximum extent practicable. The USFWS has indicated their concurrence with these mitigation measures in a revised mitigation recommendation letter (Appendix J). Potential cumulative impacts from the 'Imi Kālā Street Bridge replacement and 'Imi Kālā Street extension, as well as the Hale Mua affordable housing subdivision planned by COM may include increased traffic in the vicinity of the project, although the project itself would not generate additional long-term traffic.

Alternative V would allow the 'Īao Stream to return to its natural state; with the use of a state-of-the-art flood warning system, lives may be saved but property damage will be inevitable. The inconvenience and cost of repairs are serious public health and safety issues in the long term. If this alternative was pursued, the project would incur heavy costs to relocate residents living within the flood-prone areas. These additional costs contribute to the many factors that make Alternative V an unacceptable option.

Alternative VI would leave 'Īao Stream in its current condition. Severe erosion would continue, contributing to levee failure in multiple locations, which would eventually lead to flooding of the 'Īao Stream drainage basin. Alternative VI would be a long-term inconvenience and fiscal strain on the government to provide flood related assistance. This alternative does not provide tangible flood control for the community and may hinder future development in the area. Loss of life would be possible and damage to property would be inevitable..

Irreversible and Irretrievable Commitment of Resources. The USACE believes that project modification cannot be avoided due to the need to provide flood control for the Wailuku community. Implementation of the recommended alternative will prevent otherwise inevitable project failure and thus prevent the potential loss of life and property.

Alternative I – Long term negative impacts include visual and environmental degradation of the 'Īao Stream which may affect the tourist economy. Natural resources impacted are limited to existing aquatic species, which will not be able to adapt to the increased flow speed of water in the channel brought upon by the concrete lining.

Alternative III – Long term negative impacts of visual and environmental degradation of the stream are minimized by mitigation measures. The natural portion of the stream is currently characterized by

boulders and weeds, but a lack of water flow up to 90% of the time (Figures 4-4 and 4-5). With Alternative III, this middle reach of the 'Īao Stream would be converted to an RCC-lined section similar to the downstream and upstream portions of the stream (Figures 4-4 and 4-5). The low-flow channel incorporated into this alternative is designed to minimize habitat loss for existing aquatic species in the stream as well as provide an opportunity for migration of aquatic organisms during low water flow events. Incorporating stones into the concrete lined channel will provide a less negative visual impact to the natural character of the stream, although it will not be as aesthetically pleasing as a natural stream. Retaining the existing managed flood plain would facilitate groundwater recharge. Success of this alternative will also rest upon mitigation measures including alignment of the low-flow channel along vegetated stream banks to allow overhanging vegetation to shade the channel and reduce water temperatures, and a retrofit of improved portions of the channel that are currently lacking low-flow design elements (Appendix I and Appendix J).

Alternative V – Resources invested in the removal of all man-made flood control structures and relocation of residents in flood-prone areas would be irreversible. Replaced by a state-of-the-art flood warning system, the natural environment of the 'Īao Stream would be returned, at the cost of loss of property, and possibly life, in future flood events.

Alternative VI – Since no action would be taken, over the long-term there would be inconvenience and fiscal strain on the government to provide repairs relating to flood related issues. This alternative does not provide tangible flood control for the community and may hinder future development in the area. Loss of life would be possible and damage to property would be inevitable.

Probable Adverse Environmental Effects Which Cannot Be Avoided. Alternatives I and III will impact the existing stream environment with flood control improvements, although the impacts of Alternative III will be minimized or compensator for by mitigation measures. Alternatives V and VI would impact the existing community with floods. For Alternatives I and III, changes in the visual appearance of the stream may be viewed as adverse by some individuals. Alternative III will minimize visual impacts by incorporating boulders in the low-flow channel that mimic the natural character of the stream . For all alternatives, temporary noise and sedimentation impacts during construction or repairs are unavoidable. Possible sedimentation can be mitigated through the use of BMPs during construction. The probable impacts of Alternative III are unavoidable but can be mitigated. The proposed compensatory mitigation measures have been agreed to in a revised mitigation recommendation letter by the USFWS (Appendix J).

Risk and Uncertainty. The USACE believes that the project modification cannot be avoided due to the need to provide flood control for the Wailuku community. Implementation of the recommended

alternative (Alternative III) will prevent otherwise inevitable project failure and thereby prevent the loss of life and property. Both Alternatives I and III will achieve the project objective and prevent substantial damages to life and property in the long term. Alternative I however, may negatively impact the existing natural environment of ʻĪao Stream, leading to degradation of aquatic fauna and eventually the aesthetic quality of the stream as a whole. The proposed concrete lining of 70% of the remaining natural alluvial channel may adversely affect tourism and the economic viability of ʻĪao Valley, as it is a well-known attraction on Maui, although this is unlikely considering the 2-mile separation between the project area and the tourist attraction area. Alternative III will provide a more environmentally friendly design with integration of boulders to mimic the natural habitat of the ʻĪao Stream and the inclusion of a low-flow channel with design elements to enable migration of aquatic organisms. Not only will the aquatic fauna have an environment in which to survive, but the stream itself will appear more natural and aesthetically pleasing. Survival of aquatic organisms will depend on proposed mitigation measures. Alternative VI leaves the stream in its current state, and the area would return to a Flood Hazard Area in the fall of 2009. Alternative V eliminates all flood control, and is a high risk option.

Economic Analysis. The SPF floodplain is estimated to contain 362 single family residencies, 45 multi-unit residential structures containing 464 condominium units, and 105 tax map parcels with one or more commercial structures. The estimated replacement cost less depreciation value for commercial and residential structures is $194 million, and the estimated value of damageable contents is $164 million (Appendix K), using 2007 property tax assessed values. The benefits of the project, in terms of damages or costs prevented, are calculated by comparing the without-project damages and/or costs to the with-project damages and/or costs. The benefits summary conducted as part of the economic analysis shows an annual total of approximately $2,572,000 in damages and/or costs prevented, as compared to the without-project condition. The greatest benefits are estimated from residential and commercial structures and contents (ibid).

It is a comparison of an alternative's total average annual benefits and total average annual costs that determines its economic viability from a federal standpoint. The federal government will consider participating in the construction of the alternatives with benefit-cost ratios greater than one. The alternative with the highest net benefits is chosen as the recommended alternative from among the viable plans with benefit-cost ratios greater than one.

Alternative III has the highest net benefits of the alternatives analyzed, as well as a benefit-cost ratio greater than one, is considered the National Economic Development (NED) Alternative Recommended Plan.

Comments and Coordination. Public participation is organized in the form of public posting and agency consultations. Public posting as well as individual notices were mailed to Federal, state, and county resource agencies in 1996 through 1997. A public scoping meeting was held on August 12, 2003. Notification of the meeting was circulated via posting of the meeting notice in the daily paper, the *Maui News*. Meeting notices were also mailed to potential stakeholders and community associations. The scoping meeting was held at the Wailuku Community Center. A public informational meeting is planned for the review of the draft Environmental Assessment report.

Permits and Approvals. The following are required permits and approvals for the proposed project. Section 401 State Water Quality Certification (WQC); Section 401(b)1 Analysis, National Pollutant Discharge Elimination System (NPDES) permit; Coastal Zone Management Consistency Determination; Stream Channel Alteration Permit (SCAP); State Conservation District Use Application (CDUA); and Special Management Area Use Permit (SMP).

Table ES-1 provides a summary of the potential impacts and mitigation measures associated with each alternative.

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Table ES-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION			
Geology and Soils			
Alternative	Impact	Section	Proposed Mitigation
I	Short-term construction sedimentation Long-term reduce shoreline erosion	4.1	BMPs and appropriate permits and regulations to minimize turbidity.
III	Short-term construction sedimentation Long-term reduce shoreline erosion and reduce sediment load		BMPs and appropriate permits and regulations to minimize turbidity.
V	Short-term construction sedimentation Long-term erosion and sedimentation		BMPs and appropriate permits and regulations to minimize turbidity. None
VI	Long-term erosion and sedimentation		N/A
Oceanography, Hydrology and Flooding			
Alternative	Impact	Section	Proposed Mitigation
I	Eliminate Flooding. Potentially impact groundwater recharge.	4.4	N/A None
III	Eliminate Flooding.		N/A
V	Erosion and sedimentation impact ocean		None
VI	Erosion and sedimentation impact ocean		None
Water Quality			
Alternative	Impact	Section	Proposed Mitigation
I	Short-term construction sedimentation Long-term reduce shoreline erosion	4.5	BMPs and appropriate permits and regulations to minimize turbidity.
III	Short-term construction sedimentation Long-term reduce shoreline erosion and reduce sediment load		BMPs and appropriate permits and regulations to minimize turbidity.
V	Short-term construction sedimentation Long-term erosion and sedimentation		BMPs and appropriate permits and regulations to minimize turbidity. None
VI	Long-term erosion and sedimentation		N/A
Terrestrial and Aquatic Biological Resources			
Alternative	Impact	Section	Proposed Mitigation
I	Adverse impact to aquatic species	4.6	Baffle Blocks & Drop Structures
III	Minimal adverse impact to aquatic species		Baffle Blocks & Drop Structures; low-flow channel; align low-flow channel close to bank and maintain adequate vegetation to shade; retrofit measures.
V	No impact		N/A
VI	No impact		N/A

Table ES-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION			
Threatened and Endangered Species			
Alternative	Impact	Section	Proposed Mitigation
I	No impact	4.7	N/A
III	No impact		N/A
V	No impact		N/A
VI	No impact		N/A
Historic, Cultural Resources			
Alternative	Impact	Section	Proposed Mitigation
I	No impact on historic resources, adverse cultural impact from current residents	5.1	Cultural resources construction monitoring by a qualified archaeologist, additional public informational meeting. Ongoing consultation with resource agencies, transparency with community.
III	No historic impact, adverse cultural impact from current residents		Cultural resources construction monitoring by a qualified archaeologist, additional public informational meeting. Ongoing consultation with resource agencies, transparency with community.
V	No impact		N/A
VI	No impact		N/A
Land Use and Visual Resources			
Alternative	Impact	Section	Proposed Mitigation
I	Adverse visual impact from concrete channel	5.2	Proposed recreational features along 'Īao Stream.
III	Minimal adverse visual impact		Low-flow channel with grouted boulders to mimic natural stream habitat; Proposed recreational features along 'Īao Stream.
V	Positive visual impact		N/A
VI	Minimal adverse impact		None
Hazardous, Toxic and Radioactive Waste (HTRW)			
Alternative	Impact	Section	Proposed Mitigation
III	No impact	5.3	N/A
V	No impact		N/A
VI	No impact		N/A
Noise			
Alternative	Impact	Section	Proposed Mitigation
I	Short-term construction noise	5.4	BMPs, contractor to strictly adhere to construction monitoring plan, proper maintenance of heavy equipment, appropriate permits and regulations.
III	Short-term construction noise		BMPs, contractor to strictly adhere to construction monitoring plan, proper

Table ES-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION			
			maintenance of heavy equipment, appropriate permits and regulations.
V	Short-term construction noise		BMPs, contractor to strictly adhere to construction monitoring plan, proper maintenance of heavy equipment, appropriate permits and regulations.
VI	Short-term noise during continuous repairs		None
Air Quality			
Alternative	Impact	Section	Proposed Mitigation
I	Short-term construction fugitive dust	5.5	BMPs, contractor to strictly adhere to agreed upon dust control measures, (also add measure to control odor) and appropriate permits and regulations.
III	Short-term construction fugitive dust		BMPs, contractor to strictly adhere to agreed upon dust control measures, (also add measure to control odor) and appropriate permits and regulations.
V	Short-term construction fugitive dust		BMPs, contractor to strictly adhere to agreed upon dust control measures, (also add measure to control odor) and appropriate permits and regulations.
VI	No impact		N/A
Traffic			
Alternative	Impact	Section	Proposed Mitigation
I	No Impacts	5.6	N/A
III	No Impacts		N/A
V	No Impacts		N/A
VI	No impact		N/A
Recreation and Resource Use			
Alternative	Impact	Section	Proposed Mitigation
I	♦ Short-term construction impacts related to accessibility of public areas. ♦ Long-term aesthetic impacts to existing recreational areas.	5.7	♦ Preplanning of alternate routes and police officers to direct traffic during construction periods. ♦ Added recreational features are being proposed to be incorporated into alternative.
III	♦ Short-term construction impacts related to accessibility of public areas. ♦ Minimal long-term aesthetic impacts to existing recreational areas.		♦ Preplanning of alternate routes and police officers to direct traffic during construction periods. ♦ Added recreational features are being proposed to be incorporated into alternative.
V	♦ Short-term construction impacts related to accessibility of public areas. ♦ Long-term impacts to accessibility of areas due to lack of flood control devices.		♦ Preplanning of alternate routes and police officers to direct traffic during construction periods. ♦ Proposed recreational features may be limited due to lack of flood control devices.
VI	Long-term impacts to accessibility of areas		Recreational use may be limited due to inadequate flood control.

Table ES-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION			
	due to inadequate flood control.		
Economic and Social Resources and E.O. 12898			
Alternative	Impact	Section	Proposed Mitigation
I	♦ Short term economic vitality from construction. ♦ Long term protection from floods brings economic and social prosperity. Aesthetics of the stream is detracted and may adversely affect tourism.	5.8	Added recreational features are being proposed to be incorporated into alternative for long-term recreational value.
III	♦ Short term economic vitality from construction. ♦ Long term protection from floods brings economic and social prosperity. Minimal adverse aesthetic features may affect tourism.		Added recreational features are being proposed to be incorporated into alternative for long-term recreational value.
V	♦ Hinder future development in addition to possible loss of life and damage to property. ♦ Fiscal strain on government to provide flood related assistance.		State of the art flood warning system.
VI	♦ Hinder future development in addition to possible loss of life and damage to property. ♦ Fiscal strain on government to provide flood related assistance.		None
Cumulative Impacts			
Alternative	Impact	Section	Proposed Mitigation
I	♦ Long term protection from floods brings economic and social prosperity. ♦ Adverse impact to aquatic fauna leading to long-term deterioration of scenic quality, may in turn affect tourism and the economy. ♦ Potential impacts on traffic from ʻImi Kālā Bridge replacement, road extension and Hale Mua affordable housing subdivision.	5.10	Added recreational features are being proposed to be incorporated into alternative for long-term recreational value. None No traffic impacts attributable to the proposed projects are anticipated.
III	♦ Long term protection from floods brings		Added recreational features are being proposed to be incorporated into

Table ES-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION			
	economic and social prosperity. ♦ Minimal adverse impact to aquatic fauna and scenic quality. ♦ Potential impacts on traffic from 'Imi Kālā Bridge replacement, road extension and Hale Mua affordable housing subdivision.		alternative for long-term recreational value. Low-flow invert channel; maintenance of vegetation to reduce water temperatures, retrofit measures. No traffic impacts attributable to the proposed projects are anticipated. Alternative III incorporates design elements to support the proposed bridge replacement.
V	♦ High possibility of loss of life and property damage. Long-term inconvenience and fiscal stress on government and the community for flood related issues. ♦ Positive impact to aquatic fauna and scenic quality as all man-made structures are removed and stream is returned to natural state.		State of the art flood warning system.
VI	♦ Possibility of loss of life and property damage. Long-term inconvenience and fiscal stress on government and the community for flood related issues.		None
Irreversible and Irretrievable Commitment of Resources			
Alternative	Impact	Section	Proposed Mitigation
I	♦ Labor and fiscal resources ♦ Adverse impact to aquatic fauna leading to long-term deterioration of natural resources.	5.11	N/A
III	♦ Labor and fiscal resources ♦ Minimal adverse impact to aquatic fauna lessens impact of deterioration to natural resources.		N/A Low-flow invert channel; maintenance of vegetation to reduce water temperatures, retrofit measures.
V	♦ Labor and fiscal resources ♦ Possible loss of life/property damage ♦ Fiscal strain on government to provide flood related assistance.		N/A
VI	♦ Labor and fiscal resources ♦ Possible loss of life/property damage		N/A

Table ES-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION			
	♦ Fiscal strain on government to provide flood related assistance.		
Probable Adverse Environmental Effects Which Cannot Be Avoided			
Alternative	Impact	Section	Proposed Mitigation
I	♦ Short-term adverse impacts from construction: noise, air, and water. ♦ Visual changes to stream by increase in area covered by concrete lining resulting in harsher, less natural environment.	5.12	BMPs, contractor will be required to strictly adhere to state and county construction noise and air quality standards, and appropriate permits and regulations. Construction equipment will need to be maintained in good working order at all times.
III	♦ Short-term adverse impacts from construction: noise, air, and water. ♦ Minimal visual changes to stream from impact to natural environment.		BMPs, contractor will be required to strictly adhere to state and county construction noise and air quality standards, and appropriate permits and regulations. Visual changes mitigated by using stones to approximate natural appearance of the stream. Facilitates groundwater recharge by retaining the floodplain and incorporating weepholes. Maintain adequate vegetation to provide shade and reduce water temperatures. Retrofit measures.
V	♦ Short-term adverse impacts from construction: noise, air, and water. ♦ Positive environmental effects to enhance visual quality of stream.		BMPs, contractor will be required to strictly adhere to state and county construction noise and air quality standards, and appropriate permits and regulations.
VI	♦ Long term adverse impacts from erosion and sedimentation		None

1.0 INTRODUCTION

The United States Army Corps of Engineers (USACE) is conducting an Environmental Assessment (EA) for the modification of the 'Īao Stream Flood Control Project, Wailuku, Maui, Hawai'i, completed in 1981. During the years 1981-1989, severe flood damage caused erosion that compromised channel stability and weakened portions of the existing levees. As a result of this damage, the 'Īao Stream Flood Control Project of 1981 requires upgrades and modifications, as future flood events may cause damage to life and property in areas of Wailuku town. Levee certification that the completed project can withstand a 100-year frequency flood is required by the Federal Emergency Management Agency (FEMA) by February 2009; otherwise, the area protected by the project will revert to a flood hazard area in the fall of 2009.

The USACE has determined that the damages incurred to the 1981 Flood Control Project during the years immediately following the completion of the project are due to design deficiencies to the original project. Under the legislative authority of the Flood Control Act of 1948, Section 205, Public Law (PL) 80-858, as amended, 33 United States Code (USC) 701s; PL 93-251, as amended; PL 97-140 and PL 99-662, the USACE is authorized to implement flood damage reduction improvements to the 'Īao Stream that meet or exceed Standard Project Flood (SPF)[1] requirements to protect the existing Wailuku community. The project was designed for SPF protection with a peak discharge of 27,500 cubic feet per second (cfs) at the downstream limit of the project (250 feet (ft) upstream from the mouth of the stream) and 26,000 cfs at the upstream limit of the project (2.5 miles upstream from the mouth of the stream).

Environet, Inc. has been retained, under Contract No. DACA83-01-D-0014 to prepare an EA in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended, Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations (CFR) 1500-1508); Engineer Report (ER) 200-2-2, Environmental Quality Procedures for Implementing NEPA; and Chapter 343, Hawai'i Revised Statutes (HRS) and Act 50, as amended.

[1] The SPF is the flood that may be expected from the most severe combination of meteorologic and hydrologic conditions that are considered to be reasonably characteristic of the geographical region involved, excluding extremely rare combinations. The SPF represents a "standard" against which the degree of protection selected for a project may be judged and compared with protection provided at similar projects in other localities. The SPF for the 'Īao Stream is estimated as approximately 27,500 cfs.

1.1 LOCATION

The ʻĪao Stream drainage basin is a 10 square mile area that begins at the boundary between the Lahaina and Wailuku Judicial districts and extends along the crests of the Kahoolewa and Kapilau Ridges to the Pacific Ocean (Figure 1-1). The basin is eight miles long and averages 1.25 miles in width. It is characterized by two major topographic features: a coastal plain that extends about three miles inland, and ʻĪao Valley, the largest valley in West Maui, which extends from the coastal plain to the summit of Puʻu Kukui at an elevation of 5,800 ft above sea level.

The ʻĪao Stream Flood Control Project was initiated in 1977 and completed in 1981. The stream drains into a steep valley with stream flows at the upstream project limit conveyed into a debris basin. The 1981 ʻĪao Stream Flood Control Project consists of a debris basin located 2.5 miles upstream from the stream mouth, a 3,500-foot long channel downstream from the debris basin: levees along the left and right bank, flood plain management along 6,950 ft of the left bank, and stream realignment for a 1,730-foot reach to the shoreline. In the flood plain management reach, levees are located on the right stream bank and are offset up to 80 ft beyond the existing stream bank. The proposed improvements to the 1981 Flood Control Project extend from above Waiehu Beach Road (Sta 22+00) to the debris basin at the upstream limits of the project, a distance of approximately 2.5 miles (Figure 1-2).

The lower portion of the ʻĪao Stream in its current state (i.e., the area downstream from the water diversion structure (See Figure 1-3)) is not conducive to aquatic life. Due to the diversion of water from the stream, and also due to the intermittent nature of the stream itself, the stream below the diversion structure is absent of water approximately 90 % of the time (Appendix A). Were it not for the efforts of a local aquatic biologist to capture organisms from ponded areas near the ocean outlet and physically transport them to the upper reaches of the stream, there would likely be no instream migration of aquatic organisms from the ocean to upstream areas. In some concrete-lined portions of the stream, a low-flow channel has been constructed. This low-flow element has been identified as a positive feature for aquatic organisms, particularly where shade is present. Other barriers to instream migration of aquatic organisms include the 22-foot drop structure at Station 97+23, concrete-lined portions without a low-flow channel, and a few smooth elevation drops that lack sufficient rugosity for migrating organisms to grasp or rest (See Figure 1-3).

The preferred alternative (Alternative III) involves converting 7,200 ft of natural stream bed to a roller compacted concrete (RCC)-lined channel. The channel has been designed to include low-flow elements that will enhance passage of aquatic organisms during periods of stream flow. While United States Fish and Wildlife Service (USFWS) originally viewed the proposed alternative as a significant environmental

impact, subsequent discussions between the USACE and USFWS identified ways to mitigate these impacts to an acceptable level. As a result of these discussions, the proposed alternative includes several additional design features and retrofitting of existing concrete-lined portions of the stream that are outside the project area. These measures are discussed in greater detail in Section 3.0 of this report, and are also included in a revised mitigation recommendation letter by the USFWS (Appendix J).

1.2 PROPOSED ACTION

The proposed ʻĪao Stream Flood Control Project is intended to correct deficiencies associated with the existing Flood Control Project completed in 1981. Modifications to the 1981 Flood Control Project are needed to prevent further streambed erosion and protect Wailuku town from flood damage. In addition, construction of an alternative to restore ʻĪao Stream to its original design capacity of 27,500 cfs will certify the project to FEMA standards.

NEPA, in conjunction with applicable regulations listed in the previous section, requires alternative solutions to the proposed action be developed and presented collectively in this report. The proposed action and alternatives are then evaluated in order to determine the most feasible and environmentally acceptable plan for implementing flood damage reduction improvements that meet or exceed SPF requirements.

During the public scoping meeting for the project on August 12, 2003, consideration of an additional alternative was requested. The result was inclusion of a fifth alternative, which includes removal of existing flood control improvements from the area and the return of ʻĪao Stream to its original state, pre-flood control construction conditions.

A total of five alternatives and a no action alternative are discussed in this EA. Alternatives are presented in Table 1-1 and described further in detail in Section 3.0.

Table 1-1: Alternatives

Alternative	Description
I	Trapezoidal Concrete-Lined Channel
II	Rectangular and Compound Channel
III	RCC and Boulder Invert Channel Following Existing Alignment
IV	Levee Reconstruction
V	Removal of Flood Control Improvements
VI	No Action

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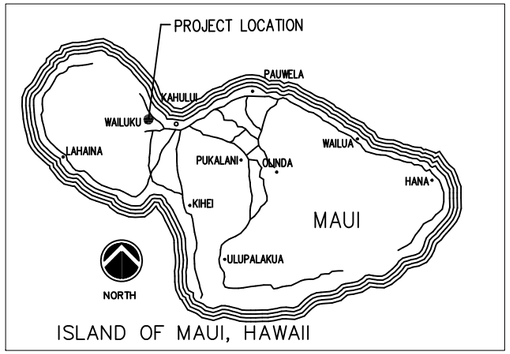

ISLAND OF MAUI, HAWAII

LEGEND:

DRAINAGE BOUNDARY

DRAINAGE SUB-BOUNDARY

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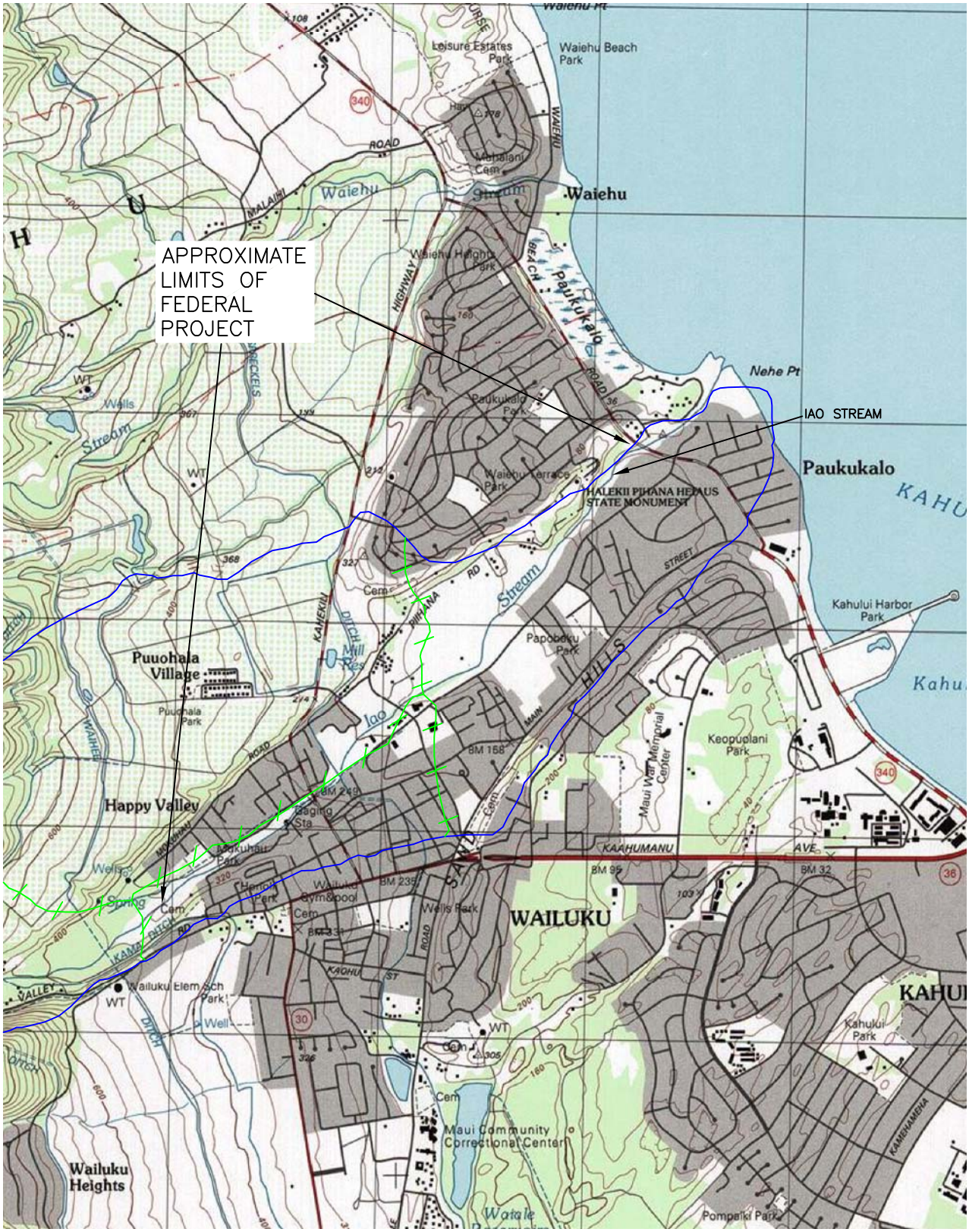
DRAWN BY: I.K.N.	IAO STREAM FLOOD CONTROL EA
CHECKED BY: R.C.A.	DRAINAGE AREA MAP IAO STREAM WAILUKU, MAUI, HAWAII
REF: USGS	FIGURE 1-1



ENVIRONET, INC. PRESERVING EARTH'S RESOURCES FOR THE FUTURE	DRAWN BY: I.K.N.	IAO STREAM FLOOD CONTROL EA	
	CHECKED BY: R.C.A.	PROJECT LOCATION IAO STREAM WAILUKU, MAUI, HAWAII	FIGURE 1–2
	REF: USACE		



Looking upstream at drop structure from Spreckles Ditch overpass.



Drop structure; note lack of water and sheer drop that prevents migration.



Smaller drop structure, with water diversion feature in the background.

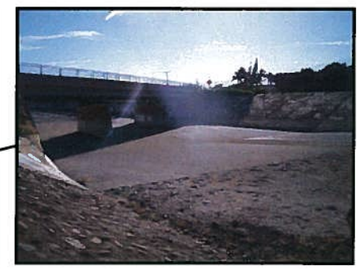


Concrete-lined low-flow stream channel upstream from water diversion structure.

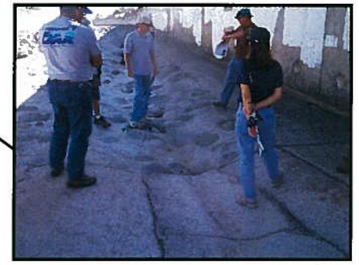


Looking down towards debris basin. Spring in foreground is supplying water to the channel.





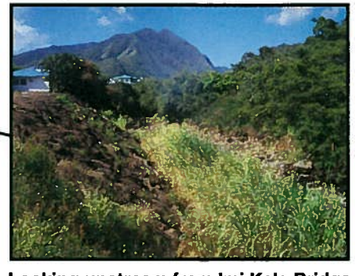
Waiehu Beach Road crossing, facing southeast.



Low-flow channel beneath Waiehu Beach Road, identified as ideal by DAR.



Looking dowstream from Imi Kala Bridge. Note lack of water in stream.



Looking upstream from Imi Kala Bridge.

Legend

Project Area

ENVIRONET, INC.
PRESERVING EARTH'S RESOURCES FOR THE FUTURE

DRAWN BY: B.I.	'IAO STREAM FLOOD CONTROL EA	
CHECKED BY: S.G.	SITE PHOTOGRAPHS 'IAO STREAM WAILUKU, MAUI, HAWAI'I	FIGURE 1–3
REF: USGS & COM		

1.3 OVERVIEW OF ALTERNATIVES CONSIDERED

In response to public comment regarding the possibility to add recreational features to the modification to the 1981 Flood Control Project, the USACE is currently working with the local project sponsor, the County of Maui (COM) Department of Public Works (PW), to look into jogging and walking paths along the levees as added recreational features to be incorporated with the chosen alternative.

The proposed alternatives are as follows:

Alternative I Trapezoidal Concrete-Lined Channel – This alternative would contain up to the SPF within the improved channel. Alternative I consists of a trapezoidal, concrete-lined channel with a 40-foot bottom width, 90-foot top width and interior splitter walls at channel curves (Figure 1-4). The new channel would mainly follow the existing stream alignment Station 22+00 (0.5 miles upstream from the stream mouth) to 92+02 (1.8 miles upstream from the stream mouth), for a distance of 7,200 ft. The channel would also be realigned to the north between Stations 76+40 to 86+60 (an approximate 950-foot length extending east and west of the ʻImi Kālā Street Bridge) to avoid affecting structures that have been constructed on the right bank. All design flows up to the standard project flood would be contained within the channel, thereby eliminating the need for the existing floodplain on the left bank and making the land available for development. Negative environmental impacts include potential objections by public and resource agencies with regard to the conversion of a natural stream bottom to a concrete-lined invert (70% conversion). Total project cost is estimated at $38.8 million. This alternative would achieve project objectives and is considered to be feasible from an engineering and economic perspective. Therefore, this alternative was further analyzed.

Alternative II Rectangular and Compound Channel – This alternative would contain up to the SPF. Alternative II consists of a rectangular and compound, concrete-lined channel with a 20-foot bottom width and 145-foot top width between Stations 22+00 and 92+02 for a distance of approximately 7,200 ft (Figure 1-5). Improvements would include a straightened alignment and a shallow 55-foot wide grass-lined channel adjacent on the left bank (to contain up to the SPF). Total project cost is estimated at $52.8 million. Although effective in addressing flood control concerns, negative environmental impacts include destruction of the existing stream habitat due to straightening of the natural channel alignment and concrete lining of the stream, which will likely generate strong objections from the public and resource agencies. This alternative was eliminated from further consideration due to environmental concerns and economic viability.

Alternative III Roller Compacted Concrete and Boulder Invert Channel – This alternative was designed for SPF protection with a peak design discharge of 27,500 cfs downstream of Station 84+42 (0.5 miles upstream from the stream mouth) and 26,000 cfs downstream of Station 92+02. Typical stream stabilization improvements would consist of boulders in the main channel low flow section with RCC stream bank protection, in order to replicate a more natural stream invert. Design elements would be included into existing and planned channel segments to facilitate the movement of native fish and other aquatic organisms (Figure 1-6). Total project length extends from Station 22+00 to the debris basin (2.5 miles upstream from the shore). Modifications are described in more detail below:

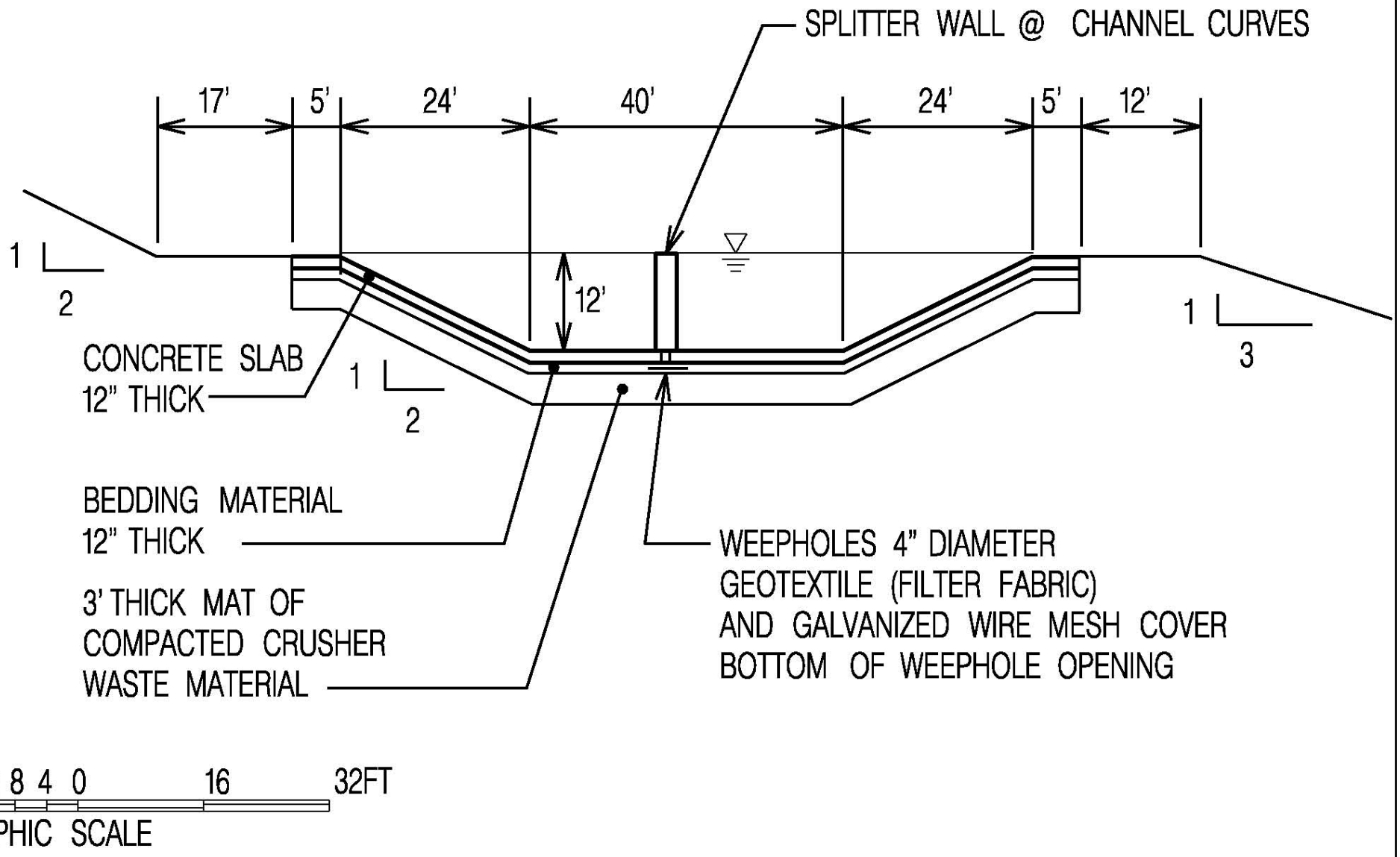
A new ground water recharge basin and diversion levee were considered for inclusion by partially blocking the low flow outlets at the existing debris basin located approximately 1,100 ft upstream of Market Street at Station 127+00 and adding a levee on the left bank upstream of the existing debris basin. Water would pond in the debris basin and help facilitate percolation into the 'Īao aquifer during rainy season. This mitigation was dropped from consideration following the recommendation of USFWS and Department of Land and Natural Resources (DLNR) Department of Aquatic Resources (DAR) personnel citing the presence of the recharge basin would have negative impacts on aquatic organisms.

Modify the drop structure between Stations 96+74.21 and 97+23.21. A new stepped drop structure would eliminate the dangerous 22-foot vertical drop and improve passage of in-stream fish ('*o*'*opu*) and other aquatic organisms.

Modify existing low flow concrete channels with small blocks to break up high velocity flows and facilitate fish passage.

Add hydraulic improvements to the concrete channel between Stations 92+02 and 95+41. These improvements include baffle blocks and a weir within the existing concrete channel to more evenly distribute flow.

Incorporate RCC side slopes and an approximately 15-foot wide and 20-inch deep grouted boulder invert channel that would mainly follow the alignment of the existing stream between Stations 22+00 and 92+02 (approximately 7,200 ft long). The median base width range would vary between 40 to 60 ft.



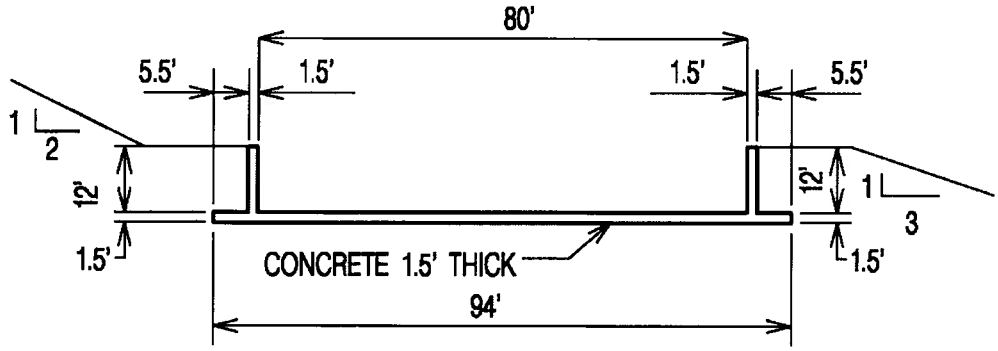
16 12 8 4 0 16 32FT

GRAPHIC SCALE

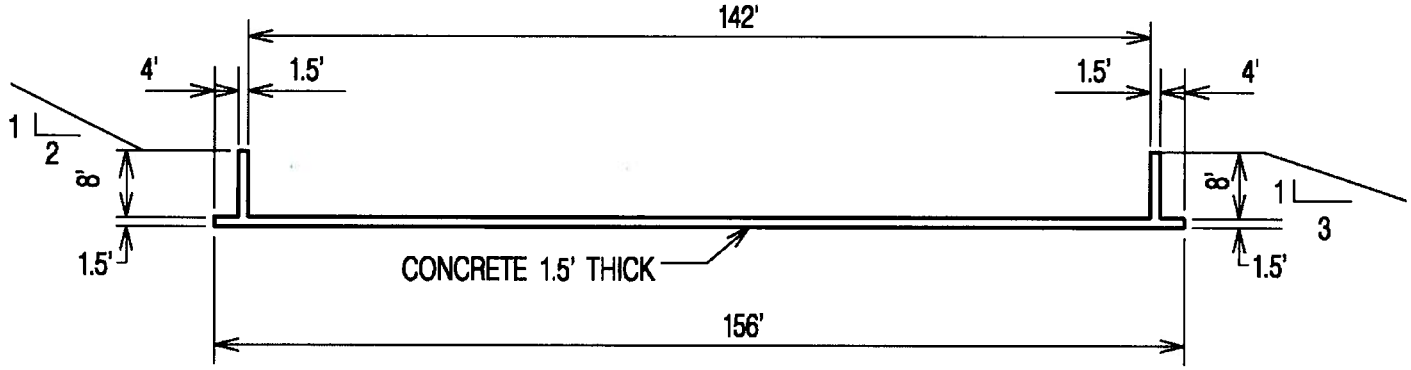
ENVIRONET, INC.

PRESERVING EARTH'S RESOURCES FOR THE FUTURE

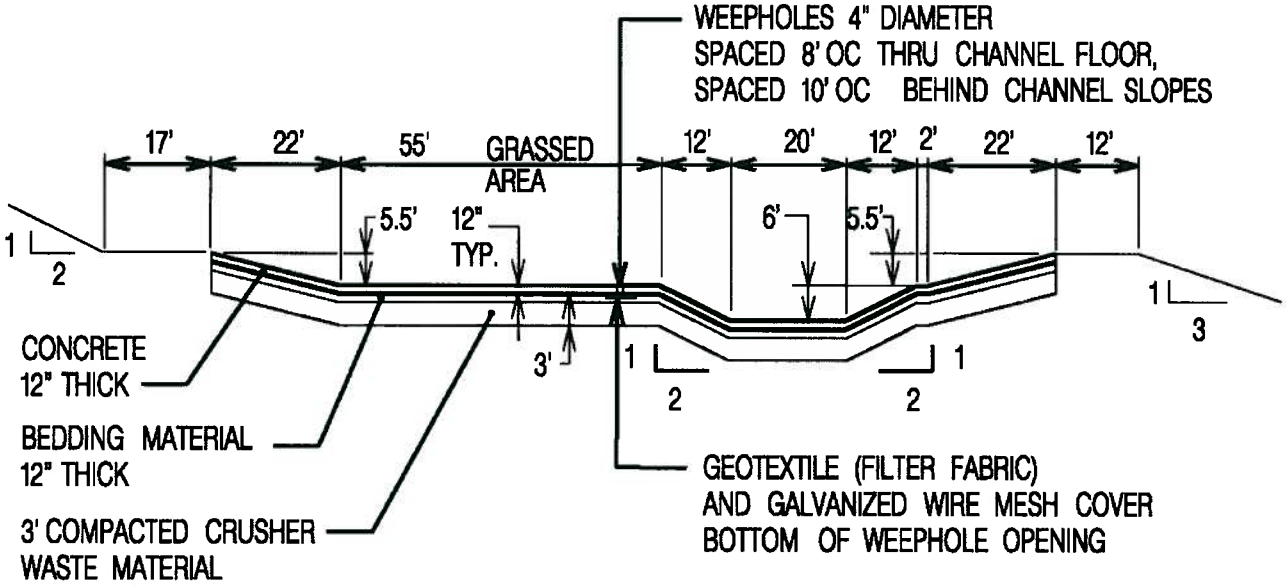
DRAWN BY: B.I.	IAO STREAM FLOOD CONTROL EA	FIGURE 1-4
CHECKED BY: S.G.	ALTERNATIVE I TRAPEZOIDAL CONCRETE CHANNEL	
REF: USACE		



UPSTREAM RECTANGULAR CHANNEL SECTION



DOWNSTREAM RECTANGULAR CHANNEL SECTION

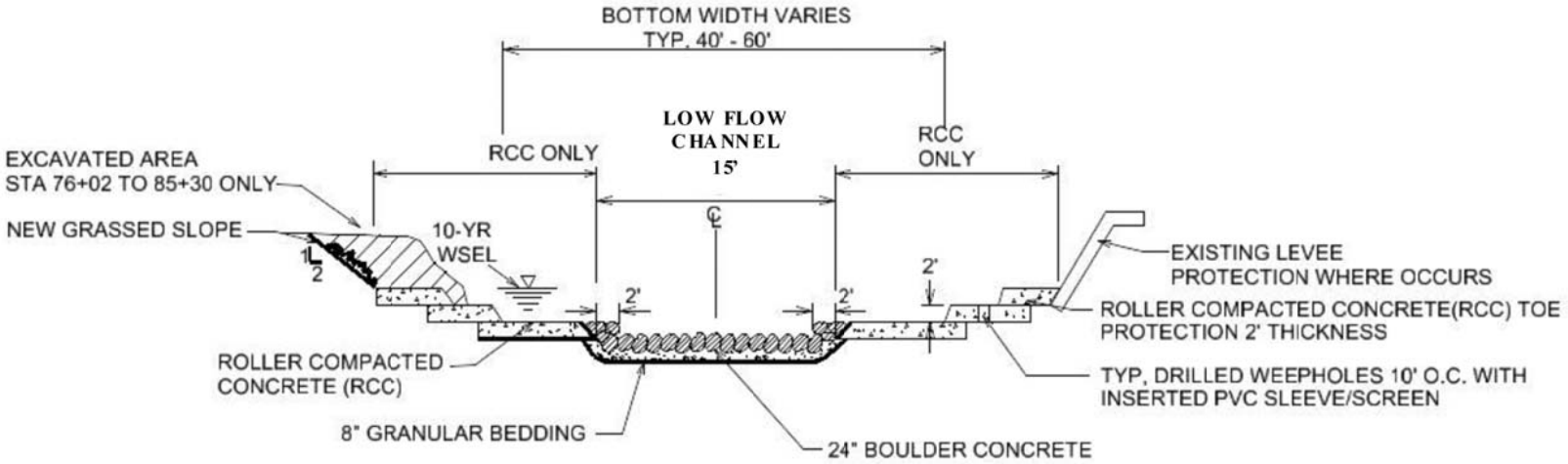


TRAPEZOIDAL CHANNEL SECTION

16 12 8 4 0 16 32FT

GRAPHIC SCALE

ENVIRONET, INC. PRESERVING EARTH'S RESOURCES FOR THE FUTURE	DRAWN BY: B.I.	IAO STREAM FLOOD CONTROL EA
	CHECKED BY: S.G.	ALTERNATIVE II RECTANGULAR AND COMPOUND CHANNEL — FIGURE 1-5
	REF: USACE	



TYPICAL CHANNEL CROSS SECTION

NOT TO SCALE

NOTES:

1. ROLLER COMPACTED CONCRETE (RCC) WILL LINE THE CHANNEL INVERT (EXCEPT LOW FLOW CHANNEL), UP TO 10 YEAR WATER SURFACE ELEVATION.
2. RCC WILL BE PLACED IN 6" - 12" LIFTS ON CLEARED AND GRUBBED GROUND SURFACE.
3. RCC TOE PROTECTION WILL BE PLACED 1 FOOT ABOVE TOE OF LEVEE.
4. RCC "STEPS" ARE UNFORMED AND WILL NOT EXCEED 1H:1V SLOPE.
5. 10-YR WSEL VARIES FROM 6'-10' DEEP, AVE = 8'.
6. BOULDERS 1' - 2' DIAMETER WILL BE GROUTED IN PLACE IN THE LOW FLOW CHANNEL. (1/3 PROJECTING)
7. CONCRETE CUTOFF WALLS 3' DEEP AND 1' THICK WILL BE ADDED PERPENDICULAR TO THE CHANNEL AT 300 FOOT INTERVALS.
8. STA 76+02 - 85+30 ONLY: DISTANCE BETWEEN TOP OF LEFT BANK TO CENTERLINE VARIES, 125' MAX .

ENVIRONET, INC. PRESERVING EARTH'S RESOURCES FOR THE FUTURE	DRAWN BY: I.K.N.	IAO STREAM FLOOD CONTROL EA	FIGURE 1–6
	CHECKED BY: R.C.A.	ALTERNATIVE III GROUTED BOULDER INVERT CHANNEL	
	REF: USACE		

Include stream realignment and widening between Stations 76+02 and 85+30. The channel would be realigned to the north on the left bank to avoid existing structures to the right bank and be widened to reduce water surface profile at the 'Imi Kālā Street Bridge. As a result of the channel widening, the 10-year flood (i.e., the low flow condition of 7,200 cfs) will be contained within the channel but floods greater than 7,200 cfs and up to the SPF of 27,500 cfs will spread out on the existing left bank flood plain area.

Construct a low flow boulder channel within the RCC portion. The approximately 15-foot wide low flow channel would use boulders embedded in concrete to replicate a more natural streambed substrate. Retrofit design elements have also been included to facilitate the movement of native organisms through the modified channel area. These elements include a step structure at the 22-foot vertical drop (Station 97+23), widening existing low-flow channel areas, installing low-flow channel segments in existing flat-bottomed cement channel segments and in the center of the existing debris basin, blocks along the sloped portions of the existing channel to provide a resting place for climbing organisms, and an alignment along the vegetated portions of the left bank to provide shade and reduce water temperatures. These mitigation measures have been proposed as compensation for unavoidable impacts, and have been agreed to in a revised mitigation recommendation letter by the USFWS (Appendix J).

Incorporate right bank levee raises. The existing right bank levee would be raised at Stations 45+37 to 48+85 by 4.5 ft using a concrete rubble masonry (CRM) wall on top of the existing earth levee and up to 0.7 ft at Stations 25+62 to 26+46. The 0.7-foot raise can be accomplished using earth levee fill material. Adjacent land uses that may have an impact to their viewscape by the levee raises include warehouses in the vicinity of the 0.7 foot levee raise and residential townhomes in the vicinity of the 4.5 foot levee raise. The impact to the viewscape of the warehouses would be minimal, but the impact to the townhomes would be noticeable. The modified levee would look similar to the levee built for the Kawainui marsh restoration on Oahu (Figure 3-4).

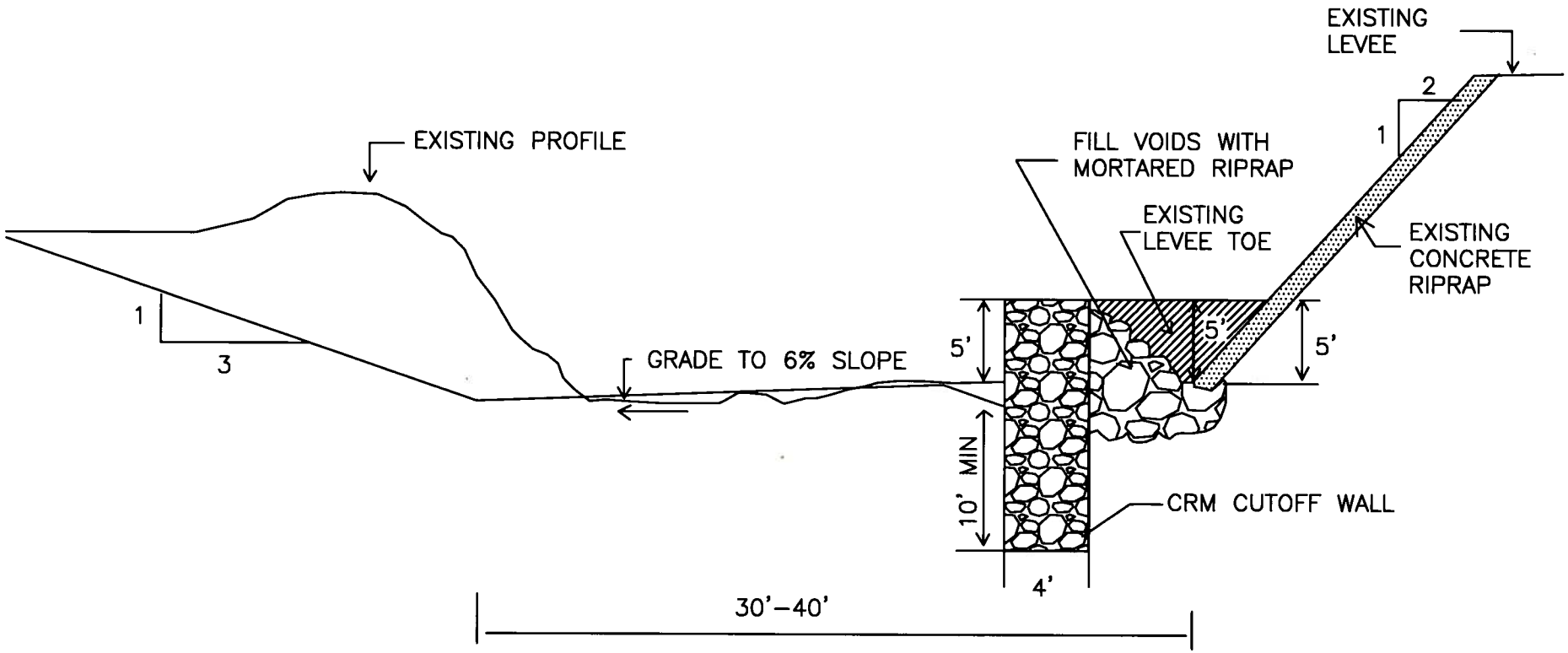
Channel lining, retaining walls, and raising the levee walls would be necessary due to the excessive flow velocities and higher flood levels. This alternative would achieve project objectives and is considered to be feasible from an engineering and cost perspective. Total project cost is estimated at $30.1 million. Alternative III is considered the "environmental alternative" because it would minimize or otherwise mitigate for negative environmental impacts to the project area. Therefore, Alternative III is the recommended alternative (reformulated plan) as it would best reduce the flooding problems and minimize or mitigate for environmental impacts.

Alternative IV Levee Reconstruction – This alternative would widen the basal stream area, flattening the slope of the left bank, and reconstructing the levee toe with concrete riprap filling the void under the levee toe. A CRM cutoff wall would be constructed fronting the existing levees (Figure 1-7). This alternative would retain the floodplain on the left bank and contain up to the SPF. Potential impacts would be minimal. Total project cost is estimated at $12.5 million.

The risk of failure also remained because rebuilding and extending toe protection was tried at 'Īao Stream after storms in January 1980 and after a storm in 1981, as documented in a Memorandum for Commander (March 28, 1995), U.S. Army Engineer Division, Pacific Ocean. 'Īao Stream has continued to erode adjacent to the toe protection works and is now 8 to 10 ft below the last toe protection repair, completed in November 1983. The toe continues to erode due because the cutoff wall at the levee toe is a fixed hard point in a moveable boulder and gravel bed stream. The unlined left bank of the stream erodes and the bottom of the stream erodes, but the cutoff wall does not. As the stream erodes, the fixed hard point is gradually uncovered and undermined. The COM PW fills areas adjacent to the toe cutoff wall after flood events by placing large boulders against the eroding levee toe (Figures 4-4 and 4-5).

Although this work is effective for low frequency events, no flood events larger than a 4% flood have occurred in 'Īao Stream since project construction. Floods larger than the 4% flood will likely have enough force and duration to erode the stream near the toe of the cutoff wall causing undermining and consequential levee slope failure. Levee toe protection with a cutoff wall is not considered a viable solution for 'Īao Stream flood control. Therefore, Alternative IV was not carried forward for further evaluation.

Alternative V Removal of Flood Control Improvements – This would include removal of all existing man-made improvements to the existing channel and returning the stream to its original natural state. The community of Wailuku would be placed back into the flood plain, with no flood protection levees. A state-of-the-art flooding warning system would replace man-made flood control devices. The estimated project cost for this alternative is $34.5 million. This estimate does not include the costs of relocating residents in flood-prone areas, which would be required for this alternative and would be expected to be quite substantial given the costs of real estate in Maui. Although this alternative does not meet project objectives from an engineering perspective, there is an expressed public support for this alternative due to its environmental benefits, and the alternative was carried forward for further evaluation. Despite its public support, this alternative was not selected due to potential for loss of life and protection to urbanized areas.



ENVIRONET, INC.
PRESERVING EARTH'S RESOURCES FOR THE FUTURE

DRAWN BY: I.K.N.	IAO STREAM FLOOD CONTROL EA	
CHECKED BY: R.C.A.	ALTERNATIVE IV LEVEE RECONSTRUCTION	FIGURE 1–7
REF: USACE		

Alternative VI No Action - Alternative VI is not to perform modifications to the existing Flood Control Project. Continuing severe erosion may be a result of the no action alternative, contributing to levee failure in multiple locations, which would eventually lead to flooding of the ʻĪao Stream drainage basin. A project failure would cause possible loss of life and extensive property damage would be inevitable. Although this alternative would not meet project objectives, it is discussed throughout the document to provide the reader with a perspective of the without-project scenario.

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2.0 PURPOSE AND NEED FOR ACTION

2.1 PURPOSE OF THE PROPOSED ACTION

The 1981 'Īao Stream Flood Control project was authorized by the Flood Control Act of 1968 and completed in October of 1981. The original project consisted of a debris basin, channel improvements, diversion levees, and flood plain management.

During the construction phase in January 1980 a flood occurred that caused extensive erosion of the sacrificial berm and undermined portions of the completed levees. As a result, the streamside slope of the levees was extended with a concrete riprap slope lining into the streambed. Considered to be a state of the art design at that time, the toe of the cutoff walls was imbedded five ft in depth as provided in the project design document.

Shortly after project completion, stream flows occurred that caused erosion of the stream bottom along an approximately 7,000 foot reach between the concrete channel and the Waiehu Beach Road. The erosion undermined the project levee with scour depths extending to a maximum of six ft below the existing boulder concrete slope lining. In July 1982, the Honolulu District Corps of Engineers requested that corrective work be approved to extend the boulder concrete slope protection from the damaged portion to a minimum of five ft below the eroded stream bottom. The Office of the Chief of Engineers granted approval for this work in January 1983. The corrective work was completed in November 1983 under the Productive Employment Appropriation Act of 1983 and authorized under Section 205 of the Flood Control Act of 1948, PL 80-858, as amended. The stream channel has since eroded as much as six to eight feet below the 1983 repair. The USACE subsequently decided to conduct a reconnaissance study to investigate solutions to the recurring problems that are slowly undermining areas of the levee. In March 1995, a report was submitted by USACE recommending modification to 'Īao Stream to replace the existing levee system with a trapezoidal concrete-lined channel (7,200 ft long).

A slope stability analysis was performed in 1997 to determine the stability of two areas identified as possible locations of levee failure. Stability analysis indicates instability may occur after flood waters have receded at Station 40+00. This assumes the 1996 slope geometry is further eroded to steepen the slope and deepen the stream bottom. Should a standard project flood occur prior to any repairs, flood waters would be able to pass through this portion of the levee and enter into adjacent housing areas. Water passing will further erode the levee.

The existing stream channel has a relatively narrow width of 40 to 60 ft, is boulder lined, and dry about 90% of the time. Levees with a surface of grouted riprap are interspersed along the right bank. The

channel has an average slope of 2.6%. This steep stream channel results in critical and supercritical flows in the stream. The average channel velocity through the unlined portion of the stream varies between 8 and 32 feet per second (fps) with an average velocity in excess of 20 fps during annual floods. These high velocities have eroded the channel bed and caused severe undermining of the existing levees. To date, no flow larger than a 4% event has occurred in 'Īao Stream since construction was completed in 1981.

Levee certification that the completed project can withstand a 100-year frequency flood is required by the Federal Emergency Management Agency (FEMA) by February 2009; otherwise, the area protected by the project will revert to a flood hazard area in the fall of 2009. A government agency responsible for levee construction or a Registered Professional Engineer must provide this certification. In its present condition, the project cannot be certified as providing 100-year flood protection.

Repeated floods in this area have caused high stream flows, undermining the existing flood plain levees in key locations (Figures 4-4 and 4-5). High stream flows resulted in downcutting of the natural streambed and erosion of the base of the east bank levee structure (See Section 2.0, and Figures 4-4 and 4-5 for more details). Several residential and commercial structures along the right bank are in danger of being undercut if streambank erosion continues, as is the heiau along the lower reach of the left bank. The USACE has determined that the damages incurred by the 1981 Flood Control Project during the years immediately following the completion of the project are due to design deficiencies of the original project.

The purpose of the proposed action is to find a solution to stop levee and streambed erosion and to protect adjoining property from flooding during major storm events. A secondary objective is to maintain habitat for aquatic species passage by keeping a low-flow channel as recommended by the USACE Committee on Channel Stabilization. The estimated lifespan of the Flood Control Project is anticipated to be between 50 and 100 years. Five alternatives and a no action alternative have been formulated for consideration. Of these alternatives, three are considered for further evaluation in this EA (see Section 1.3).

2.2 NEED FOR THE PROPOSED ACTION

The 'Īao Stream Flood Control project has prevented an estimated $24.2 million in damages to date. It has instilled a sense of security in the growing community of Wailuku. A failure in the existing levees would cause flood waters to inundate the 'Īao Stream drainage basin as if there were no levees present at all. Loss of life and extensive property damage due to floods and erosion would be inevitable.

Modifications to the existing ʻĪao Stream Flood Control Project are needed to preserve the reliability of the existing project and to protect the health and well-being of the Wailuku Community. Implementation of the modifications would resolve the project's design deficiency and prevent further high levels of streambed erosion, thereby eliminating the risk of levee failure and the associated loss of life and property damage that could result.

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3.0 ALTERNATIVES

3.1 GENERAL DESCRIPTION OF THE ACTION'S TECHNICAL, ECONOMIC, SOCIAL, AND ENVIRONMENTAL CHARACTERISTICS

3.1.1 Technical

Baffle Blocks and Weir. The recommended baffle block structures consist of nine concrete blocks that would be constructed at the downstream end of the existing concrete channel (Station 92+02). These blocks are required to slow high velocity flows before they enter the middle reach of the project within the levee system. A weir structure is also required upstream of the baffle blocks in the concrete channel section to more evenly distribute water flows (Figure 3-1). The weir is placed at an angle across the channel to more evenly distribute flows. The weir is 45 ft long and 3 ft high and begins at Station 95+41 and ends at Station 95+10. A modified drop structure would eliminate the 22-foot vertical drop that exists at the end of the rectangular channel. The structure is not required for hydraulic reasons or a criterion required by any of the resource agencies, but is desirable for safety and in-stream fish passage. The estimated construction cost of the blocks is $188,400.

Drop Structure. A drop structure (Stations 96+74.21 to 97+23.21) would eliminate the existing 22-foot vertical drop at the end of the existing rectangular channel. This structure, although not required for hydraulic reasons, is desirable for safety of residents utilizing the area because it would increase safety in the stream as well as improve the ability of aquatic animals to migrate upstream (Figure 3-2). The present 22-foot drop prevents instream migration. Proposed mitigation measures for Alternative III include a stepped fish passage structure at the drop structure to facilitate upstream fish and invertebrate migration. This portion of the channel would also be designed to connect the low-flow channel upstream from the drop structure to the low-flow channel downstream from the drop structure. The profile and plan views for the proposed drop structure are shown on Figure 3-2.

The drop structure, weir, and baffle blocks improve flow conditions in the concrete channel no matter what is constructed downstream. An existing danger is that high velocity flows leaving the concrete channel would erode the outlet area and cause undermining of the channel. The weir and baffle blocks would typically even out the flow and reduce exit velocities from the concrete channel, thereby improving flow conditions downstream. This was verified by the hydraulic model study conducted by the Army Engineer Research and Development Center (ERDC).

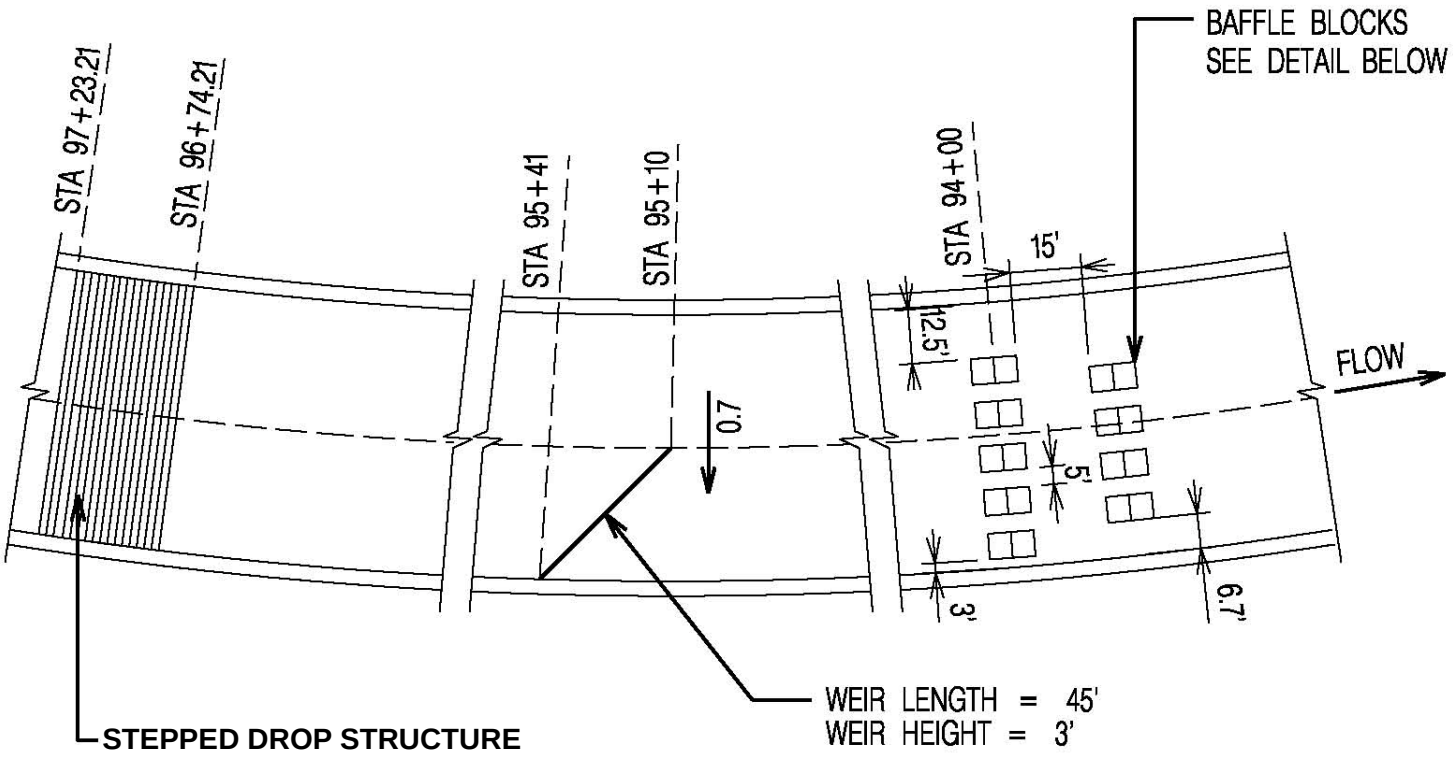
The model study showed that hydraulic conditions in this portion of the channel are unbalanced below the drop structure with the inside of the bend at channel Station 94+20 dewatered and velocities exiting the channel approaching 40 fps. This is much different than the original design report which assumed a hydraulic jump would form downstream of the drop structure and velocities would not exceed 11.8 fps in this section of the concrete channel. This unbalanced flow as detailed in the model study may result in undermining and failure of the concrete channel at its downstream end. Recommendations from ERDC to improve existing conditions included adding baffle blocks and a weir to more evenly distribute flows. ERDC also recommended construction of a stilling basin at the outlet.

The drop structure, weir, and baffle blocks should be considered part of each alternative, except the alternative of removing all structures from the channel (Alternative V) and the No Action alternative (Alternative VI). The decision to include this structure will be determined by the PW who is the local project sponsor. The PW will review such factors as feasibility, maintenance requirements, and community interest. The estimated construction cost of the drop structure is $266,000.

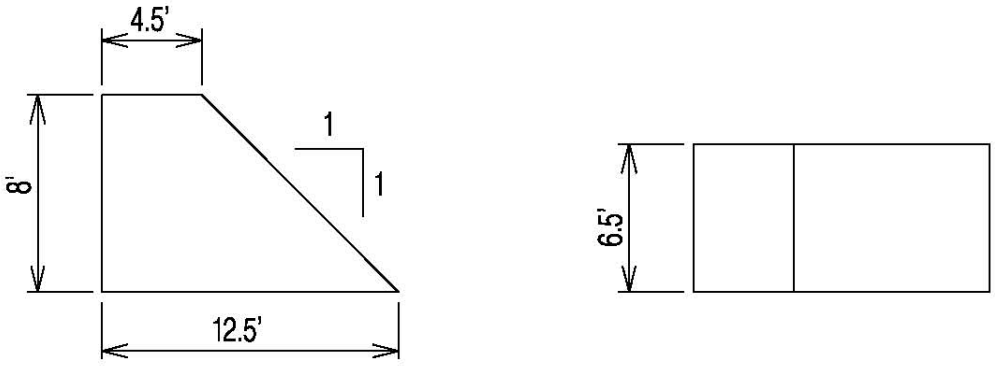
Low-Flow Channel. The proposed typical section in Alternative III includes an approximately 15-foot wide low flow channel installed approximately 20 inches lower than the proposed RCC channel invert. Due to high velocities, the boulders, which will range in size from 15 to 18 inches in diameter with six inches protruding above the channel, will be grouted. Minimal non-woody vegetation would be allowed to grow in the low flow channel in order to simulate a more natural channel and reduce water temperatures. Where practical, the low flow channel would be placed closer to the left bank because trees on the overbank would provide some shade over the channel and reduce water temperatures.

As part of an agreement between USFWS, USACE, DAR, and PW, Alternative III includes a retrofit of some portions of the currently existing concrete lined low-flow channel elements. The retrofit, which would mainly include widening the low-flow channel in specified areas, would allow for enhanced passage of aquatic organisms during periods of stream flow.

Channel Realignment and Widening. The channel will be realigned away from the right bank between Stations 76+02 and 85+30. The right bank in this area is very steep and buildings located at the top of bank are in danger of collapse into the stream. Additional hydraulic analysis of this reach indicates that if the reach captures the entire design flow of 27,500 cfs then existing levees on the right bank will be overtopped. In order to reduce the probability of this overtopping, a channel widening is recommended in this area.

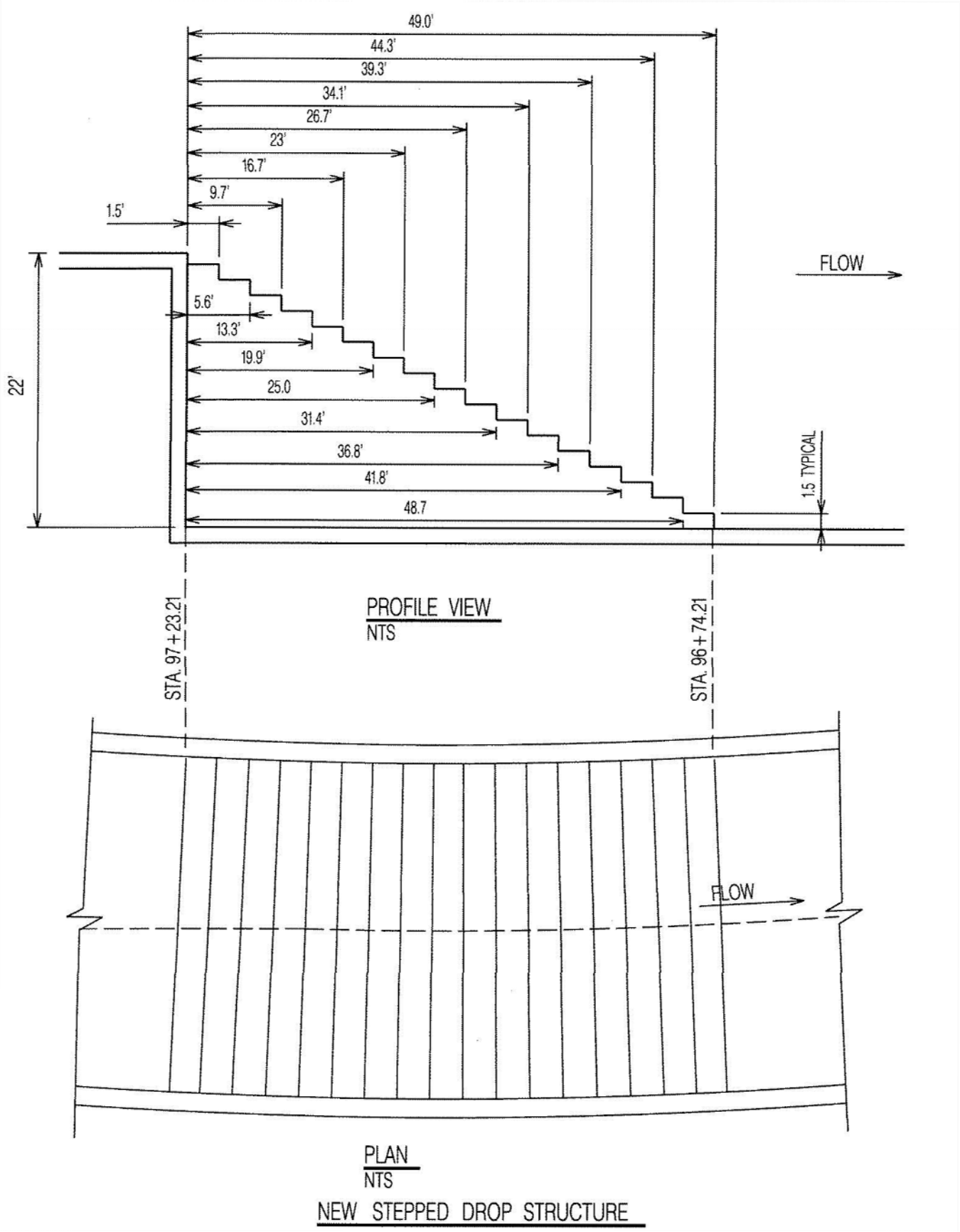


NEW DROP STRUCTURE, BAFFLE BLOCKS, AND WEIR PLAN VIEW
NTS



BAFFLE BLOCK DETAIL
NTS

ENVIRONET, INC. PRESERVING EARTH'S RESOURCES FOR THE FUTURE	DRAWN BY: B.I.	IAO STREAM FLOOD CONTROL EA	FIGURE 3-1
	CHECKED BY: S.G.	NEW DROP STRUCTURE, BAFFLE BLOCKS, AND WEIR PLANE VIEW	
	REF: USACE		



NEW STEPPED DROP STRUCTURE

ENVIRONET, INC. PRESERVING EARTH'S RESOURCES FOR THE FUTURE	DRAWN BY: I.K.N.	IAO STREAM FLOOD CONTROL EA	
	CHECKED BY: R.C.A.	NEW STEPPED DROP STRUCTURE	FIGURE 3–2
	REF: USACE		

The channel realignment between Stations 76+02 and 85+30 includes a wider main channel which will significantly reduce water surface profile at the 'Imi Kālā Street Bridge. To widen the channel, the left bank would be excavated up to 90 ft starting at a bank elevation just above the 10% flood elevation. Low flows and flood flows of less than 10% frequency will remain in the existing channel. When flows exceed the 10% flood, they would overtop the left overbank and flow through the excavated area, reducing the design water surface profile from existing conditions. The widened cut surface would be paved with roller compacted concrete to withstand the high design velocities of approximately 25 fps. The new left bank in the excavated area would be cut to a 3 horizontal to 1 vertical side slope and would be revegetated. The widened channel Water Surface Elevation (WSEL) is significantly below the right bank elevation but was designed like that in order to accommodate the low chord elevation of the new 'Imi Kālā Street Bridge. The 'Imi Kālā Street Bridge would require two separate spans to cross the excavated section at Station 78+61 (Table 3-1).

Table 3-1: Channel Widening

River Cross Section	Existing WSEL* (ft msl)	Right Bank Elevation (ft msl)	Left Overbank Widening From Channel Centerline(ft)	Left Overbank Elevation (ft msl)	Widened Channel WSEL* (ft msl)
85+30	198.19	215.52	0	190.73	197.71
84+81	202.65	214.20	52	190.48	201.74
84+57	202.83	212.34	55	188.7	201.99
84+42	202.81	212.29	53	188.3	202.05
84+13	199.61	212.38	60	188.26	199.37
83+12	195.37	208.14	89	185.34	191.44
82+12	190.96	199.93	122	184.02	188.36
81+07	186.22	197.10	125	180.86	184.81
80+12	192.18	194.14	96	179.05	183.24
79+01	189.01	189.00	76	174.81	179.57
78+61	186.64	186.31	60	173.33	178.63

Table 3-1: Channel Widening

River Cross Section	Existing WSEL* (ft msl)	Right Bank Elevation (ft msl)	Left Overbank Widening From Channel Centerline(ft)	Left Overbank Elevation (ft msl)	Widened Channel WSEL* (ft msl)
77+95	187.14	183.01	58	171.56	177.05
77+18	180.53	180.01	60	170.28	177.15
76+02	175.24	180.01	0	166.66	179.33
75+03	171.40	179.96	0	165.13	172.19

*27,500 cfs – Downstream of Station 84+42

'Imi Kālā Street Bridge. The existing bridge near Station 78+61 has a computed capacity of about 9,600 cfs based on the original design report. The water surface at this bridge was computed at the approximate elevation of the underside of the bridge in the original design analysis with significant flows bypassing the bridge on the left bank. The County of Maui, in cooperation with a private developer, has plans to replace this bridge. The design discharge for the new bridge will be 27,500 cfs.

Grouted riprap. Grouted riprap consists of stone bed and slope protection having voids filled with grout or concrete to form a veneer of cementitious-bonded aggregate armor. Components of the grouted riprap system include stable and properly prepared slope; free draining sub-base or bedding layer; and protection layer consisting sound, durable stone bonded by a mixture of cementitious materials, water, aggregates, and admixtures. Granular filter and sub-base materials, geotextiles, sub-drains, weep holes, cutoffs, and other special features are also included as needed. Grouted riprap is widely used as an economical alternative to conventional riprap treatment where required stone size cannot be economically produced; and when repairing conventional riprap that has been damaged as a consequence of being subjected to water velocities exceeding design values. However, extreme caution is advised to insure that the stone displacement was indeed related to high velocities and not the result of slope or foundation failure. Grouted riprap must only be used on properly designed slopes. Grouted riprap requires special attention to the design of stable slopes, edge and toe protections, sub-base, pressure relief and drainage, stone size and gradation, stone quality, and grout design. Stability of the materials to be protected by grouted riprap controls the design of slope geometry in the same manner as it would for conventional riprap protection. Grouted riprap is generally considered to be a rigid structure but does not possess significant strength to

bridge sizeable voids or withstand uplift pressures. Therefore, foundation support is critical. Riprapped levee side slopes have performed well in this project except where the toe has been undermined.

Roller-Compacted Concrete. RCC may be considered for application where no-slump concrete can be transported, placed, and compacted using earth and rock-fill construction equipment. Ideal RCC projects will involve large placement areas with little or no reinforcement. RCC may be used to repair undermined sections of the boulder concrete and for repair of the failed levee slopes. The properties of hardened RCC are similar to those of conventionally placed mass concrete. For well-compacted RCC mixtures, the influences of type of cementitious materials and aggregate quality to the compressive strength are similar to those for conventionally placed mass concrete. RCC with high-quality aggregates will produce compressive strength equal to that of conventional concrete.

A primary design consideration for RCC for this project is abrasion-erosion resistance. For both RCC and conventional concrete, resistance to degradation by abrasion-erosion increases with compressive strength. Since hard durable basalt concrete aggregates are readily available, a design compressive strength ($f'c_{90}$) of 5000 to 6000 pounds per square inch should be considered. Based on historical data, an estimated cement content of 500 pounds per cubic yard will be required to achieve this strength level for the RCC.

The foundation and slopes on which RCC is to be placed should be properly prepared to fully support the RCC. The RCC system should be designed similar to a conventional concrete channel liner including a free-draining granular sub-base, weep holes, drains and other special features as needed (Figure 3-3). A significant amount of excavation will be required to remove large boulders and vegetation, level the stream channel invert and trim and excavate the side slopes.

Minor flooding is possible at any time of the year and so construction sequencing and staging is an important consideration. Channel and side slope excavation, foundation preparation and placement of RCC should be accomplished in a staged fashion exposing a minimal amount of the prepared channel that is not protected by RCC. RCC that is in place five to seven days should perform well if exposed to flowing water.

Existing Floodplain Hydraulic Modeling. This analysis assumes that existing right bank levees will fail or become non-effective if a flood event of greater than 25-year return period occurs. The project floodplain thus reverts to the original floodplain that existed before the right bank levees downstream of Station 92+02 were constructed. The areas and depths of flooding were modeled to match the floodplains shown in ʻĪao Stream Design Memorandum No. 1, Hydrology, dated March 1974.

Manning Roughness Coefficients. Manning Roughness Coefficients (Table 3-2) are 0.07 for the left bank based on pasture and light brush and 0.015 for the RCC lined main channel. Values of 0.03 are used for the low flow boulder channel located within the RCC lined area. The "n" value shown is taken from the 1976 Design Memorandum.

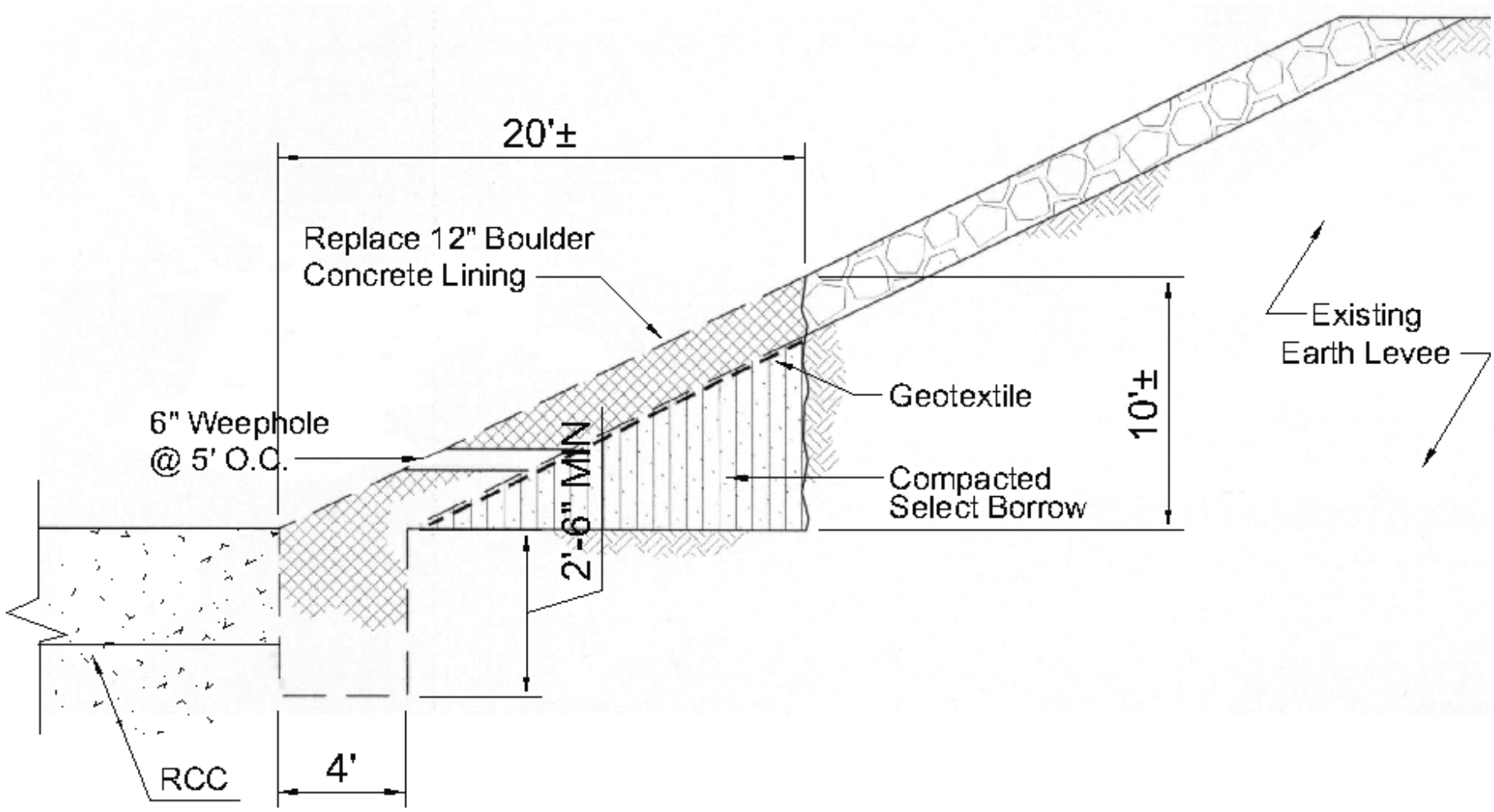
Table 3-2: Roughness Factors Manning's "n"

Item	"n"*
Concrete - RCC Lining	0.015
Boulder Concrete *	0.030
Right Overbank Primary Flow Area	0.032
Grouted Riprap *	0.035
Existing Stream *	0.040
Residential Areas or Pasture/Light Brush *	0.070
Dense Brush *	0.090

Source: *1976 Design Memorandum

Levee Raise Risk and Uncertainty Analyses. The top of levee has been set based on a risk and uncertainty analyses using the guidance provided in EM 1110-2-1619 dated 1 August 1996. The standard deviation used for stage is estimated at 0.6 ft based on Table 5-2 (EM 1110-2-1619); 'Īao Stream cross sections are based on a topographic map with 4-foot contours and Manning's n reliability is considered good. Assuming that 95 % of the error range would be encompassed by stages two standard deviations above the mean, then 1.2 ft is added to the mean WSEL to determine the upper WSEL. Because 'Īao Stream experiences rapid flow with significant wave action during floods that is not accounted for in Hydrologic Engineering Center River Analysis System (HEC-RAS), an additional 2.0 ft was added to the upper bound of stage to set the top of levee height. For example, at Station 47+93 the mean WSEL based on HEC-RAS was found to be 104.67 ft above msl (Figure 3-4). Adding 1.2 feet for the upper bound of state plus 2.0 feet for wave uncertainty, the levee height is determined to be 107.87 feet above msl which is 3.37 feet above the existing right bank elevation.

The levees in damage Reaches 2 and 4 between river stations 25+62 and 49+03 have shown in multiple studies that the existing levee heights are not high enough to meet the criteria of the Risk and Uncertainty analysis. The levees may need to be raised as much as four feet in certain areas, however, the existing levee elevations are based on old survey information that has not been updated or tested for accuracy. It is recommended that a survey of the top of the right bank levee be completed during Plans and Specifications to determine the actual height the levee would need to be raised in order to meet the risk and uncertainty requirements stated above.



NOT TO SCALE

ENVIRONET, INC. PRESERVING EARTH'S RESOURCES FOR THE FUTURE	DRAWN BY: B.I. CHECKED BY: S.D. REF: USACE	IAO STREAM FLOOD CONTROL EA ERODED SLOPE REPAIR WITH ROLLER-COMPACTED CONCRETE	FIGURE 3-3

Construction. Normal construction equipment for this project would most likely include bulldozers, backhoes, front-end loaders, and dump trucks. Alternative III would also include a batch plant with rotating drum mixer, rolling compactors (probably rubber tires), and bottom dump trucks for placing the RCC before it is compacted by the rollers. For Alternatives I and III, concrete trucks with pumping equipment would likely be used to line the channel (Alternative I) or embed the boulders in the bottom of the low-flow channel (Alternative III).

Alternative I. Alternative I consists of a trapezoidal, concrete-lined channel with a 40-foot bottom width and 90-foot top width. The new channel alignment would mostly follow the existing stream alignment from Stations 22+00 (0.5 miles upstream from the stream mouth) and Station 94+00 (2.5 miles upstream from the stream mouth), for a distance of approximately 7,200 ft. However, between Stations 76+40 and 86+60, the channel would be realigned to the north to avoid affecting existing structures on the right of the bank. The channel includes interior splitter walls at all channel curves. All design flows up to the SPF would be contained within the channel, thereby eliminating the need for a floodplain on the left bank of the project and making the land available for development (See Figure 3-5). All the levees could possibly be de-authorized through separate action. The channel would be widened in the vicinity of the 'Imi Kālā Street Bridge to reduce WSELs, reduce erosion potential on the right bank, and accommodate the proposed road and bridge crossing the 'Īao Stream at Station 78+61. Total project cost is estimated at $38.8 million. This alternative would achieve project objectives and is considered to be feasible from an engineering and economic perspective. Negative environmental impacts include potential objections by public and resource agencies with regard to the conversion of a natural stream bottom to a concrete-lined invert.

Alternative II. Alternative II would contain up to the SPF. Alternative II consists of a rectangular and compound, concrete-lined channel with a 20-foot bottom width and 145-foot top width. Improvements would include a straightened alignment and a shallow 55-foot wide grass-lined channel adjacent on the left bank (to contain up to the SPF). Total project cost is estimated at $52.8 million. Although effective in addressing flood control concerns, negative environmental impacts include destruction of the existing stream habitat due to straightening of the natural channel alignment and concrete lining of the stream, which will likely generate strong objections from the public and resource agencies. Due to potentially severe environmental impacts and the likelihood of strenuous objections from the public and resource agencies, this alternative was not carried forward for detailed evaluation.

Alternative III. Alternative III would contain 10-year flood events, also known as low-flow events (7,200 cfs) within the structural improvements and overflows up to the SPF within the existing floodplain

on the left bank. This alternative would include an RCC-lined main channel with a grouted boulder invert channel, which would mainly follow the existing stream alignment between Stations 22+00 and 94+00 (approximately 7,200 ft long). However, between Stations 76+40 and 86+60, the channel would be realigned to the north to avoid existing structures to the right bank. This alternative involves excavating approximately 8,000 cubic yards of material along the 7,200 foot channel. The channel invert would also be graded in order to place the RCC. The median base width would vary between 40 to 60 ft. Typical stream stabilization improvements would consist of boulders in the main channel low-flow section with RCC stream bank protection on a 1.5:1 (height to volume (H:V)) to 5:1 bank slope. These boulders would replicate a more natural stream invert and facilitate the movement of native fish and other aquatic organisms through the modified low-flow channel area. Channel lining, retaining walls, and raising the levee walls would be necessary due to the excessive flow velocities and higher flood levels. The channel would be widened in the vicinity of the 'Imi Kālā Street Bridge to reduce WSELs, reduce erosion potential on the right bank, and accommodate the proposed road and bridge crossing the 'Īao Stream at river Station 78+61 (Figures 3-6 through 3-8).

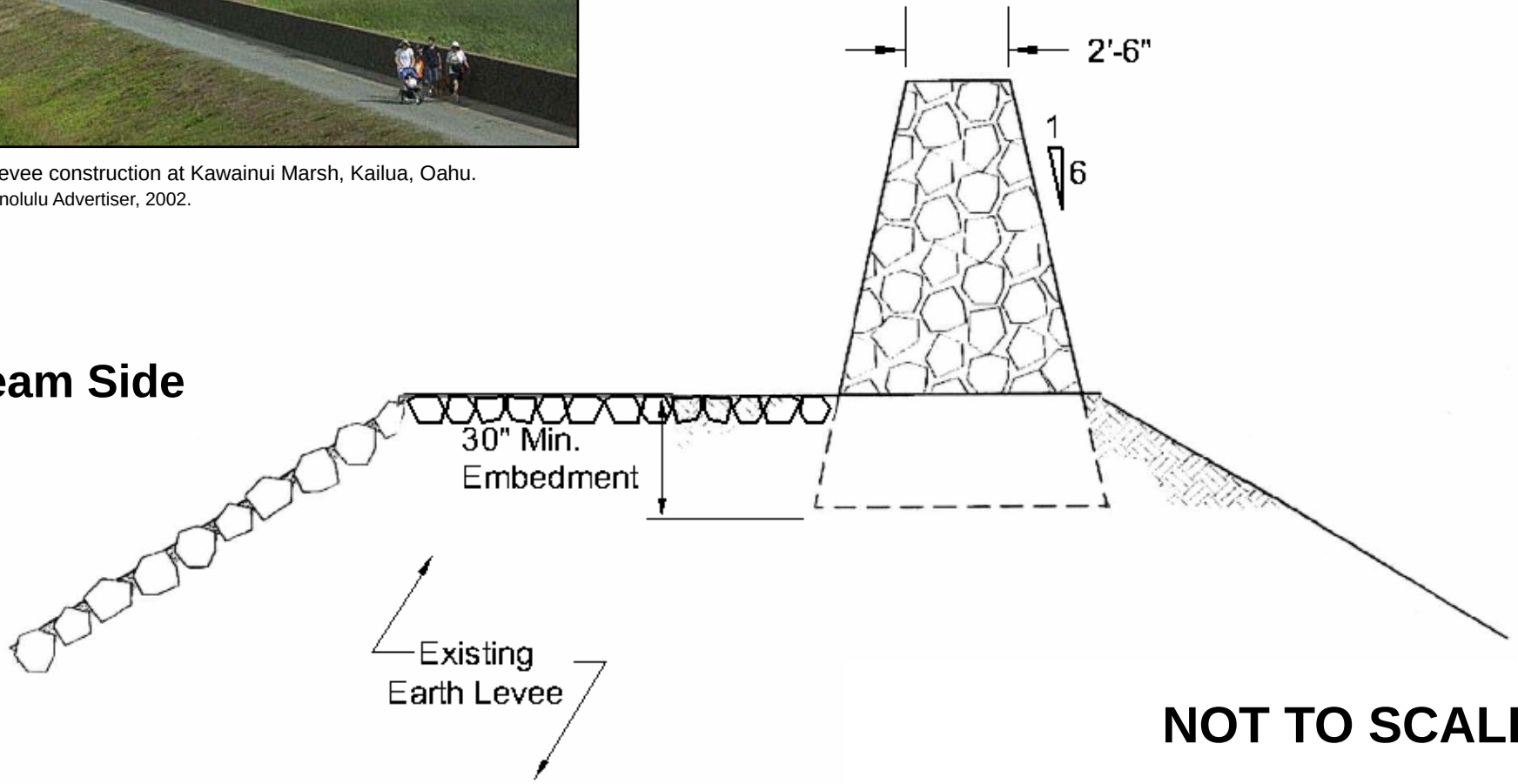
A new ground water recharge basin and diversion levee were considered for inclusion in this alternative. The basin would be constructed by partially blocking the low-flow outlets at the existing debris basin, located approximately 1,100 ft upstream of Market Street at the top of the project. Water would pond in the debris basin and help facilitate percolation into the 'Īao aquifer during rainy season. The recharge basin was dropped from consideration following the recommendation of USFWS and DLNR-DAR personnel citing negative impacts on aquatic organisms.

Alternative III would achieve project objectives and is considered to be feasible from an engineering and cost perspective. Total project cost is estimated at $30.1 million.

Alternative III is considered the "environmental alternative", because it would minimize negative environmental impacts to the project area by: 1) utilizing the original floodplain along the left bank of the project for flood flows greater than 7,200 cfs and as a result keeping this area in open space; and 2) incorporating a boulder lined low-flow channel that would simulate a natural stream thereby creating a less severe stream environment than one that is strictly concrete lined. The low-flow channel is also designed to facilitate upstream and downstream migration of aquatic organisms. During discussions between the USFWS and the USACE, additional mitigation measures were discussed. The first is to align the low-flow channel close to stream banks with overhanging vegetation where possible, so that the vegetation will provide shade for the channel, thereby reducing water temperatures.

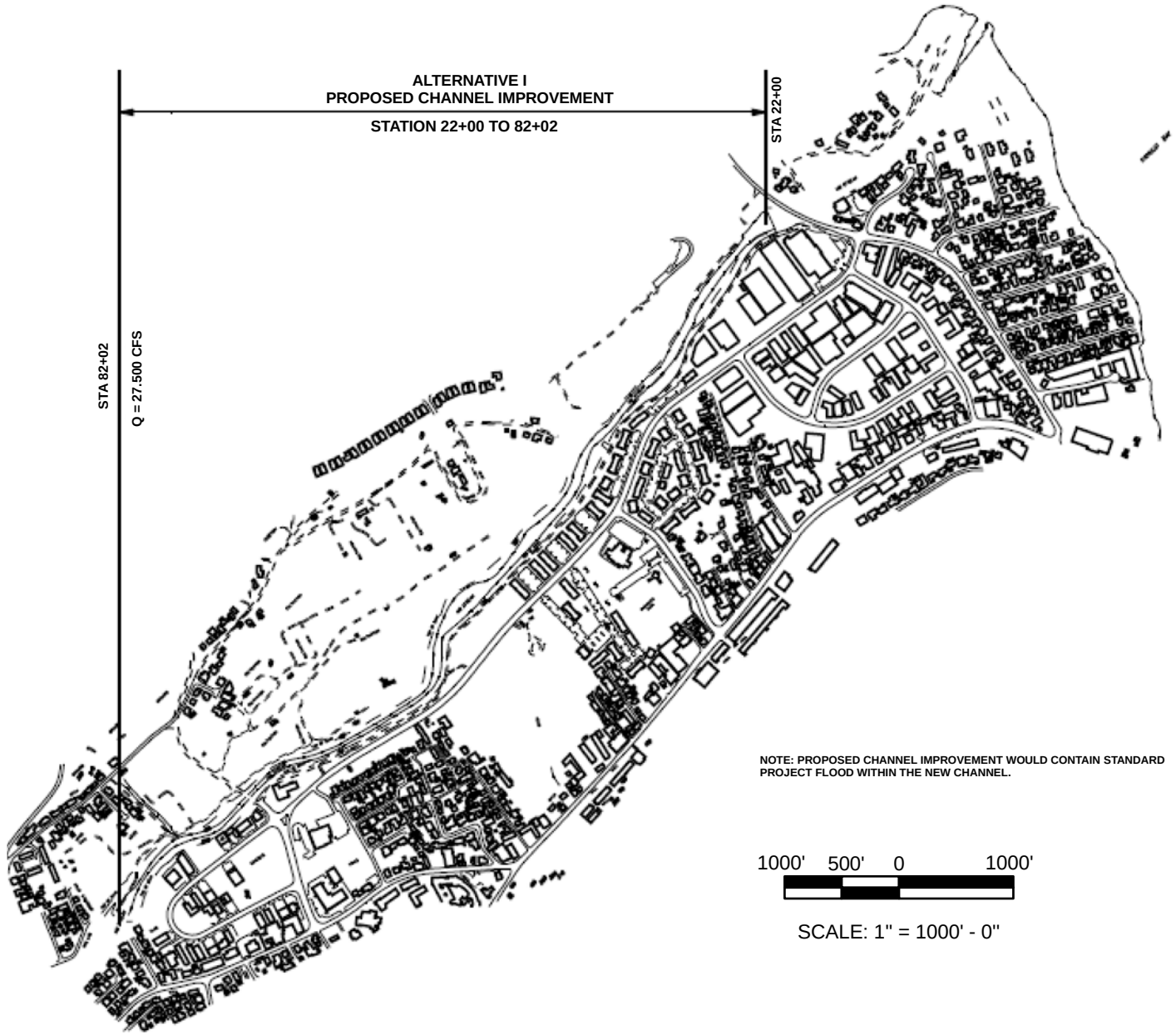


Example levee construction at Kawainui Marsh, Kailua, Oahu.
Source: Honolulu Advertiser, 2002.



NOT TO SCALE

ENVIRONET, INC. PRESERVING EARTH'S RESOURCES FOR THE FUTURE	DRAWN BY: B.I.	IAO STREAM FLOOD CONTROL EA	FIGURE 3-4
	CHECKED BY: S.D.	CONCRETE RUBBLE MASONRY LEVEE WALL RAISE	
	REF: USACE		



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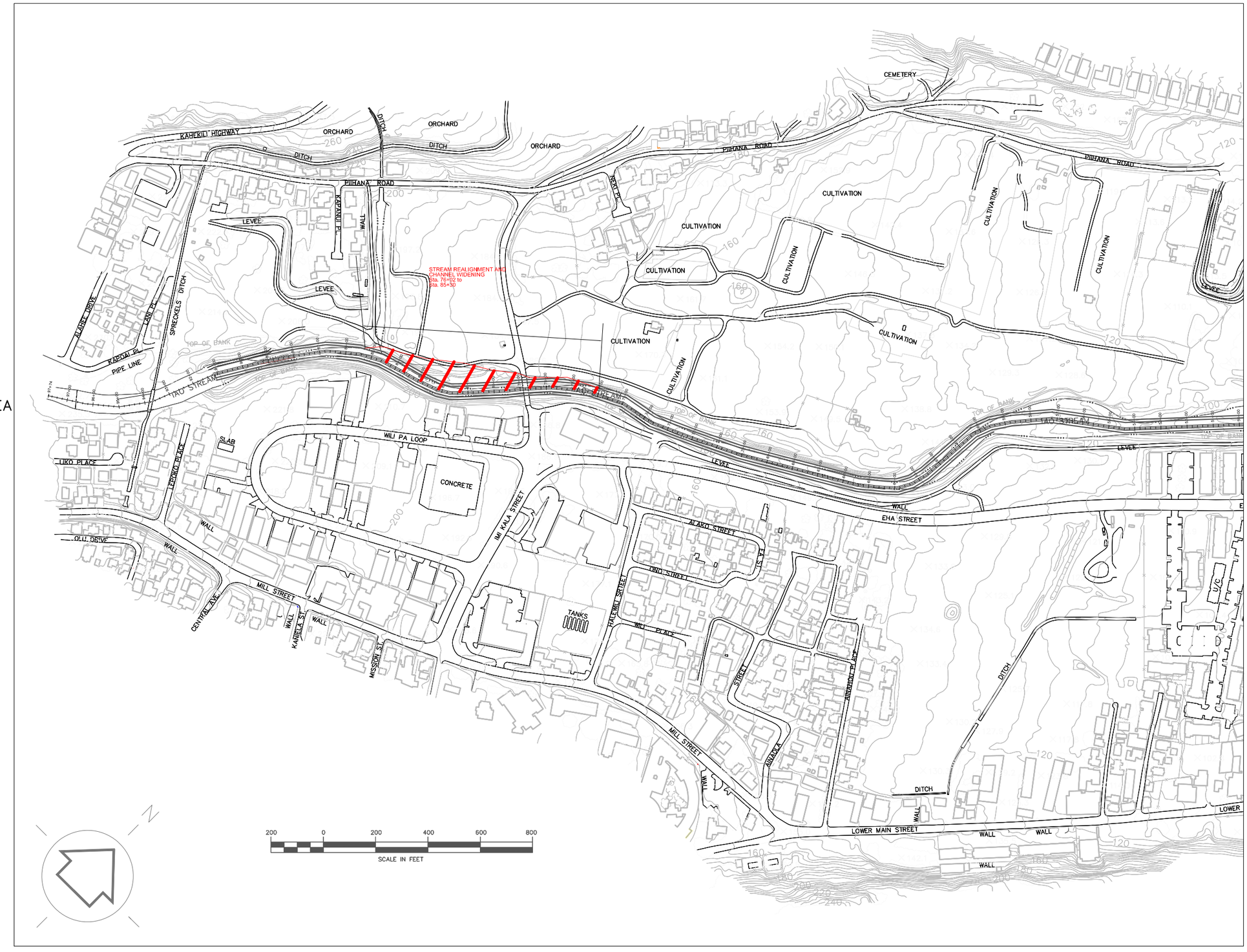
ALTERNATIVE 1: OVERVIEW
TRAPEZOIDAL CONCRETE CHANNEL

FIGURE 3-5

LEGEND

- BUILDING
- PAVEMENT
- TRAIL OR EARTH ROAD
- FENCE
- STREAM OR SHORELINE
- 460 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- SPOT ELEVATION
- TREES
- TREELINE
- POLE
- STREAM REALIGNMENT AREA



NOTES

1. CONTOUR INTERVAL; 4'.
2. VERTICAL DATUM: MEAN SEA LEVEL.
3. ORIGIN OF COORDINATES: HAWAIIAN PLANE COORDINATE SYSTEM, ZONE 2.
4. COMPILED BY PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY TAKEN 8-21-96 AT AN ALTITUDE OF 4400' ABOVE MEAN TERRAIN.
5. ALL CONTOURS IN AREAS WHERE THE HEIGHT OF THE VEGETATION EXCEEDS FIVE FEET ARE TO BE INTERPRETED AS FORM LINES ONLY AND AS SUCH MAY BE SUBSTANDARD.

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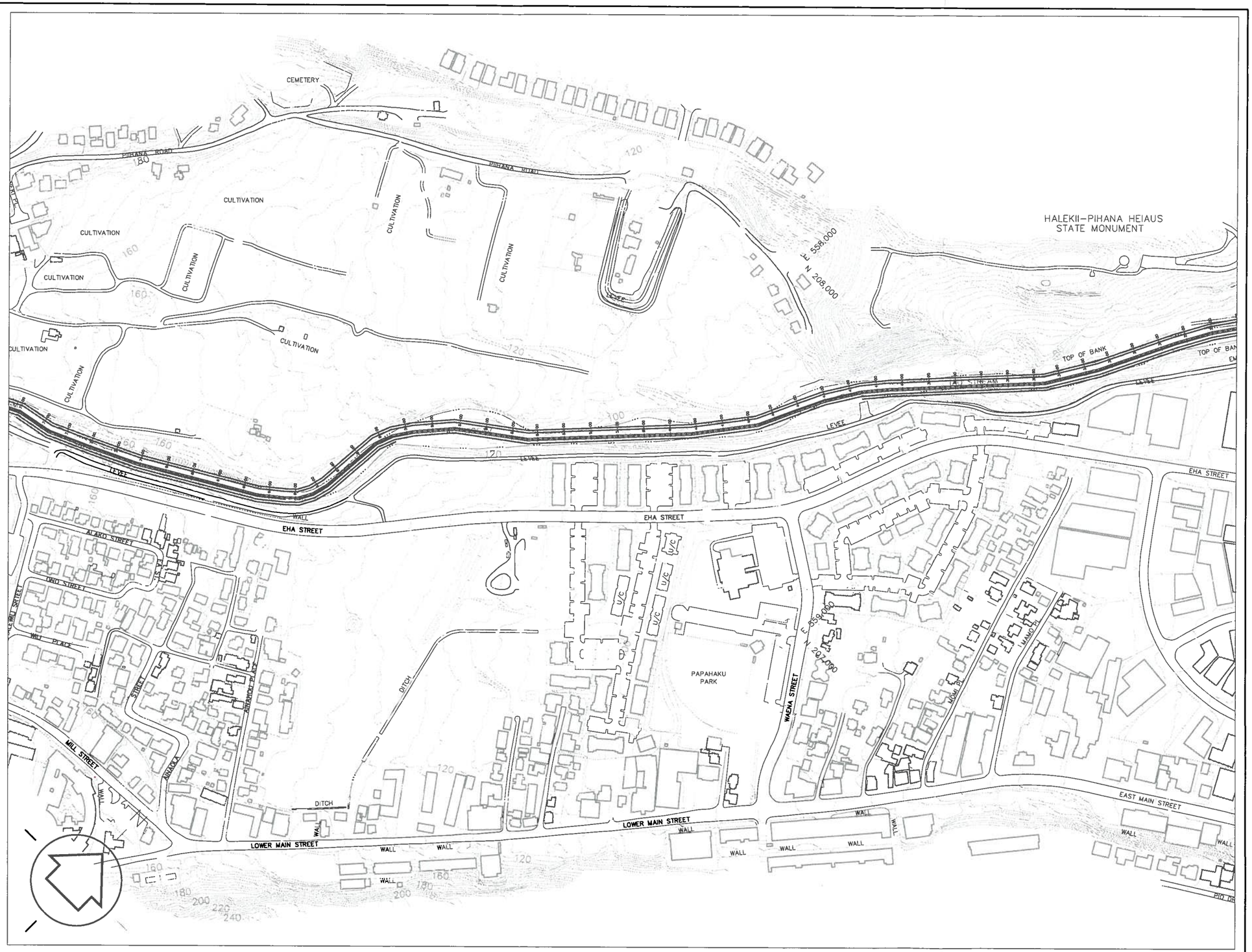
IAO STREAM FLOOD CONTROL EA

ALTERNATIVE III: WESTERN PORTION OVERVIEW
IAO STREAM
WAILUKU, MAUI, HAWAII

FIGURE 3-6

LEGEND

- BUILDING
- PAVEMENT
- TRAIL OR EARTH ROAD
- FENCE
- STREAM OR SHORELINE
- 460 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- SPOT ELEVATION
- TREES
- TREELINE
- POLE



NOTES

1. CONTOUR INTERVAL; 4'.
2. VERTICAL DATUM: MEAN SEA LEVEL.
3. ORIGIN OF COORDINATES: HAWAIIAN PLANE COORDINATE SYSTEM, ZONE 2.
4. COMPILED BY PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY TAKEN 8-21-96 AT AN ALTITUDE OF 4400' ABOVE MEAN TERRAIN.
5. ALL CONTOURS IN AREAS WHERE THE HEIGHT OF THE VEGETATION EXCEEDS FIVE FEET ARE TO BE INTERPRETED AS FORM LINES ONLY AND AS SUCH MAY BE SUBSTANDARD.

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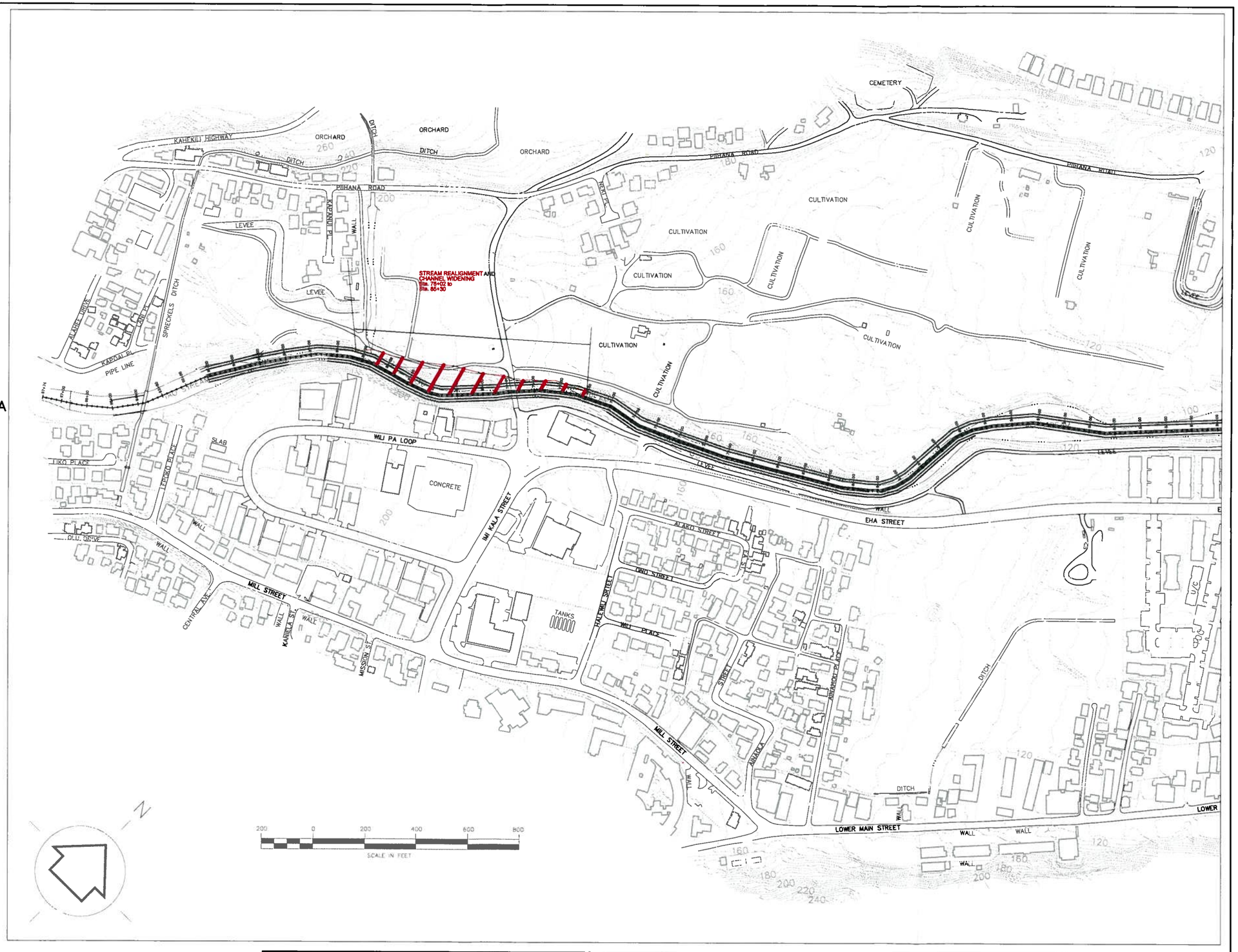
DRAWN BY: AEH	IAO STREAM FLOOD CONTROL EA
CHECKED BY: SG	ALTERNATIVE III: CENTRAL PORTION OVERVIEW IAO STREAM WAILUKU, MAUI, HAWAII
REF: USACE	FIGURE 3-7

LEGEND

- BUILDING
- PAVEMENT
- TRAIL OR EARTH ROAD
- FENCE
- STREAM OR SHORELINE
- 460 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- SPOT ELEVATION
- TREES
- TREELINE
- POLE
- STREAM REALIGNMENT AREA



NOTES

1. CONTOUR INTERVAL; 4'.
2. VERTICAL DATUM: MEAN SEA LEVEL.
3. ORIGIN OF COORDINATES: HAWAIIAN PLANE COORDINATE SYSTEM, ZONE 2.
4. COMPILED BY PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY TAKEN 8-21-96 AT AN ALTITUDE OF 4400' ABOVE MEAN TERRAIN.
5. ALL CONTOURS IN AREAS WHERE THE HEIGHT OF THE VEGETATION EXCEEDS FIVE FEET ARE TO BE INTERPRETED AS FORM LINES ONLY AND AS SUCH MAY BE SUBSTANDARD.

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DRAWN BY: AEH	IAO STREAM FLOOD CONTROL EA
CHECKED BY: SG	ALTERNATIVE III: WESTERN PORTION OVERVIEW IAO STREAM WAILUKU, MAUI, HAWAII
REF: USACE	FIGURE 3-8

The second mitigation measure is a retrofit of improved portions of the stream that are currently not conducive to fish and other aquatic organism migration. Retrofit design elements have also been included to facilitate the movement of native organisms through the modified channel area. These elements include a step structure at the 22-foot vertical drop (Station 97+23), widening existing low-flow channel areas, installing low-flow channel segments in existing flat-bottomed cement channel segments and in the center of the existing debris basin, blocks along the sloped portions of the existing channel to provide a resting place for climbing organisms, and an alignment along the vegetated portions of the left bank to provide shade and reduce water temperatures. These mitigation measures have been proposed as compensation for unavoidable impacts, and have been agreed to in a revised mitigation recommendation letter by the USFWS (Appendix J). Therefore, Alternative III is preferred as it would best reduce the flooding problems and minimize or mitigate for unavoidable environmental impacts.

Alternative IV. Rebuilding and extending toe protection was tried at 'Īao Stream after a storm in January 1980 and after a storm in 1981, as documented by the U.S. Army Engineer Division, Pacific Ocean (USACE, March 1995). 'Īao Stream has continued to erode adjacent to the toe protection works and is now 8 to 10 ft below the last toe protection repair, completed in November 1983. The toe continues to erode because the cutoff wall at the levee toe is a fixed hard point in a moveable boulder and gravel bed stream. Although COM continues to fill areas adjacent to the toe cutoff wall after flood events by placing boulders against the eroding levee toe, the fixes are temporary because the work is effective for low frequency events (USACE, 2008). No flood events larger than a four % flood have occurred in the 'Īao Stream since project construction. Floods larger than the four % flood will likely have enough force and duration to erode the stream near the toe of the cutoff wall causing undermining and consequential levee slope failure. Therefore, levee toe protection with a cutoff wall is not considered a viable solution for 'Īao Stream flood control.

This option would not meet the project objective and erosion would continue to occur. This alternative was therefore not carried forward for detailed evaluation.

Alternative V. Alternative V includes the removal of all concrete and man-made structures constructed since 1981 for the existing Flood Control Project, thereby returning the stream to its original natural condition. This alternative would result in removal of 2,500 linear feet of existing cement-lined stream channel. Urbanized areas adjacent to the stream would become part of the natural stream overbank and would be placed back into the flood plain, subject to flooding.

A flooding warning system would be installed to replace the protection provided by the Flood Control Project levees. The estimated project cost is $34.5 million. Although this alternative does not meet

project objectives from an engineering perspective, there is an expressed public support for this alternative due to its environmental benefits, and the alternative was carried forward for further analysis.

Alternative VI. Alternative VI is to not perform the modifications to the existing Flood Control Project. Continued severe erosion may be a result of Alternative VI, contributing to levee failure in multiple locations. This would eventually lead to flooding of the 'Īao Stream drainage basin as if there were no Flood Control Project. The existing Flood Control Project has instilled a sense of security in the Wailuku community which has grown in size since 1981. A project failure would cause possible loss of life and extensive property damage would be inevitable. Although this alternative is not feasible, it has been carried forward throughout this document to illustrate the "without-project" scenario.

3.1.2 Socioeconomic

Estimated project costs range from approximately $12.5 million to $52.8 million depending on the alternative chosen. Short-term, negative impacts during construction are expected for residences/businesses near the construction areas. With the exception of Alternative V and VI, long-term positive impacts include the protection from erosion and flood damages to life and property from future flooding in the Wailuku area. Long-term positive impacts from Alternative V include restoration of the 'Īao Stream to a state near its natural condition, although negative impacts such as flood and erosion damages to property would be unavoidable. Alternative VI would leave 'Īao Stream in its current condition, which would allow the continual erosion of the streambanks and a high risk of flooding. Property damage would occur, and the reversion of the area to a Flood Hazard Area would have a negative impact on businesses in the area.

A Real Estate Planning Report was prepared by the USACE to determine the cost of completing this project according to the recommended alternative, Alternative III, an RCC and boulder invert channel with a 40 to 60-foot bottom. The report found that there is no necessity for relocation of public utilities, and no relocations under PL 91-646 are anticipated. There are no known surface or subsurface minerals that would affect the construction, operation or maintenance of this modification project. The non-Federal sponsor, COM, has been assessed as to its capabilities to acquire the necessary land, easements and/or rights of way (LER) for this modification project. Zoning is agricultural, residential, and industrial (Figure 3-7) and no zoning adjustments or land use change is required for this project (Appendix L)

The modification project will require 4.78 acres of permanent channel improvement easements, 0.32 acres of perpetual joint use road easements, and 2.06 acres of temporary work area easements. The non-Federal sponsor, COM, has approved the Government's standard easement estates for the 3 types of easements

necessary for this modification project. There are multiple owners. Baseline cost estimate for real estate includes $118,400 for the easements, a 30 % contingency in the amount of $35,000 and $240,000 for administrative costs, totaling $394,000. A schedule of proposed land acquisition milestones, approved by the Government Project Manager and COM, is included in the Real Estate Planning report, which is included as part of the Engineering Documentation Report (EDR) prepared by USACE (USACE, 2008).

3.1.3 Environmental

Available alternatives include I, III, V, and VI. Of these options, Alternative I would result in the most changes to the existing habitat of the native stream fauna. Proposed changes in stream alignment and smooth concrete channelization would adversely affect existing natural habitat as well as alter stream flow, so that native amphidromous species may not survive. Alternative V presents the least long term alteration to the native environment, as all previous man-made flood control improvements would be removed, thus resulting in a completely natural stream, and a community susceptible to flooding. Alternative VI would have long term adverse impacts from erosion and sedimentation and would not meet the goals of this project. Alternative VI also represents the current condition of the stream, which lacks stream flow approximately 90% of the time and is not conducive to migration of instream aquatic organisms. Alternative III will be able to achieve both flood control and environmental project objectives, as flood control improvements are designed to include a habitat for native species as well as maintaining a flood plain, and low-flow stream channel. Mitigation measures currently under discussion between the USACE, USFWS, and the COM include alignment of the low-flow channel along vegetated stream banks to allow overhanging vegetation to shade the channel and reduce water temperatures, and a potential retrofit of improved portions of the channel that are currently lacking low-flow design elements or that pose a hindrance to migration of aquatic organisms. These mitigation measures have been agreed to by USFWS in a recent revised mitigation recommendation letter (Appendix J) as sufficient compensation for unavoidable impacts to the natural environment.

Alternative III is designed to facilitate upstream and downstream migration of aquatic organisms, given sufficient water flow. Stream flow restoration is a topic that is currently under discussion by state and federal resource agencies, community groups, and private entities that hold licenses for diversion and out-of-stream consumptive use of 'Īao Stream water. This decision is outside the function and authority of the USACE, however. If and when stream flow is partially restored, the low-flow design elements of Alternative III will function to enhance passage of native stream fauna.

Baffle blocks and a low weir are required to slow down and more evenly distribute high velocity flows before entry to the middle reach of the project within the levee system. This system will be considered

for all the alternatives, and consist of nine concrete blocks that would be constructed at Station 94+00, near the downstream end of the existing rectangular concrete channel, and a low weir structure upstream of the baffle blocks in the concrete channel section.

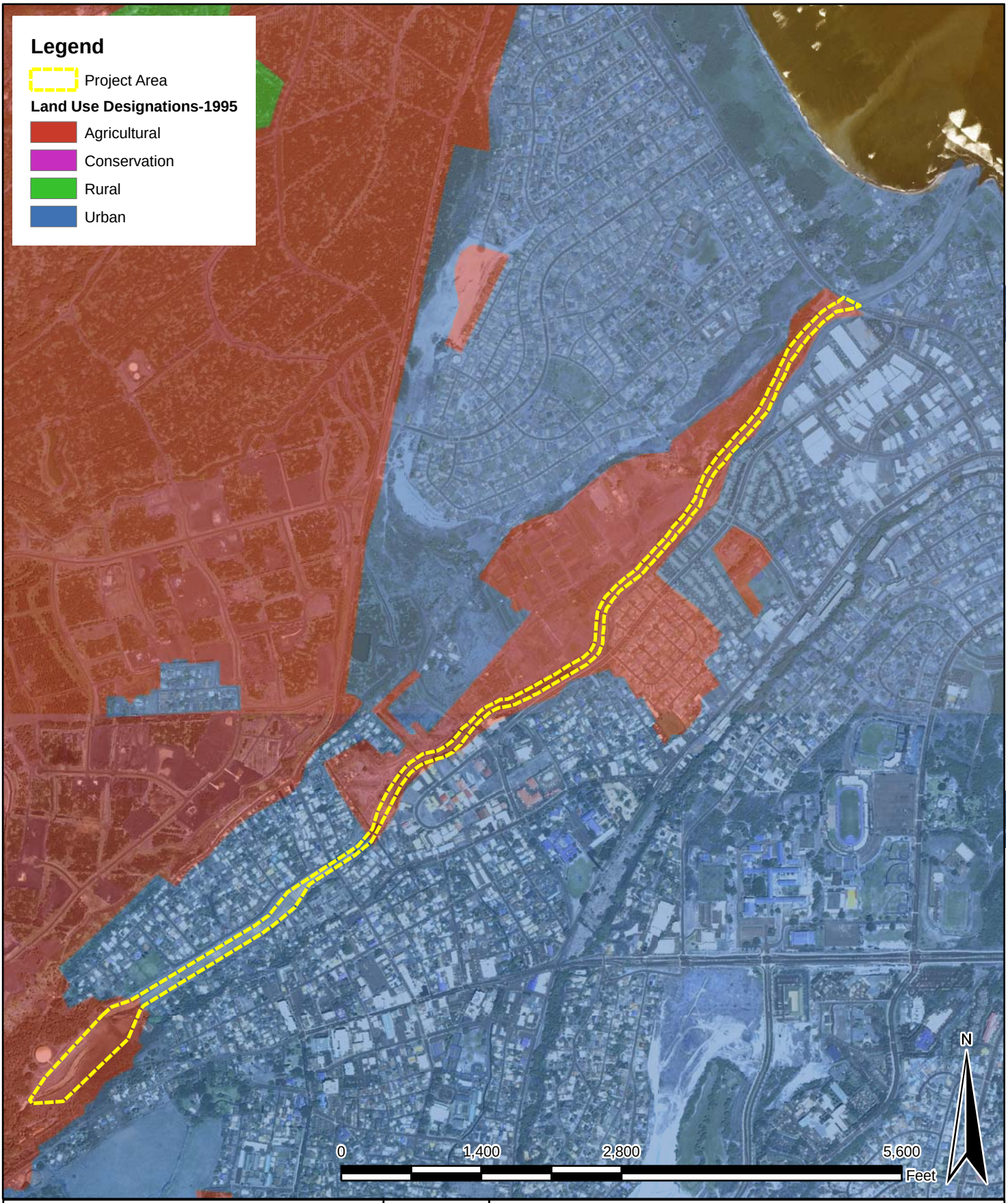
A drop structure would eliminate the existing 22-foot vertical drop at the end of the existing rectangular channel located at Station 97+23. This structure is not required for hydraulic reasons, but is desirable for safety for people utilizing the area and could provide a pathway for the migration of native fish and other aquatic organisms. The decision for the construction of this structure will be determined consistent with COM plans and public interest.

3.2 COMPARISON OF ALTERNATIVES

The alternatives evaluated in this EA are summarized in Table 3-1. Alternatives that are suitable upon evaluation of environmental and social impacts are further discussed in subsequent sections.

3.2.1 Recommended Alternative

Alternative III is the recommended alternative as it addresses both flood control and environmental issues. The selection process for choosing this alternative from the available options presented is three-fold. First, the type of management measures, both structural and nonstructural, are considered in regards to problem resolution and meeting the purpose and constraints for the project. Second, the best management measures are combined with consideration for environmental impacts and mitigation of the affected areas. Third, local community desires and needs are evaluated in detail when considering the selected alternative. Alternative III addresses all concerns as implementation of this design will meet the project purpose of flood control and stream bank stabilization, while minimizing or mitigating for the impact to the existing environment. Recommended mitigation measures include alignment of the low-flow channel along vegetated stream banks to allow overhanging vegetation to shade the channel and reduce water temperatures, and a retrofit of improved portions of the channel that are currently lacking low-flow design elements and a pathway for migration of aquatic organisms.



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CHECKED BY: S.G.
REF: HSOP

'IAO STREAM FLOOD CONTROL EA

STATE OF HAWAI'I LAND USE DESIGNATIONS
'IAO STREAM
WAILUKU, MAUI, HAWAI'I

FIGURE 3-9

Table 3-3: Summary Comparison of Alternatives

	Alternative I	Alternative II	Alternative III	Alternative IV	Alternative V	Alternative VI
Description of Alternative	Trapezoidal Concrete-Lined Channel	Rectangular and Compound Channel	RCC and Grouted Boulder Invert Channel Following Existing Alignment	Levee Reconstruction	Removal of Flood Control Improvements	No Action
Level of Flood Protection	SPF Protection	SPF Protection	SPF Protection	SPF Protection, but risk of structural failure	None. Flood warning system only	SPF Protection, but risk of structural failure
Utilization of Flood Plain	Flood plain may be utilized for other purpose	Flood plain may be utilized for other purpose	Left bank remains a restricted flood plain	Left bank remains a restricted flood plain	Left bank remains a restricted flood plain	Left bank remains a restricted flood plain
Visual Aesthetics	Concrete channel replaces natural stream	Concrete channel replaces natural stream bottom	RCC channel replaces natural bottom; include low-flow channel.	Retains natural stream invert	Natural stream	Retains natural stream invert
Ease of Maintenance	Easiest to maintain	Somewhat easy to maintain	Difficult to maintain	Difficult to maintain. Requires continual repairs of levees	No maintenance required	Future reconstruction is required
Environmental Acceptability	May not be easily acceptable	Not likely to be accepted	2nd most favorable	May be accepted	Most favorable	May be accepted
Technical Adequacy	Meets project objective	Meets engineering project objective but does not meet environmental preservation objective	Meets project objective	Does not meet project objective. Risk of failure remains	Does not meet project objective	Does not meet project objective. Risk of failure remains
Cost	3rd highest cost	Most expensive	4th highest cost	5th highest cost	2nd highest cost	Least expensive

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4.0 AFFECTED NATURAL ENVIRONMENT

4.1 GEOLOGY AND SOILS

The Hawaiian Archipelago is a chain of seamounts and islands in the North Pacific extending 1,616 miles west by northwest from the largest island of Hawai'i. Volcanic rocks are the dominant rock type and consist of basaltic flows, caldera and dike complexes, and pyroclastics. Sediments include limestone reefs and dunes, beach and dune sands, and alluvium deposited near present day and ancient shorelines, typical of tropical to subtropical atoll cycles. Some ancient limestone reefs and dunes are found inland due to climatic and sea level fluctuations.

The island of Maui, the second largest of the Hawaiian chain, was formed by two volcanoes, East Maui (Haleakalā) and West Maui, linked by the narrow Isthmus of Maui. The older, smaller, and more eroded volcanic center constitutes West Maui, while East Maui is the product of Haleakalā, a younger, much larger, and less dissected volcanic shield (Hazlett and Hyndman, 1996; Stearns, 1985). West Maui rises 5,788 ft above sea level and is 18 miles long and 15 miles wide. Thin flows of pāhoehoe lava formed the young shield of West Maui, completed around 1.3 million years ago. The lavas that erupted during this main stage of growth are known as the Wailuku basalts. Rift zones were developed that trend north and south of the caldera at the summit of West Maui.

As volcanic activity declined, the chemical composition of West Maui's lavas changed from the early frequent and mild eruptions of tholeiitic basalt to more explosive eruptions of alkalic basalt and trachyte during late-stage volcanism. The new cinder cones and domes made the originally smooth profile of West Maui's shield rough. The youngest Honolua lavas probably erupted about a half million years ago (Hazlett and Hyndman, 1996). The younger volcano forming East Maui, Haleakalā, is 33 miles long, 20 miles wide and 10,023 ft high. The volcano first rose above sea level around 900,000 years ago. In its prime, Haleakalā was a vast shield of olivine tholeiite basalts.

About 700,000 years ago, shield growth slowed and explosive eruptions began to produce more alkalic rocks. These eruptions are known as the Kula volcanic formation and continued until about 350,000 years ago. About 100,000 years ago, the rejuvenated stage of volcanism began on Haleakalā, resulting in hundreds of cinder cones and flows of alkalic basalt with 'a'ā surfaces. Rocks from the rejuvenated stage are the Hāna volcanic formation (Hazlett and Hyndman, 1996). The most recent eruption from East Maui in the early 1790's flowed from the southwest rift zone near Mākena.

Soils in the area of Wailuku retain a high organic matter, and are composed of clay, silt, and sand, mixed with varying degrees of gravel, cobble, and boulders. Major soil types in the vicinity of the stream

include 'Īao silty clay, 0 to 3 percent slopes (IaA), Puuone sand, 7 to 30 percent slopes (PZUE), Pulehu cobbly clay loam, 0 to 3 percent slopes (PtA), 'Īao cobbly silty clay, 3 to 7 percent slopes (IbB), Jaucas sand, saline, 0 to 12 percent slopes (JcC), and stony alluvial land (rSM) (Figure 4-1). In its current state, the 'Īao Stream bed is experiencing extreme erosion of the right bank in the vicinity of Station 82+12. The channel has dropped up to nine feet in some locations, and is being actively graded on a regular basis by COM to prevent accelerated erosion. This erosion is likely contributing to sedimentation of the near shore marine environment at the mouth of the 'Īao Stream. While some degree of erosion and sedimentation is natural for any stream system, the erosion experienced during flood events is excessive. Of the proposed alternatives, I and III would eliminate this excessive erosion and resulting sedimentation, but Alternative V would potentially exacerbate it. In turn this would increase the turbidity of 'Īao Stream and siltation of Kahului Bay especially during storm and flood events (see Section 4.5.2 for a more detailed discussion of sedimentation).

4.2 CLIMATE

Maui has a subtropical climate with uniform temperatures year-round. Much like the rest of the Hawaiian Islands, it is dominated by mild temperatures, humid conditions with a variety of rainfall, and a constant trade wind flow from the northeast. The seasons are characterized by two stages consisting of a five-month summer and a seven-month winter. Ocean temperatures range from 77-81 degrees Fahrenheit (°F) in the summer; and 72-77 °F in the winter. From May through September, trade winds prevail 80 to 95% of the time, providing heat relief during the summer months. From October through April, the prevalence of the trade winds decreases to 50 to 80%.

Maui's strikingly different geographic differences of mountains and valleys create numerous microclimates with dramatically different rainfall averages. The project area is generally tropical with cooler and wetter areas at higher elevations.

4.3 PRECIPITATION

Trade winds produce most of the annual rainfall over the Hawaiian Islands; however it is during their absence that most of the flood producing rainfall occurs. Southerly winds bring moist warm air which creates "Kona" storms that produce the damaging floods in Hawai'i. These storms usually occur during the winter months. Rainfall in and around the project area varies greatly due to geographic locations. The mean annual precipitation along the project area varies from about 20 inches along the coastal plain to about 400 inches at the summit of Pu'u Kukui. Precipitation increases with elevation from the

coastline, which follows normal orographic patterns for windward areas of Maui. Table 4-1 shows rain gage stations and corresponding data.

Table 4-1: 'Īao Aquifer System Rainfall Station Data

Station	Station Number	Elevation (ft)	Mean Annual Rain (in)	Median Annual Rain (in)	Period of Record
Pu'u Kukui	380	5788	391.6 380.9	381 NA	1928-02
'Īao Valley Cave	380.1	1720	162	NA	1911-14
'Īao Needle	387.2	1250	70	70	1949-77
'Īao Valley	387.1	720	67.3	66.8	1949-02

Source: DLNR, 2002
ft = feet
in = inches

4.4 OCEANOGRAPHY, HYDROLOGY AND FLOODING

Executive Order (EO) 11988 on Floodplain Management requires the responsible Federal agency to evaluate the proposed action with respect to flood plain management and related controls. Development within the regulatory flood plain is not allowed unless proper provisions to minimize or eliminate flood damages are implemented.

COM is authorized to implement their flood plain management regulations once a flood plain has been delineated on the Flood Insurance Rate Map (FIRM) that is prepared by the FEMA (Figure 4-2). Development within the regulatory flood plain is not allowed unless proper provisions to minimize or eliminate flood damages are implemented.

Existing Conditions

The 'Īao Stream begins in the upper elevations of the 'Īao Valley and flows eastward towards the Pacific Ocean, discharging into Kahului Bay. The stream has a drainage basin of approximately 10 square miles (sq. mi.), and is located above the 'Īao Aquifer (Figure 4-3). The 'Īao Aquifer is approximately 17.81 sq. mi. (11,400 acres) and is subject to intermittent, high intensity rainfall causing runoff from drainage basins for North and South Waiehu Streams as well as the 'Īao Stream within the 'Īao Aquifer boundaries.

The State Commission on Water Resource Management (CWRM) estimates that the 'Īao Aquifer has a total annual runoff of 54.4 million gallons per day (MGD). Table 4-2 below summarizes stream discharge data for the 'Īao Aquifer area from DLNR (2002).

Table 4-2: 'Īao Aquifer System Stream Gage Discharge Data

Gage	Drainage Area (sq. mi.)	Period of Record	Average Flow (MGD)	Median Flow (MGD)	Base Flow (MGD)
'Īao Stream	NA	1910-15	51.2 38.7	35.0	13.6
'Īao Stream	5.98	1983-00	42.1	26.5	12.9

Source: DLNR, 2002

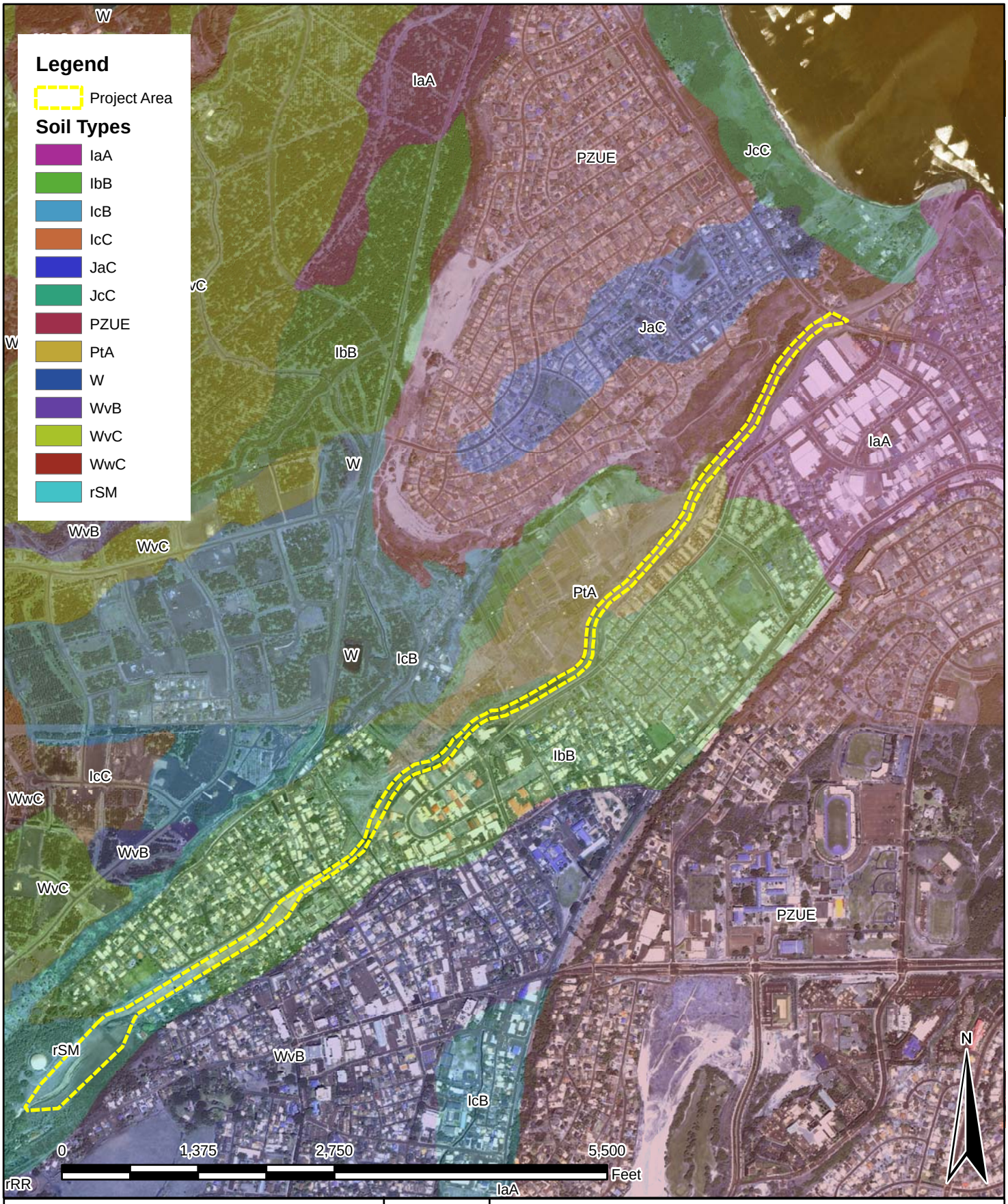
Groundwater occurs in the upper regional high-level dike confined water, lower regional basal water, and caprock water. The basal aquifer's initial volume is computed to be 220 billion gallons. Potable ground water in the 'Īao Aquifer system is found in high-level and basal portions of the system while non-potable ground water is found in the caprock. CWRM records indicate there are a total of 48 listed wells, test holes, and tunnels within the 'Īao Aquifer system.

Stream Description and Flow Records

'Īao Stream is one of three major waterways on the island of Maui. Located on the windward side of the West Maui Mountains, the stream has a drainage basin of approximately 10 sq. mi. The headwaters of 'Īao Stream begin in the upper elevations of the 'Īao Valley near Pu'u Kukui, originating from the confluence of the Po'o hahoahoa and Nakalaloa Streams. Flowing eastward towards the Pacific Ocean, the stream is joined by a third major tributary, the Kinihapai Stream about 3,100 ft from the Po'o hahoahoa-Nakalaloa confluence.

Except for its flood plain along the west bank, 'Īao Stream has a width of about 2.5 miles at the debris basin to about a half a mile near the stream outlet. The stream is about 10,000 ft in length, and about 30% is lined with existing concrete channels. The remaining 7,200 ft of the stream is an alluvial channel where the stabilization problems occur. Levees are situated on the right bank to protect the town of Wailuku.

The stream is perennial and is subject to short duration, high intensity rainfall typical of the windward geomorphic region. Stream flow is intermittent below the 'Īao Intake due to three diversion structures which redirect the water to agricultural interests in the drainage basin. Downstream of the diversions, 'Īao Stream can be characterized by the absence of water about 80 to 90% of the time, punctuated by infrequent high flows when stream discharge volume is sufficient to overtop the water diversion structures (USFWS, 2006). Water flows into the channelized portion of 'Īao Stream only during periods of prolonged intense rainfall.



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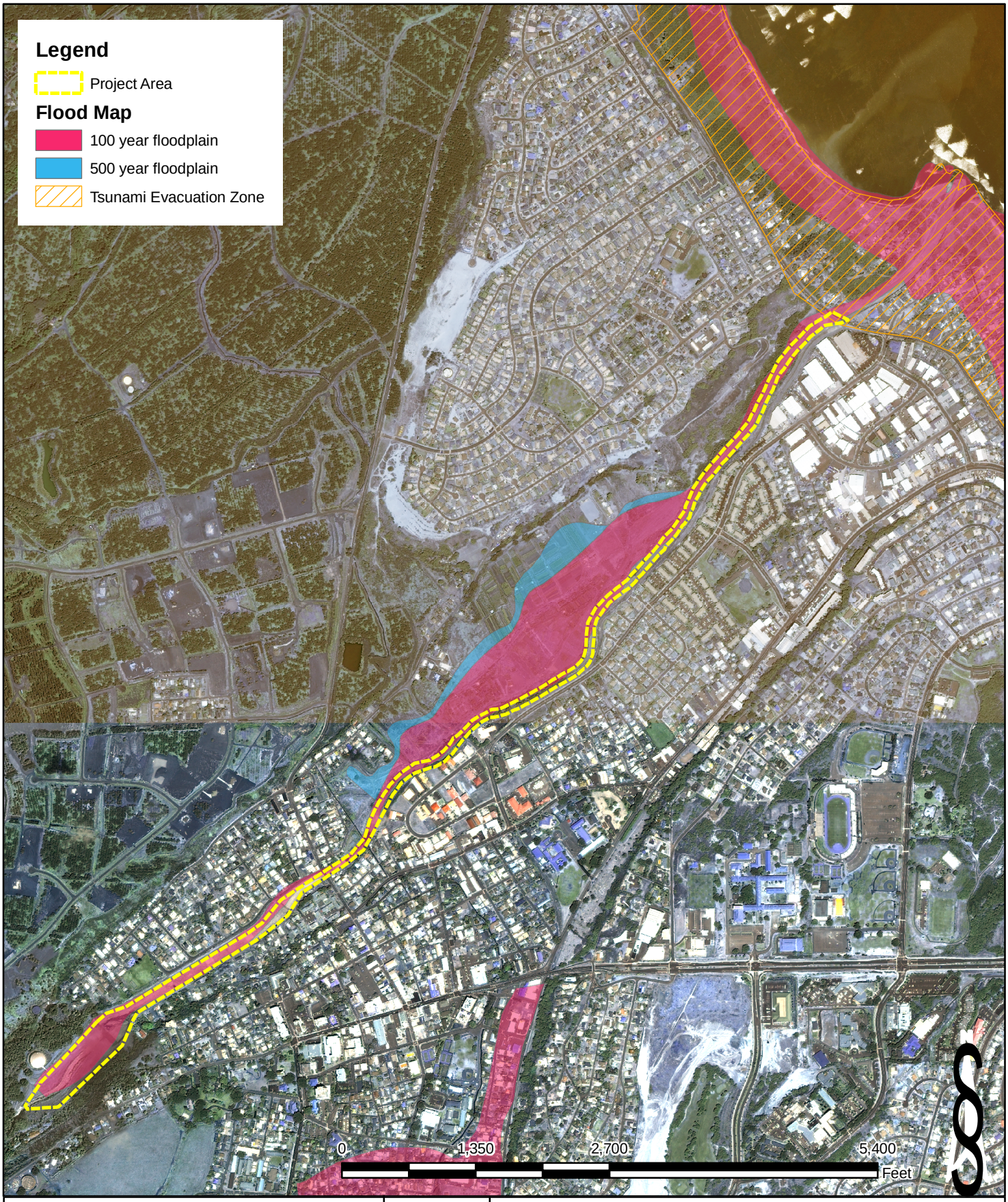
DRAWN BY: A.E.H.	'IAO STREAM FLOOD CONTROL EA
CHECKED BY: S.G.	SOIL TYPES 'IAO STREAM WAILUKU, MAUI, HAWAI'I
REF: USGS	FIGURE 4–1



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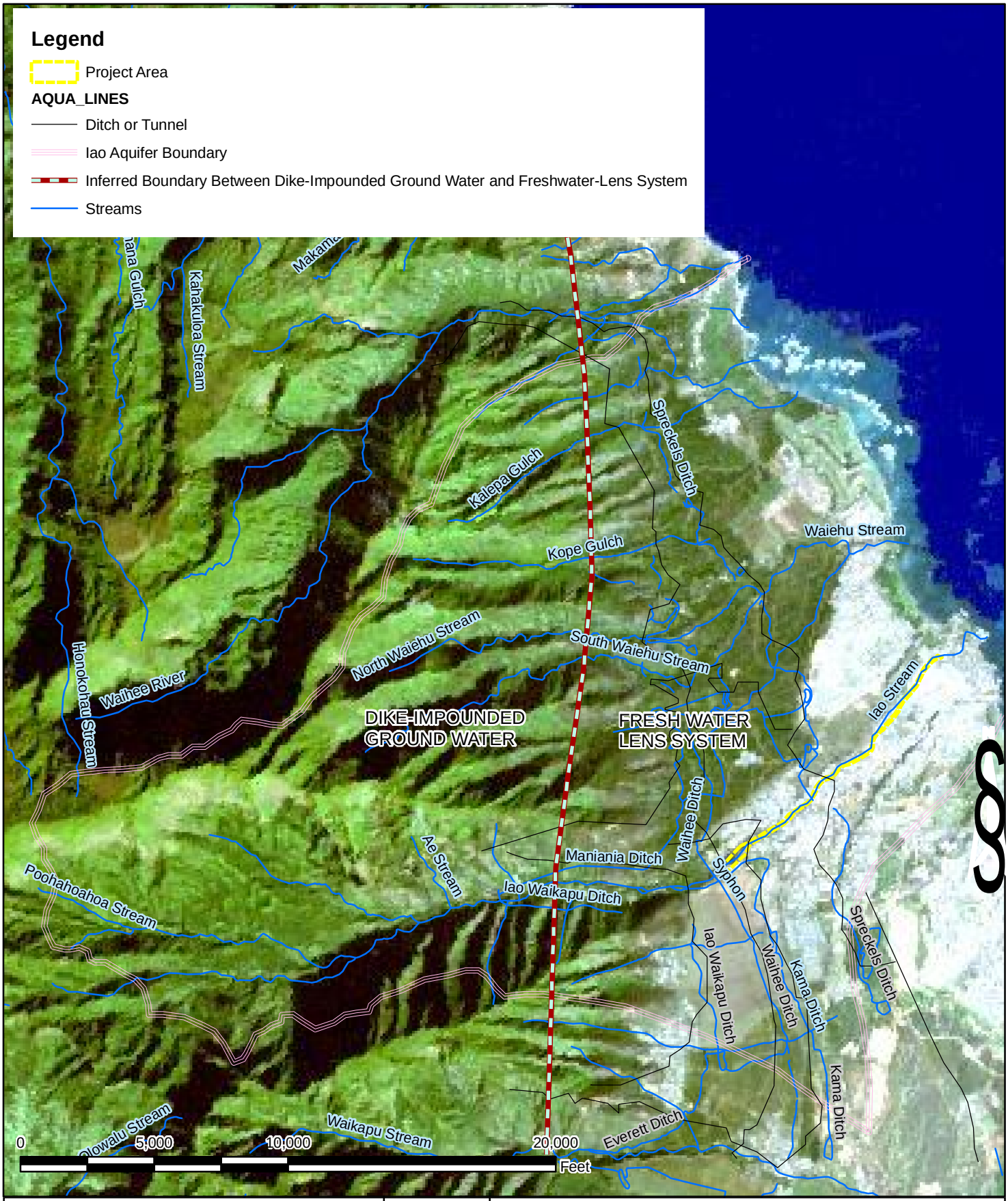
DRAWN BY: A.E.H.
CHECKED BY: S.G.
REF: FIRM

`IAO STREAM FLOOD CONTROL EA

FLOOD ZONES
`IAO STREAM
WAILUKU, MAUI, HAWAI`I

FIGURE 4 - 2



ENVIRONET, INC.
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DRAWN BY: A.E.H.
CHECKED BY: S.G.
REF: USACE

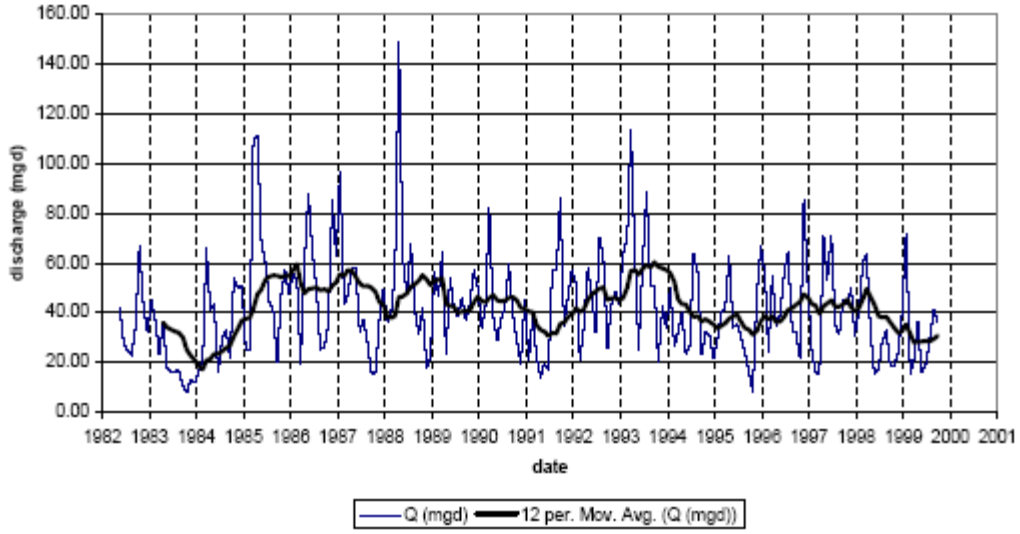
`IAO STREAM FLOOD CONTROL EA

`IAO AQUIFER
`IAO STREAM
WAILUKU, MAUI, HAWAI`I

FIGURE 4 - 3

Since completion of the original federal project in 1981, the maximum discharge experienced in the 'Īao Stream is approximately 4,100 cfs, and the average channel velocities throughout the natural portion of the channel range between about 8 and 32 fps during a project design discharge event with average velocities in excess of 20 fps at most places in the natural reach. Table 4-3 below summarizes stream flow data for 'Īao Stream at Kepaniwai Park (Stream Gage No. 16604500) from 1982 to 2001.

Table 4-3: 'Īao Stream Average Monthly Flow



Source: DLNR, 2002

The lack of consistent stream flow has been reported as detrimental to aquatic resources in the stream (USFWS, 2006). Observations by DLNR-DAR staff made at the lower channel and mouth of 'Īao Stream provide an estimate of the number of days per year that the stream flows through the extent of the channel and reaches the sea. These estimates are shown in Table 4-4.

Because of these long periods in which the stream is not flowing to the ocean, there has been an impact on native organisms that are migrating both upstream and downstream, and get stranded during the dry times. These impacts are discussed in further detail in Section 4.5.

Flooding

A history of flooding during and after the completion of the 'Īao Stream Flood Control Project in 1981 has caused extensive streambed erosion (Figure 4-4 and 4-5). This is of great concern due to the high probability of future flood damage in the community. During the original project construction, a January 1980 flood caused extensive erosion which undermined portions of the completed levees. Shortly thereafter, in 1981, high stream flows eroded a 980 foot reach of the stream bottom above Waiehu Beach

Road. Then again in 1989, more flood damage occurred along the streambed. Overall, damage in the form of erosion is slowly compromising channel stability and undermining portions of the existing levees.

Table 4-4: 'Īao Stream Estimated Days of Continuous Flow to the Ocean

YEAR	Days of flow to ocean (approx.)	Percent of days per year of stream flow to ocean
1993-94	72	20
1994-95	33	9
1995-96	35	10
1996-97	39	11
1997-98	48	13
1998-99	34	9
1999-00	18	5

Source: USFWS, 2006

Potential Effects and Mitigation

Alternatives I and III are designed to improve the existing Flood Control Project and Alternative V is designed to restore the 'Īao Stream to its natural condition prior to man made improvements made before 1981. Flooding would be mitigated with Alternatives I and III, but significant adverse affects of flooding would be expected under Alternatives V and VI which lack sufficient improvements to prevent water from overflowing the streambanks and entering the surrounding communities during high intensity rainfall events.

Alternatives I and III address the current stabilization problems by converting an additional 7,200 ft of natural stream bottom to a concrete-lined channel; smooth concrete for Alternative I and a RCC and boulder-grouted invert channel with the potential for vegetative growth for Alternative III. Alternative V would likely exacerbate the stabilization problems by removing all improvements from the stream. Alternative VI would likewise allow for further stabilization problems, although to a lesser degree than Alternative V.



View from right bank looking west from top of levee at approximate Station 24+00



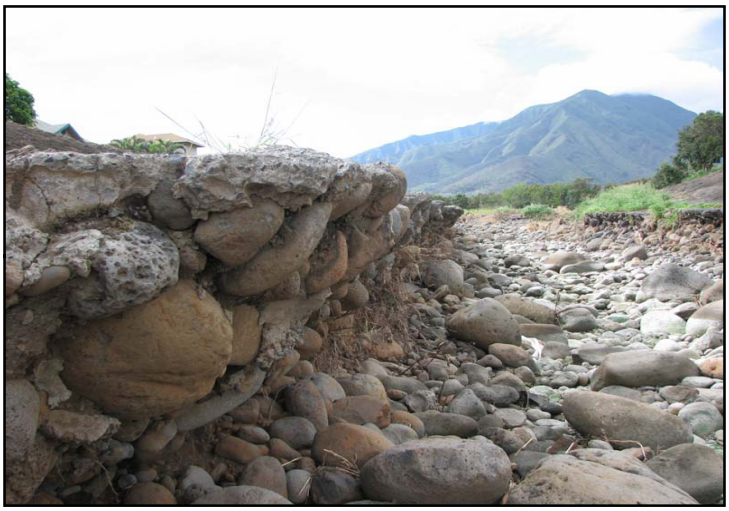
Channel invert eroded 6' to 8' below original channel cutoff walls



Slope failure of levee on right bank at approximate Station 39+00



Maintenance performed by Maui County includes placing stone along the toe of the levee as an interim repair measure



Erosion of channel invert causing undermining of 'boulder concrete' along right bank



View looking west from the right bank

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`IAO STREAM FLOOD CONTROL EA

STREAMBED EROSION PHOTOGRAPHS
`IAO STREAM
WAILUKU, MAUI, HAWAI`I

FIGURE 4 - 4



View looking at the area of "boulder concrete" that is being undermined by erosion



Imi Kala Street Bridge (To be replaced by others)



View looking east from the right bank
Note the proximity of homes to the levee



View looking downstream from the Imi Kala Street Bridge



View looking upstream at the left bank
Note vegetation and erosion



View looking upstream from the Imi Kala Street Bridge

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CHECKED BY: S.G.
REF: USACE

`IAO STREAM FLOOD CONTROL EA

STREAMBED EROSION PHOTOGRAPHS
`IAO STREAM
WAILUKU, MAUI, HAWAI`I

FIGURE 4 - 5

The current stream is characterized by intermittent stream flow in the downstream reaches of the project. An increase in the rate and volume of water flow through the channel during heavy rainfall events would be anticipated with Alternative I due to the smooth, concrete lined channel bottom and increased flows contained within the channel, due to the removal of a flood plain. Alternative I would not provide a means to maintain a low-flow stream in the absence of high volume events. Alternative III addresses this by altering the 7,200 ft to a RCC channel with a low-flow grouted-boulder invert channel that would facilitate the migration of native organisms. Alternatives V and VI retain 7,200 ft of natural alluvial stream bed which is currently unstable.

Due to the infrequent nature of water flow in the lower portions of the 'Īao Stream and the high wave energy system of the near shore environment (Appendix E), none of the proposed alternatives would be expected to cause a long-term adverse effect on oceanographic characteristics of the area, adjacent beaches, or the inshore water circulation patterns (although see Section 4.5 for a discussion of sedimentation).

Alternative I would be expected to adversely affect groundwater recharge due to the elimination of the flood plain and hardening of the stream channel along the entire length of the project. This would be mitigated under Alternative III, which includes weepholes in the RCC lining and retains the existing floodplain. The proposed recharge basin was dropped from consideration following the recommendation of USFWS and DLNR-DAR personnel. The retention of the flood plain will facilitate percolation into the 'Īao Aquifer during rainy season. Groundwater recharge would also be enhanced under Alternative V, which removes all concrete lining of the channel along the entire length of the project area and retains the flood plain. Alternative VI would provide the same level of groundwater recharge currently experienced in the area.

Implementation of Alternative I would close off the existing floodplain on the left bank and make it available to be utilized for future developments in the Wailuku area, whereas Alternatives III, V, and VI are designed to allow the floodplain to remain as is.

4.5 WATER QUALITY

4.5.1 The Federal Water Pollution Control Act (FWPCA)

Section 402 of the 1972 amendments established the National Pollutant Discharge Elimination System (NPDES) to authorize the EPA issuance of discharge permits (33 USC 1342). Section 403 stipulated guidelines for EPA to issue permits for discharges into the territorial sea, the contiguous zone, and ocean waters further offshore (33 USC 1393).

The Clean Water Act (CWA) of 1977 (PL 95-217) expanded provisions related to pollutant discharges and applies regulatory and non-regulatory tools to reduce point source and non-point source pollution, in addition to setting standards for water quality.

Impacts to the water quality are based on: 1) whether the alternatives will create an imbalance of chemical, physical, and biological integrity to the stream waters; 2) possible negative effects on existing aquatic species and recreation in and on the water; and 3) duration of imbalance. Applicable Army regulations include Army Regulation (AR) 200-1 and ER-200-2-3, as the policy of the Army is to ensure the availability, conservation, and protection of water resources of civil works activities that are under the jurisdiction of the USACE.

Existing Conditions

Water sampling was conducted from October of 1996 to September of 1997. Sampling and analysis were performed at four locations in the near shore ocean off of the mouth of the 'Īao Stream. To obtain representative sampling, a set time and date was chosen for the monthly sampling. Sampling reports are included in Appendix E.

Results of the analysis showed no distinct patterns. Turbidity and potential hydrogen (pH) were similar at all stations. Near shore waters in the sampling area were turbid with very limited visibility due to strong winds and large waves caused by consistent northeasterly trade winds and currents.

Potential Effects and Mitigation

The presented alternatives would involve a discharge into waters of the United States and would require preparation of a Section 404(b) (1) evaluation by the Corps which has been conducted and is included in Appendix G. A Section 401 State Water Quality Certification (WQC) from the State of Hawai'i Department of Health (HDOH) would also be required. In addition, the HDOH may require a NPDES permit.

Some degree of erosion and sedimentation is expected for any natural stream system. The 'Īao Stream system is experiencing accelerated erosion during high water flow events, which likely contributes to short-term increases in turbidity of Kahului Bay. An increase in turbidity is likewise inevitable if water is flowing in the stream during construction. This is the case for all available alternatives. The general contractor is required to use silt containment devices and other known methods to control turbidity to the maximum extent practicable. Construction will be timed to coincide with the dry season, as much as is practicable. Low water flows will be diverted away from the work area, particularly during grading. Any flows greater than the 1 to 2 year storm event would most likely flow through the work area. The

USACE will monitor the marine water quality at the mouth of the stream before, during, and after construction to assure water quality standards are not exceeded. Best management practices (BMPs) will be strictly adhered to during construction.

4.5.2 Section 303(d)

Section 303(d) of the CWA requires states to maintain a list of water bodies that do not meet, or are not expected to meet state water quality standards. States must obtain and review all readily available surface water quality data to compare against state standards, and then make a decision on the level of impairment for each waterbody. The listing applies to both point and non-point sources of pollution, and must include a listing of pollutants for which applicable standards are exceeded.

Existing Conditions

The segment of the 'Īao Stream discussed in this EA is classified as "Class 2 inland waters" by the State of Hawai'i. The objective of Class 2 waters is "to protect their use for recreational purposes, the support and propagation of aquatic life, agricultural and industrial water supplies, shipping, and navigation" (Hawai'i Administrative Rules (HAR) §11-54-3(b)(2)). Kahului Bay is classified as "Class A marine waters" by the State of Hawai'i. It is the objective of Class A waters "that their use for recreational purposes and aesthetic enjoyment be protected" (HAR §11-54-3(c)(2). This section includes a discussion of the anticipated effects of the proposed alternatives on the water quality of 'Īao Stream and Kahului Bay.

The State of Hawai'i's most recent list is the 2004 303(d) list (HDOH, 2004), which includes a listing of impaired waterbodies and a low, medium, or high prioritization for total maximum daily load (TMDL) development. 'Īao Stream and Kahului Bay, into which 'Īao Stream flows, are included on the state list.

The 'Īao Stream is included in the 2004 303(d) list as a high priority impaired waterbody for turbidity and trash. This listing was based on a visual, rather than a numerical assessment. The source of trash in the 'Īao Stream was not identified as originating from a specific source or point, and is thus assumed to fall into the category of non-point source discharge. The amount of trash discharged into the stream is a function of residents of the surrounding area and their actions. None of the proposed alternatives are expected to have any significant influence on the amount of trash deposited in or near the stream by residents of the area.

The second parameter, turbidity, is a measurement of the degree of cloudiness, or murkiness of the water. Turbidity is largely determined by the amount of suspended particulates found in the water. Particulates are typically sediment particles, although they can also be phytoplankton or zooplankton, or small

fragments of organic detritus, such as dead plant or animal material. The amount of suspended particulates in the ʻĪao Stream can be affected by the degree of stream bank erosion and methods for trapping or reducing sediment load within the stream. A reduction in erosion would result in lowered turbidity, or increased water clarity.

Potential Effects and Mitigation

Alternative I would provide a reduction in streambank erosion, but would not provide vegetation to trap or reduce particulate load in the water. Alternative III would provide a reduction in streambank erosion, and would also provide a vegetative buffer on the floodplain and habitat for natural aquatic plant life on the channel bottom, which would help trap and anchor particulates in place. Alternatives V and VI would not provide substantial reduction of erosion and sedimentation, and thus turbidity would not be decreased. Of the alternatives discussed, Alternative III would provide the maximum potential for reducing sediment load by stabilizing the streambank, maintaining a flood plain as a buffer for high volume water events, and by providing a habitat for natural aquatic organisms, which help trap and anchor particulates in place along the stream bed.

Kahului Bay is included in the 2004 303(d) list as a low priority impaired waterbody for turbidity, chlorophyll a, total nitrogen (N), nitrite/nitrates, and ammonium. This listing was based on numerical assessments in both wet and dry conditions for all standards, with the exception of total N, which only exceeded the standard under wet conditions. These pollutants likely originate from a number of non-point sources both along the shoreline as well as throughout the watershed. The ʻĪao Stream, as one of the major sources of freshwater discharging to the bay, has the potential to affect the water quality of the bay. Improvements to the water quality of the stream will result in improvements to the water quality of Kahului Bay. As discussed in the paragraph above, Alternative III is expected to provide the greatest reduction in suspended particulates and sediment in the ʻĪao Stream, and will also provide some uptake of nutrients via the plants allowed to grow in the channel.

A decrease in turbidity of the ʻĪao Stream would be expected to also prevent an increase in turbidity of Kahului Bay over the long term. The other pollutants listed for Kahului Bay can also be reduced by improving the water quality of the ʻĪao Stream. These pollutants are not limited to stream bank erosion, however, and are more difficult to identify and reduce. Typical targets for excess nutrient load include fertilizer use, animal wastes, and urban runoff. While none of these targets can be directly addressed through the ʻĪao Stream Flood Control Project, Alternative III would allow for uptake of nutrients by vegetation in the channel and the flood plain on the left bank.

Alternative I would not provide habitat for natural vegetation in the channel or flood plain. Alternative V would provide maximum habitat for natural vegetation, but would most likely result in increased erosion and sedimentation. Alternative VI would also retain a large area of natural vegetation, but would not stop the erosion and resulting sedimentation experienced during high water flow events. Of the alternatives considered, Alternative III would provide the maximum potential for reducing both sediment and nutrient loading of Kahului Bay.

Both the ‘Īao Stream and Kahului Bay are assigned into EPA Category 5, where “water is impaired or threatened and a TMDL is needed.” Factors for determining the priority level included the severity of pollution (both number of pollutants listed and degree to which standards were exceeded); the uses of the waters; type and location of the waterbody; degree of public interest; and vulnerability of the waters. As mentioned above, the ‘Īao Stream was assigned a high priority for the development of a TMDL, while Kahului Bay was assigned a low priority for TMDL development.

4.6 TERRESTRIAL AND AQUATIC BIOLOGICAL RESOURCES

Pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1946, projects by any agency under Federal permit or license that involve the "waters of any stream or other body of water (which) are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" must consult with the USFWS and the fish and wildlife agencies of the state where the project is to take place. In conjunction with USACE, ER 1130-2-540, consultation and environmental maintenance is to be undertaken for the purpose of preventing loss and/or damage to wildlife/environmental resources.

The FWCA requires that proposed USACE actions be coordinated with the USFWS, the National Marine Fisheries Service (NMFS), and the appropriate head of the state agency (DLNR) exercising administration over fish and wildlife resources. A FWCA Revised Draft Report was prepared by the USFWS to describe existing conditions and assess potential resource impacts associated with the ‘Īao Stream Flood Control Project (USFWS, 2006). The report in its entirety is included as Appendix A. Key elements of the report are included in the discussion below.

Existing Conditions

Sufficient documentation and information is available to characterize the existing biological resources conditions, thus a survey was not conducted for terrestrial and riparian biological resources within the project area. The proposed alternatives will subject terrestrial and riparian species to minimal adverse impacts. A review of Scientific Consultant Services/Cultural Resource Management Services (2003)

prepared for the 'Īao Stream area indicates the presence of the following terrestrial vegetation and wildlife species in the project area and the general vicinity:

Table 4-5: Vegetation and Wildlife Observed in the Project Vicinity in Previous Reports

Vegetation		
Sub-Region	Scientific name	Common Name
Coastal Lowlands	ns	sugarcane
	Prosopsis pallida	*kiawe*
'Īao Valley entrance	*Persea americana*	avocado
	Aleurites moluccana	*kukui*
	Eugenia cuminii	java plum
	Samanea saman	monkeypod
	Melia azedarach	pride of India
	Mangifera indica	mango
	Psidium guajava	guava
Higher valley slopes	*Casuarina equisetifolia*	ironwood
	Leucaena sp.	*koa haole*
Wildlife		
Sub-Region	Scientific name	Common Name
Drainage basin	ns	*amakihi*
	ns	*apapane*
	ns	Kentucky cardinal
	ns	house finch
	ns	house sparrow
	ns	mockingbird
	ns	mynah
	ns	red-billed leiothrix
	ns	white eye
	ns	pacific golden plover
	ns	ruddy turnstone
Upland	ns	barr doves
	ns	lace necked doves
	ns	pheasants
	ns	Franklin partridge
Lowland area and seashore marsh south of the project area	ns	black-crowned night herons
	ns	egrets
	ns	Hawaiian stilt

ns = not specified

Source: SCS/CRMS, Inc., 2003

Other terrestrial fauna observed in the vicinity of the project include introduced species such as cats, mice, rates, and mongoose. Game animals such as wild goats, pigs, and deer have been reported to occur in the forest reserve area.

Additional riparian and terrestrial vegetation in and around project site can be characterized as coastal dry forest and consists of at least nine plants species: Bermuda grass (*Cynodon*), bristly foxtail (*Setaria*

verticillata L.), finger grass (*Chloris* L.), *kiawe* (*Prosopis pallida*), klu (*Acacia farnesiana* L.), lantana or *lakana* (*Lantana camara* L.), *koa haole* (*Leucaena leucocephala*), sand bur (*Cenchrus* L.; endemic), and natal red top (*Rhynchely trum repens* Wild.) (SCS/CRMS, Inc., 2003).

According to wetland maps created by the USFWS, several freshwater emergent wetlands may be located adjacent to the project limits (Figure 4-6), although some of the depicted wetlands occur in areas currently developed for residential or commercial purposes. The mapped wetlands may or may not be present, and would require field verification to definitively prove their presence. The other potential wetland area occurs in the managed flood plain on the north side of the 'Īao Stream. No wetlands are depicted within the boundaries of the actual project. These downstream portions of the project were heavily modified between 1968 and 1981 (USFWS, 2006), and this project does not constitute new development of an emergent wetland, but rather maintenance of an existing structure.

UWFWS personnel conducted a habitat characterization assessment of the 'Īao Stream in the vicinity of the 'Imi Kālā Street Bridge (USFWS, 2006). Based on an assessment of nine factors, the stream was assessed to have a total score of 83 out of 135 points, or a score of 61.5%. According to the grading matrix, this score puts 'Īao Stream in the category having habitat that is partially supportive of aquatic life.

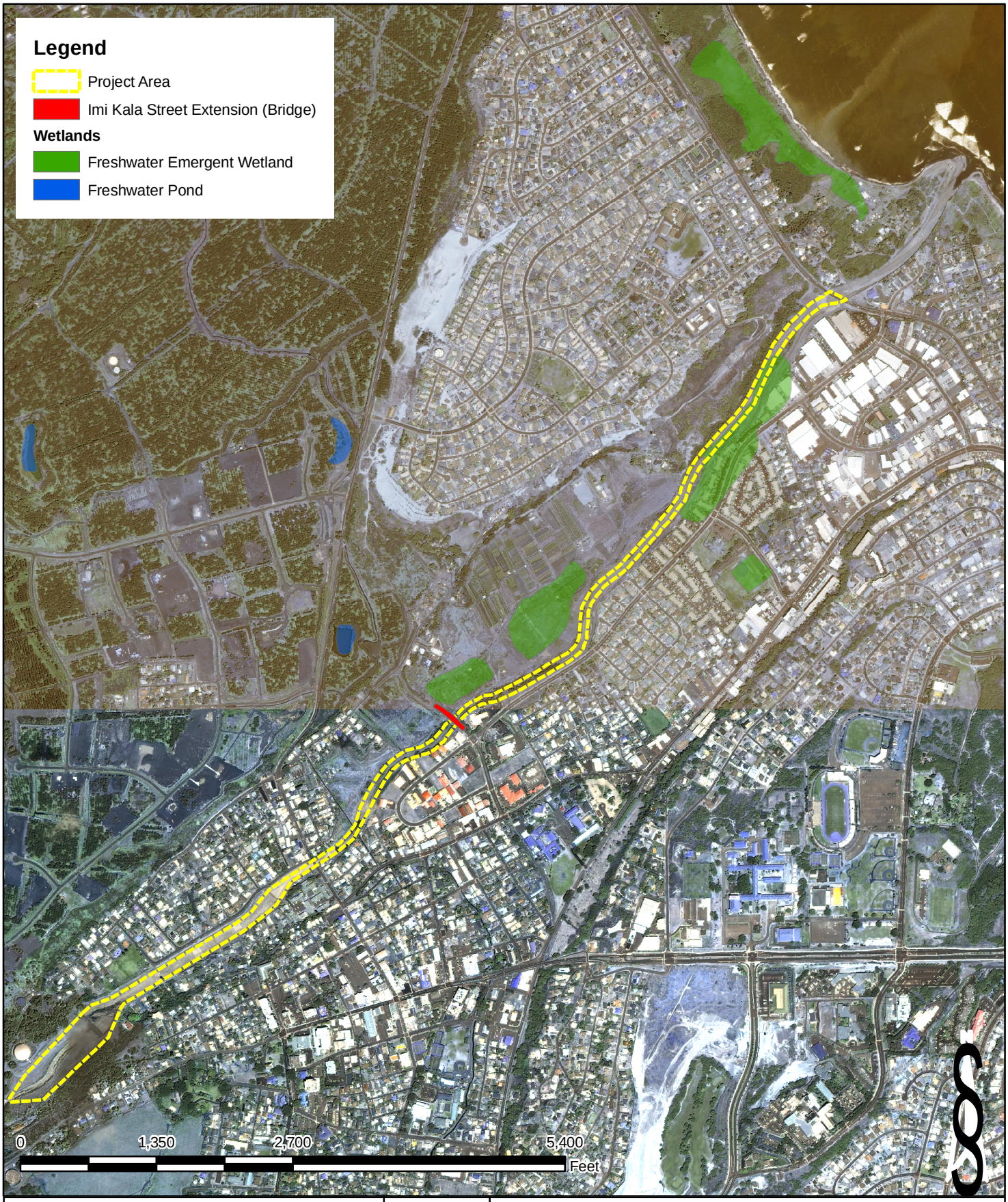
Aquatic species are sensitive to any modifications of the stream as they have an amphidromous life cycle. Native and indigenous freshwater gobies such as *Lentipes concolor*, *Sicyopterus stimpsoni*, and *Awaous guamensis* were observed in 'Īao Stream (Way, 1996). Along with the atyid shrimp and neritid snail, these stream-dwelling fauna require streams which flow continuously as eggs and larvae are washed into the ocean. Juveniles subsequently migrate back into 'Īao Stream and 'Īao Valley to mature, reproduce and spawn, although the project area itself is used for migration only, not breeding. Three significant water diversion features, located upstream from or within the channelized portion of the stream, carry a significant amount of water away from the stream for consumptive use, primarily sugarcane and other agricultural crops. The current lack of continuous stream flow has been detrimental to populations of native organisms, due to stranding and desiccation of organisms during upstream and downstream migration (USFWS, 2006). Recent changes to land use patterns in the vicinity of the stream have included the conversion of former sugarcane lands to other crops, as well as to commercial and residential real estate. The replacement crops require only a small fraction of the water required by sugarcane, yet the existing diversion infrastructure is being maintained with no change to the amount of water diverted from the stream.

Field surveys of marine ecosystems and species were not included in the USFWS draft report due to limited funds, logistics, and time constraints. The report did note the presence of coral reefs in the coastal ecosystem adjacent to the mouth of the 'Īao Stream. Coral reef ecosystems, comprising corals, reef fish, and associated invertebrates and plants are considered sensitive ecosystems. Corals and reef-associated fish in particular are of fundamental importance to species diversity and abundance of this valued resource. Corals are sensitive to sediment and nutrient runoff, and require clean, relatively nutrient free waters to thrive. Because corals form the framework of the coral reef ecosystem, any decline in coral health can result in an eventual decline or shift of the entire reef ecosystem. The near shore coastal environment in Kahului Bay is also noted to support sport fisheries for jacks (Carangidae) including *Caranx melampygus* and *C. ignobilis* (called omilu or ulua as adults and papio as juveniles); *Selar crumenopthalmus* (called akule as adults and halalu as juveniles); and goatfish (Mullidae) such as *Mullodichthys vanicolensis* (called weke as adults and oama as juveniles).

The USFWS report identified the lower 'Īao Stream as belonging to Resource Category 2 habitat (Habitat to be impacted is of high value for selected evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section) due to the severe degradation of stream habitat across the north shore Maui landscape and statewide. The marine waters adjacent to the mouth of 'Īao Stream at Waiehu are also considered to be Resource Category 2 due to the presence of coral reef habitat throughout the area. The USFWS resource goal for Category 2 habitat is no net loss of in-kind habitat values. If losses are unavoidable, mitigation measures will be recommended to immediately rectify, reduce, or eliminate those losses (USFWS, 2006).

Potential Effects and Mitigation

Alternative I would allow for residential and commercial development of the existing floodplain. As noted earlier, there may be wetlands in the floodplain, and thus Alternative I would require a field investigation to determine whether any wetlands are present. With Alternatives III, V, and VI the floodplain would remain undeveloped, thus there would be no wetlands concerns. There are no wetlands concerns for work to be conducted within the project area. These downstream portions of the project were heavily modified between 1968 and 1981 (USFWS, 2006), and this project does not constitute new development of an emergent wetland, but rather maintenance of an existing structure.



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REF: HDA

`IAO STREAM FLOOD CONTROL EA

WETLANDS
`IAO STREAM
WAILUKU, MAUI, HAWAI`I

FIGURE
4 - 6

All project alternatives, with the exception of Alternative VI, share the potential for temporary construction-related impacts. Alternative VI includes continued short-term construction activities during regular repairs. During the period of construction, earthmoving and related activities would create a risk for the entry of terrigenous sediments into the stream channel and adjacent near shore marine waters. This is especially the case during periods of wet weather. A variety of voluntary and regulatory controls function to minimize this risk. Runoff is inevitable, however, during torrential rains which occur regularly but unpredictably in Hawaiʻi. Development of site-specific BMPs are integral elements in the planning and application process for the CWA section 404 permits and the concurrent CWA section 401 WQC administered by the HDOH Clean Water Branch. Both Alternatives I and III provide for a long-term reduction in sedimentation, however, as either would eliminate the current large-scale streambank erosion occurring within the channel during flood events.

Alternative I would have the greatest negative impact due to loss of habitat currently used by native aquatic species during periods of flowing water. Converting the current natural boulder and cobble stream bottom substrate to a flat concrete lined channel would also effectively eliminate the riparian vegetation that is currently found along the unlined section of the stream. This vegetation, although consisting of introduced "weedy" species such as java plum (*Syzygium cumini)* and haole koa (*Leucaena leucocephala)* provide shade to much of this section of the stream. Native fauna are very sensitive to elevated temperatures and associated changes in dissolved oxygen and pH. Because shade results in lower water temperatures, removing vegetation would most likely prove detrimental to native aquatic species currently present in the stream (USFWS, 2006).

Alternative III reduces the impacts to the natural stream bottom and riparian vegetation anticipated under Alternative I by incorporating several mitigation measures agreed to by the USFWS (Appendix J). During periods of moderate to low stream discharge, water would be entrained in a low-flow channel that is envisioned to be of sufficient rugosity to create microhabitat conditions that are more suitable than flat unshaded concrete for upstream migrating organisms. Where possible, the low-flow channel would be aligned close to the stream bank so that existing vegetation could provide shade to the channel. In addition, non-woody vegetation could grow among the grouted boulders that form the low-flow channel. This streambank and channel vegetation, if appropriately managed, would function to provide critical shade and maintain lower water temperatures.

In their draft FWCA report, USFWS expressed concerns that converting 7,200 ft of natural alluvial stream bed to a RCC and boulder invert channel would have a negative impact on the ʻĪao Stream and cumulatively to the hydrologic landscape of north-shore Maui (USFWS, 2006; Appendix A). USFWS

also noted that although they would recommend Alternative V or IV as the preferred alternative, they do not meet the project requirements and thus would likely be removed from consideration. In that case, USFWS recommended selection of Alternative III as the preferred alternative, emphasizing that "the goal of the mitigation flow would be to re-establish continuous flow of 'Īao Stream to the sea no less than 80% of the time and to enhance flow duration to maximize survival of migratory aquatic organisms." In a follow-up discussion between USFWS, USACE, and the COM, stream flow restoration was discussed and was recognized as being outside the authority or purpose of the USACE. Retrofit design elements have also been included to facilitate the movement of native organisms through the modified channel area. A site visit was conducted on 3/4/2008 to identify these areas and measures (Appendix I). These elements include a step structure at the 22-foot vertical drop (Station 97+23), widening existing low-flow channel areas, installing low-flow channel segments in existing flat-bottomed cement channel segments and in the center of the existing debris basin, blocks along the sloped portions of the existing channel to provide a resting place for climbing organisms, and an alignment along the vegetated portions of the left bank to provide shade and reduce water temperatures. These mitigation measures have been proposed as compensation for unavoidable impacts, and have been agreed to in a revised mitigation recommendation letter by the USFWS (Appendix J).

Alternative III is designed to facilitate upstream and downstream migration of aquatic organisms, given sufficient water flow. Stream flow restoration is a topic that is currently under discussion by the CWRM, state and federal resource agencies, community groups, and private entities that hold licenses for diversion and out-of-stream consumptive use of 'Īao Stream Water. This decision is outside the function and authority of the USACE, however. If and when stream flow is partially restored, the low-flow design elements of Alternative III will function to enhance passage of stream fauna.

Alternative V would result in increased usable stream habitat that could support native fish and invertebrates, particularly if there was an effort to appropriately reconstruct the natural channel specifically for habitat value. This would only be possible if stream flow was restored, however. This alternative would result in removal of 2,500 ft of existing cement-lined stream channel. Removal of the existing 'Īao Stream Flood Control Project would result in one of the largest stream channel restoration projects ever undertaken in the State and would result in a precedent-setting benefit to the entire stream ecosystem. Over the long-term, however, neighborhoods with homes and businesses located within the newly unprotected flood plain would be subject to major flood events. Although infrequent, major floods are expected to occur with regularity. Recurring floods will result in deposition of large amounts of debris (flood-demolished homes and other structures, vehicles, etc.) either into the stream channel itself or into the near shore marine environment. This debris would contain contaminants such as sewage,

petrochemicals, lead paint, and other materials. Flood-related input of contaminants and debris could be minimized with sufficient acquisition of land along the 'Īao Stream corridor and within the floodplain, and relocation of residential and business structures (USFWS, 2006). Opinions of support for Alternative V were presented by members of the community during the August 12, 2003 public scoping meeting. Comments included concerns about groundwater recharge, restoration of area, and cultural/recreational practices and values associated with 'Īao Stream (See Table 8-1).

Alternative VI would retain 7,200 feet of natural stream bottom which would be a continued benefit to aquatic organsisms, but similar to Alternative V this is of little benefit in the absence of stream flow. Alternative VI would also allow continued high levels of streambank erosion and resulting excessive sedimentation during high water flow events.

4.7 THREATENED AND ENDANGERED SPECIES

The Endangered Species Act of 1973, (50 CFR 402), Section 7, requires Federal agencies to consult with other agencies to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species. Correspondence with USFWS and NMFS is included in Appendix H.

Existing Conditions

There are no known federally listed endangered or threatened biota and their critical habitats within the study area, therefore formal consultation under Section 7 of the Endangered Species Act is not required. The USFWS and NMFS concurred in this determination by letters dated July 1, 1996 and March 19, 1996. The USFWS stated that there is a potential existence of two candidate species of insects (*Megalagrion pacificum and M. xanthomelas*) in the project area, although this has not been confirmed by field studies. These letters of concurrence are attached in Appendix H.

Potential Impacts and Mitigation

Because no known federally listed endangered or threatened biota are present within the proposed project area, no effects to listed species are expected.

Table 4-6: Proposed Mitigation measure for natural resource impacts of Alternative III.

Potential Impacts	Potential Mitigation Measures
Aquatic Organism Passage	
• No stream flow	• Low flow element built into proposed channel structures. • Existing channel to be retrofitted with low flow elements. • Low flow element to be approximately 15 ft wide and 20 inches deep.
• Vertical Drop at Station 92+20	• Step type structure to eliminate existing 22-foot vertical drop structure. • Low-flow channel continuation along the new drop structure on the right bank side, and then connect to existing low-flow channel on the left bank side.
• High water temperatures	• Aligned to bank that provides shaded areas.
• High water velocity	• Installation of small concrete blocks to slow stream flow in smooth, sloped areas of current concrete-lined channel. • Provides resting area for migrating species.
Vegetation Removal and Paving	
• Aquatic Vegetation	• Cobble structures in channel would promote deposition of sediment and reestablishment of aquatic and riparian vegetation species.
Hydrology	
• Negative Impact to Groundwater Recharge	• Weepholes in RCC. • Retention of the natural floodplain.

5.0 AFFECTED HUMAN ENVIRONMENT

The following subsections contain detailed descriptions of possible impacts as well as proposed mitigation measures. As stated in earlier sections, Alternatives II and IV were not carried forward for detailed evaluation regarding impacts and mitigation.

5.1 HISTORIC AND CULTURAL RESOURCES

Pursuant to Section 106 of the National Historic Preservation Act (NHPA) of 1966 and its implementing regulations (36 CFR Part 800), alternatives which may affect properties listed or eligible for listing on the National Register of Historic Places are subject to the provisions of this Act.

An archaeological reconnaissance study, including subsurface testing, was conducted in November and December of 1998 by Scientific Consultant Services/Cultural Resource Management Services, (SCS/CRMS) Inc. 2003. At the time of the study, the proposed alternatives included realignment to the north of the current ʻĪao Stream, and thus the study included an investigation of this corridor. Subsequent to the completion of the archeological reconnaissance study, the alternatives were revised such that improvements have been limited to the existing ʻĪao Stream alignment. The single site discovered during the archaeological reconnaissance study, although presented in Appendix B as being within the project corridor, is actually now outside the boundaries of any of the alternatives.

The purpose of the archaeological reconnaissance study was to identify any archaeological sites or features occurring within the project boundaries. Information collected for this report includes previous archaeological research, pedestrian (reconnaissance) survey, limited excavations, and laboratory analysis. The extent of the project was altered after the archaeological reconnaissance study was completed, thus the study only covers the area from the downstream limit of the project to the Spreckels Ditch area, approximately 4,700 ft upstream. The extent of the archaeological survey thus does not cover the area from Spreckels Ditch to the debris basin, a distance of approximately 1.5 miles. The original Flood Control Project, covering the entire 2.5 project length, included additional archaeological study of the upstream area. These previous studies are discussed in the SCS/CRMS, Inc. report, key elements of which are discussed in the sections below.

Articles IX and XII of the State Constitution of Hawaiʻi (Chapter 343, HRS) require government agencies to promote and preserve cultural beliefs, practices, and resources of native Hawaiian and other ethnic groups. The "Guidelines for Assessing Cultural Impacts", adopted by the Environmental Council of the State of Hawaiʻi (1997), identifies the protocol for conducting cultural assessments.

An oral history survey and a cultural impact assessment (CIA) were conducted between August and November of 2003 by Social Research Pacific, (SRP) Inc. to identify properties of historic and cultural significance (SRP, Inc., 2003).

5.1.1 Archaeological Resources

A complete archaeological reconnaissance survey found the area between Spreckles Ditch and the downstream limit of the project to be relatively void of visible architectural and/or surface remains with the exception of one site, as described below. The full report, "Archaeological Reconnaissance Survey and Limited Subsurface Testing for the Alternative Channel Alignment, ʻĪao Stream Flood Control, ʻĪao Valley, Island of Maui, Hawai'i", (2003) by SCS/CRMS, Inc. is provided in Appendix B.

One site was originally identified during the reconnaissance survey as being within the project boundaries, but due to revisions of the alternatives is now located outside the boundaries of any of the alternatives. The site in question is known as State Site Number 50-50-04-4755 (Tax Map Key (TMK) 3-4-32:1). The site is composed of three features. The three features consist of a concrete foundation with concrete troughs, a soil filled terrace and retaining wall, and a wall remnant. These features form a small, presumably historic (post 1776) habitation complex activity area. A majority of these features, particularly the basalt cobble and boulder-formed walls, exist in the state of poor-to-fair preservation condition. Structurally and materially, the site is most probably a post-Contact, late 19th or early 20th century, agricultural site (SCS/CRMS Inc., 2003). According to local residents, the site was associated with a former piggery in operation several decades ago. This site was initially assessed as significant under Criterion D, due to its potential to yield information important to research on the history in the area, but considering information collected during the current reconnaissance survey, the site is now deemed to be no longer significant. No further work is considered necessary or recommended for the site (SCS/CRMS Inc., 2003).

Additional archaeological sites identified in the vicinity of the ʻĪao Stream project include State Site No. 50-50-04-2978 (Wallace System Complex) and State Site No. 50-50-04-2979 (North Terrace System Complex). These sites were identified by Connolly (1974, as cited in SCS/CRMS Inc., 2003) during the initial ʻĪao Valley Flood Control Project, and were reported as two historic complexes composed of a substantial amount of terraces, free-standing walls, ditches, historic house foundations, and several stone mounds (Figure 5-1). Further discussion of previous archaeological studies is provided in Appendix B.



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REF: USACE

`IAO STREAM FLOOD CONTROL EA

CULTURAL RESOURCES
`IAO STREAM
WAILUKU, MAUI, HAWAI`I

FIGURE
5 - 1

5.1.2 Cultural Resources

An oral history survey was conducted in November of 2003 by SRP, Inc., to obtain information regarding properties of cultural and historical significance from Hawaiian *kūpuna,* Hawaiian elders, that live on Maui. Along with interviews, information about traditional cultural properties (TCPs) was gathered from written and archival sources and incorporated in a CIA in accordance with National Park Service guidance (Parker and King, 1995). The full report is provided in Appendix C.

The 'Īao Valley, as with the remainder of the Wailuku ahupua'a has unique significance to native Hawaiian culture. Changes in land ownership, military presence, sugar cane farming, and general urbanization have over time, however, dramatically altered the land uses within 'Īao Valley. Remnants of old buildings and traditional land uses are being phased out by the influx of urban growth in the valley. Traditional practices had been discontinued even before the rise of sugar cane farming in the project location (SRP, Inc., 2003).

Even with the substantial change to this cultural landscape, vestiges of its highly significant past do remain and the traditional significance of Wailuku as a region needs to be preserved. Oral history from Hawaiian *küpuna* indicates there are three known TCPs in the vicinity of the project area but not within the boundaries of the proposed location. TCPs in the vicinity of the project area are noted below:

- Haleki'i-Pi'ihana *heiau* complex (Figure 5-1).
- Fresh water spring (listed as *Waiola* by the CWRM), located on the Sevilla property.
- Burials along the sand dunes and at Mahalani Cemetery (Pi'ihana side). The burials within the sand dunes are well known and recorded.

Possible cultural impacts were assessed using a questionnaire-based survey for existing residents within the project area. Thirty-two residents of the project area were surveyed, and results of the report are summarized as follows.

The majority of individuals interviewed have not witnessed severe floods, and expressed more concern over erosion than flood control. Although most of the interviewees rarely use the stream for recreational and/or social purposes, the community's concern is concentrated around social and recreational values of the 'Īao Stream, including a concern that the proposed flood control measures will only lead to more inefficient water flow to further promote degradation of the natural stream (SRP, Inc., 2003).

The cultural impacts report also noted that the Haleki'i-Pi'ihana Heiau State Monument lies along the bank of the 'Īao Stream, near the downstream limits of the project. Specifically, the report noted that

continued erosion of the stream bank could lead to the land beneath the heiau being compromised (SRP, Inc., 2003).

Potential Impacts and Mitigation Measures

Although one archaeological site was initially assessed as significant under Criterion D, this based upon archaeological work conducted at the site, sufficient information has now been obtained from recording and excavations at the site so it may be considered no longer significant. No further work is necessary (SCS/CRMS Inc., 2003).

Cultural resources coordination and consultation with the State of Hawaiʻi Historic Preservation Officer (SHPO) was based on the assumption that construction efforts will be confined to the existing stream channel, and thus any construction work will have no effect on historic properties or significant cultural resources. In the area of ʻImi Kālā Street, however, the channel will be widened to accommodate the proposed improvement of the ʻImi Kālā Street bridge. In this area, there is the potential that buried cultural resources may be adversely impacted. To counter such potential adverse effects, the USACE will include monitoring by a qualified archaeologist during construction associated with the widening of the stream to accommodate the proposed improvement of the ʻImi Kālā Street Bridge.

Based on written history, oral information from Hawaiian *kūpuna*, and a questionnaire-based survey, no immediate/direct changes are foreseen to known TCPs within the vicinity of the project area as a result of the implementation of any of the considered alternatives for the proposed project. It is recommended that the Halekiʻi-Piʻihana *Heiau* State Monument be monitored on a continuous basis, as the *heiau* lies immediately along the banks of the ʻĪao Stream. The location of this *heiau* has been identified as a potentially high erosion area, and inadequate flood control measures may compromise the land on which the *heiau* is situated.

The USACE sent a copy of the CIA to Office of Hawaiian Affairs (OHA) summarizing the cultural study conducted for the project and including a "no adverse effect" determination. The OHA responded in a letter dated October 30, 2007 (Appendix H), that included an appreciation for the number of sources consulted in preparation of the CIS, but noted their concerns about the presence of numerous culturally significant sites and native Hawaiian practices in the vicinity of the project. These concerns are addressed in the Section 106 consultation letter sent to OHA in November 2007 (See Appendix H and the following section) as well as in this draft EA, a copy of which will be forwarded to OHA for their review.

5.1.3 Section 106 Compliance and Coordination

The USACE assessed the potential cultural affects of proposed modifications to the project area, and summarized their finding of "no effect" in letters to the SHPO and OHA, as well as the County of Maui Cultural Resources Commission, the Central Maui Hawaiian Civic Club, and the President of the Association of Hawaiian Civic Clubs. The SHPO was contacted initially in 1996 and responded with concurrence in a letter to the USACE (Appendix H). A second set of letters was sent to both SHPO and OHA in 2005, and a response was received from OHA requesting that archeological level survey work be conducted in the project area. The third round of letters was sent to SHPO, OHA, the County of Maui Cultural Resources Commission, the Central Maui Hawaiian Civic Club, and the President of the Association of Hawaiian Civic Clubs in 2007, requesting Section 106 consultation. OHA responded that they did not receive a Section 106 consultation letter, so the USACE resent the letter on November 5, 2007. As of the time of report preparation, no responses have been received from OHA, but both USACE and OHA are committed to the ongoing consultation process. Any updates or revisions reached during the consultation will be incorporated into the final EA.

5.2 LAND USE AND VISUAL RESOURCES

Development and analysis of the EA alternatives also took into consideration the possible visual and aesthetic impacts the modification to the existing Flood Control Project might have on existing visual resources. The 'Īao Stream is situated in the 'Īao Valley, a 6.2 acre landmark seeped in Hawaiian history and beauty. The valley is a steep, eroded caldera of the West Maui Mountains occupied by lush green vegetation. With the exception of the existing concrete lined channels and water diversions that occupy 30% of the stream, it remains mostly undeveloped. The 'Īao Stream remains a natural beauty and tourist attraction of Maui.

Existing Conditions

Present day land uses generally fall into residential, commercial, recreational, and farming categories (Figures 5-2 and 5-3). Just along 'Īao Stream, residential uses extend from Kahului Bay to the far western (mauka) sections of the valley, with the densest residential concentration along the lower (makai) portions of the stream. From Millyard to Waiehu Beach Road along the northern corridor of the project area, there is additional residential housing along with farms located in the flood plain bordering Pi'ihana. The farms grow mostly banana and papayas and are restricted to the northern corridor of the stream. The southern corridor of the project area consists of residential and commercial properties.

With the exception of a few older businesses, commercial development is restricted to the southern corridor of the project area. The types of businesses vary significantly, from a supermarket at the westernmost end, to the Maui Waste Disposal and several legal, accounting and real estate firms on the easternmost end. A levee along the southern corridor is utilized as a maintenance road for County of Maui vehicles, and also serves as a recreational area for local residents, as well as a buffer for many of the homes from the stream.

Land in and surrounding the affected area is owned by multiple private landowners, COM, and the State of Hawaiʻi. Zoning is agricultural, residential and industrial and no land use change is required for this project. The local, non-Federal sponsor, COM, will be responsible for acquiring the necessary LER for this project.

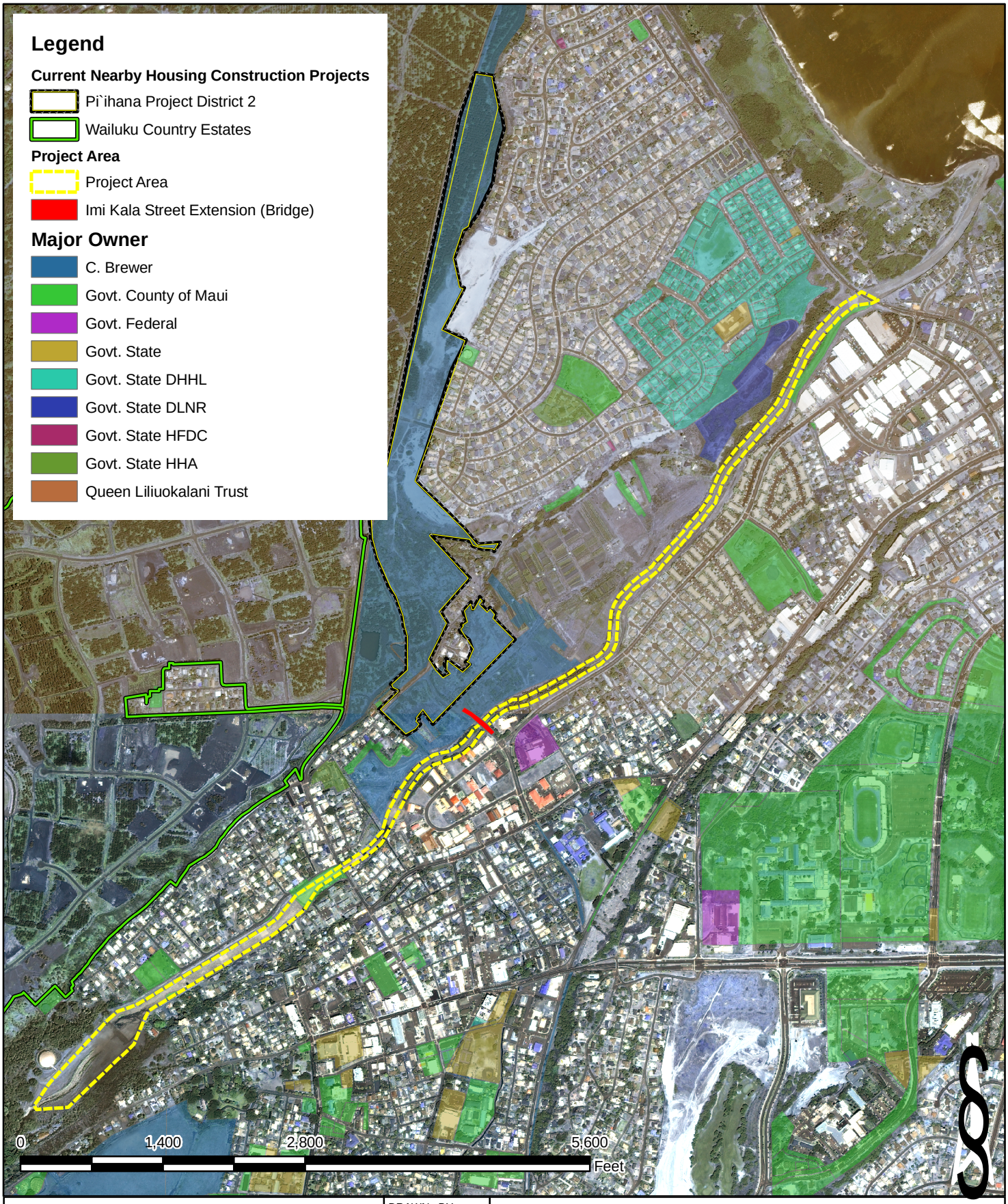
The existing flood plain occurs in an area designated as prime agricultural lands by the State of Hawaiʻi, Department of Agriculture (HDOA). This designation also applies to several stretches of land occurring on both the east and west sides of the ʻĪao Stream, however they have subsequently been developed for commercial and residential use (Figure 5-4).

Three significant water diversion features, located in or upstream from the channelized portion of the stream, carry a significant amount of water away from the stream for consumptive use, which formerly consisted primarily of sugarcane and other agricultural crops. Recent changes to land use patterns in the vicinity of the stream have included the conversion of former sugarcane lands to other crops, as well as to commercial and residential real estate. The replacement crops require only a small fraction of the water required by sugarcane, yet the existing diversion infrastructure is being maintained with no change to the amount of water diverted from the stream.

Potential Effects and Mitigation

Alternative I would allow development of an area designated as prime agricultural lands (existing floodplain), while Alternatives III, V, and VI would leave the floodplain as is. Approximately three acres of vegetated streambank would be cleared during construction for Alternative III, but it would be allowed to regrow as much as possible following the completion of construction activities.

Short term land use impacts may be generated from construction activities which may limit access to and from public and/or recreational areas for use by the community. USACE will require its contractor to work closely with local police and fire authorities and provide early planning for alternate routes, as well as a traffic control plan.



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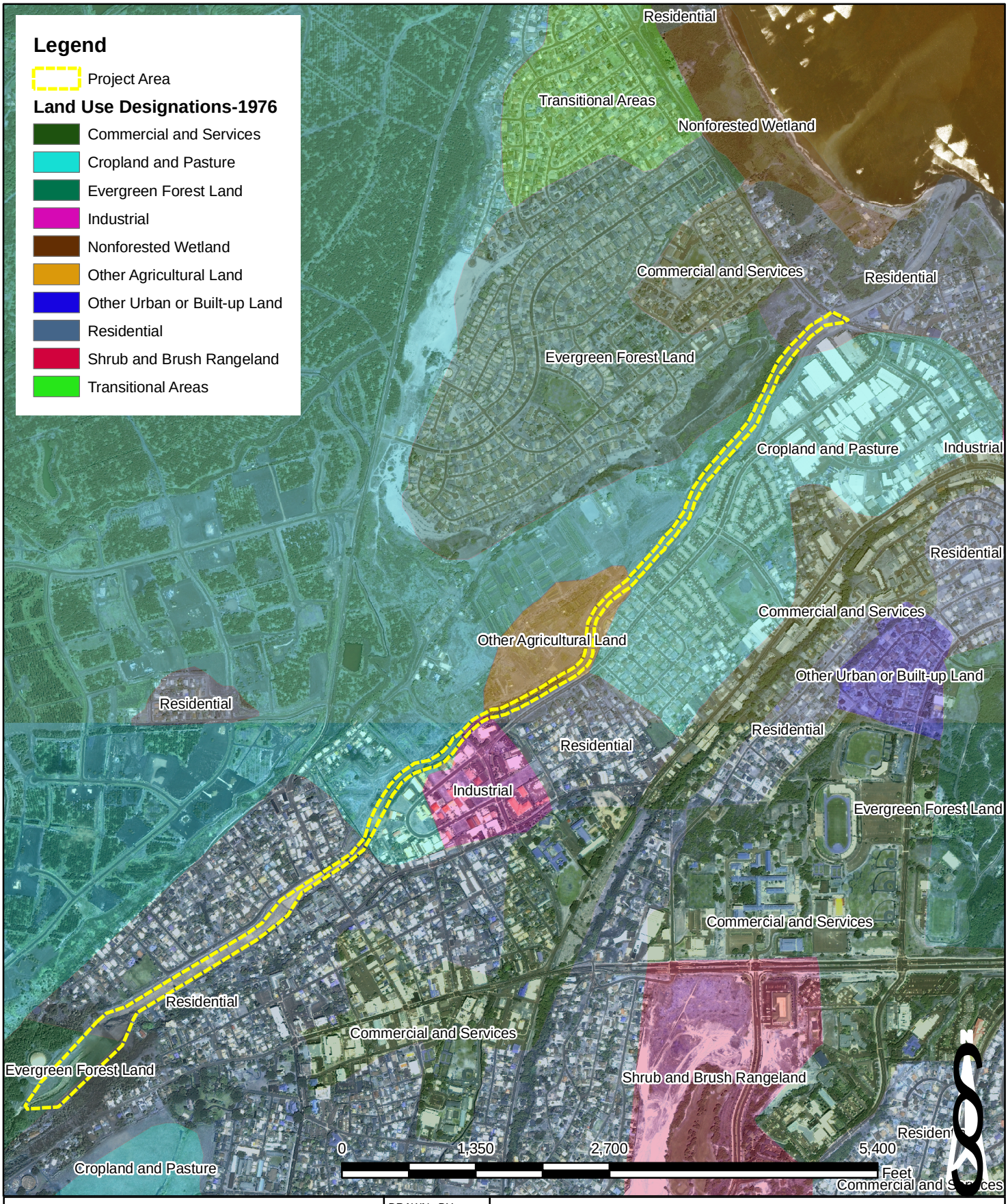
CHECKED BY: S.G.
REF: COM

`IAO STREAM FLOOD CONTROL EA

SURROUNDING PROPERTY CHARACTERISTICS: `IAO STREAM WAILUKU, MAUI, HAWAI`I

FIGURE 5 - 2



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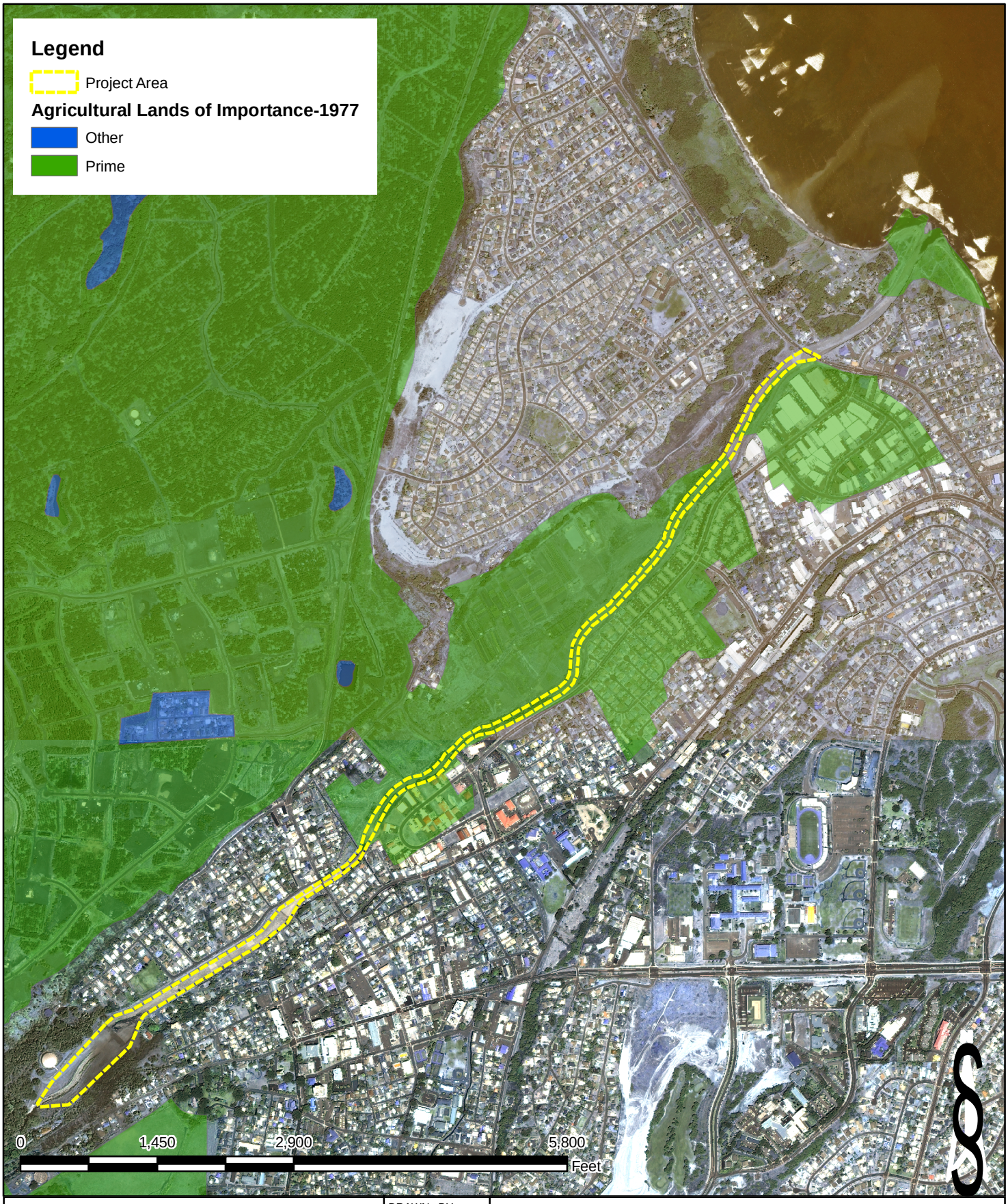
CHECKED BY: S.G.
REF: USGS & COM

`IAO STREAM FLOOD CONTROL EA

EXISTING LAND USES
`IAO STREAM
WAILUKU, MAUI, HAWAI`I

FIGURE 5 - 3



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DRAWN BY: A.E.H.
CHECKED BY: S.G.
REF: HDA

`IAO STREAM FLOOD CONTROL EA

AGRICULTURAL LANDS OF IMPORTANCE TO STATE OF HAWAI`I (ALISH): `IAO STREAM WAILUKU, MAUI, HAWAI`I

FIGURE 5 - 4

With the exception of Alternatives V and VI, there are no foreseeable long-term adverse land use impacts, as Alternatives I and III do not encroach into developed areas of the Wailuku community. Alternatives V and VI will result in long-term erosion and private property damage to key parcels of land along the stream.

Aesthetic impacts differ depending on the alternative chosen. Alternative I includes a fully lined concrete channel, which will take away the remaining natural alluvial channel of the 'Īao Stream without providing a means for instream migration. This would take away the aesthetic beauty of the stream, and affect aquatic biological resources that depend on the alluvial channel habitat for survival.

Alternative III offers a more natural alternative, following most of the existing stream alignment, with stream stabilization improvements consisting of boulders in the main channel low-flow section with RCC stream bank protection. The boulder-embedded low flow channel is more natural in appearance than a standard concrete stream bottom, and will minimize but not eliminate the visual impact to the existing natural quality of the 'Īao Stream (refer to the photos in Figures 4-4 and 4-5 for photos of RCC lining compared to natural stream bottom).

Alternative V would effectively remove all man-made flood control improvements since 1981. With time, the stream would be restored to a completely natural condition which may or may not become more aesthetically pleasing than its current state. Alternative VI would leave 7,200 feet of natural stream bottom, although erosion of side-slopes and levee undermining would continue.

COM will be responsible for the acquisition of land and easements in order to implement the proposed project improvements. The project will require three types of easements: 1) 4.78 acres of permanent channel improvement easements; 2) 0.32 acre of permanent joint use road easements; and 3) 2.06 acres of temporary work area easements. The total cost of real estate acquisition for easements is estimated at $394,000.00 according to USACE (Real Estate Planning Report, November 2007). The project is not expected to result in the need to relocate public utilities. No relocations under the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (PL 91-646, 42 USC 4601, 7 CFR 21) are anticipated. Table 5-1 provides a detailed breakout of the land areas involved.

Impacts to existing land uses are expected to be minimal because the affected land is vacant, no surface or subsurface minerals or cultural resources are known to exist, and no change in zoning is necessary for the proposed creation of the easements (Appendix L). COM has been notified of the acquisition actions needed to proceed, and coordination between the Federal sponsor and COM is ongoing.

Table 5-1: Proposed Project Easements

Expected Use of Easement	Size of Area	Permanent or Temporary
Channel improvement easements	4.78 acres	permanent
Joint-use road easements	0.32 acres	permanent
Work-area easements	2.06 acres	temporary

Source: Appendix L

5.3 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

Hazardous, Toxic and Radioactive Waste (HTRW) occurrences within the project area must be treated in compliance with AR 200-1 Environmental Protection and Enhancement, ER 200-2-3 on hazardous waste management procedures, and ER 1130-2-540 Environmental Stewardship Operations and Maintenance Policies as well as applicable Federal, state, and local environmental laws and regulations.

Under ER 1165-2-132, HTRW Guidance for Civil Works Projects, HTRW is defined as any material listed as a hazardous substance in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Dredged materials and sediments beneath navigable waters are exceptions to the list of identified HTRW.

HTRW initial assessment was conducted under USACE regulations (ER 1165-2-132) by the USACE, U.S. Army Engineer District, Honolulu. The report was completed in 1997 and revised in 2002, and is attached in Appendix D.

Existing Conditions

The results of the report have indicated that there are no existing or previous HTRW activities located in the project area. The 'Īao Stream basin has not been designated as a CERCLA action site, and no spills or other HTRW activities are known to have affected the project area in the past. There are no known Formerly Used Defense Sites in the project vicinity, according to USACE (2005).

Potential Effects and Mitigation

Under ER 1165-2-132, HTRW is defined as any material listed as a hazardous substance in accordance with CERCLA, with the exception of dredged material and sediments beneath navigable waters proposed for dredging. All available alternatives will consist of excavation of materials from the stream channel and its margins. As the project area does not contain HTRW materials, the excavated material is not deemed hazardous. Excess quantities of excavated materials from Alternatives I and III will most likely be recycled and used on other sections of the project. Any excess materials not recycled will be subject to

testing and evaluation for suitability of disposal in accordance with the EPA before disposal in the COM landfill. Therefore, no potentially damaging impacts will befall the surrounding environment.

5.4 NOISE

Sound travels through the air as waves of minute air pressure fluctuations caused by some type of vibration. Determination of noise levels are based on: 1) sound pressure level generated (decibels (dBA) scale); 2) distance of listener from source of noise; 3) attenuating and propagating effects of the medium between the source and the listener; and 4) period of exposure.

The average exterior noise level generally considered acceptable for projects receiving Federal assistance is 65 day-night sound level (DNL). The DNL represents the 24-hour average sound level for day, with nighttime noise levels increased by 10 dBA.

The Noise Control Act of 1972 requires Federal agencies to adhere to all applicable Federal, state, and local regulations when engaging in any activity which may result in the emission of noise. Supplemented by AR 200-1 Environmental Protection and Enhancement, any and all noise impacts will be properly mitigated to protect the health and welfare of the community.

The U.S. Department of Housing and Urban Development (HUD) is the lead Federal agency setting standards for interior and exterior noise for housing. These standards, outlined in 24 CFR 51, establish site acceptability standards based on day-night equivalent sound levels. The standards are used to designate noise levels as acceptable, normally unacceptable, or unacceptable. The acceptable exterior noise level for residential housing is 65 dBA or less, the normally unacceptable noise level is 65 dBA to 75 dBA, and the unacceptable noise level is above 75 dBA.

The Occupational Safety and Health Administration (OSHA), Occupational Noise Exposure guidelines, codified in 29 CFR 1910.95, set an action level of 85 dBA as the maximum acceptable noise level for the workplace.

Existing Conditions

Sensitive noise receptors are land uses, such as residences, schools, libraries, and hospitals that are considered to be sensitive to noise. There are no sensitive receptors within the project area, but residences are present adjacent and to the east of the project area, in Wailuku town. There are normally no noise sources within the project area.

Construction of the flood control improvement within the project area will involve varying degrees of excavation, grading and other typical construction activities depending on the alternative chosen. The

construction may generate significant amounts of noise. The surrounding residences may be impacted by the construction noise due to their proximity to the project. The actual noise levels produced during construction will be a function of the methods employed during the construction process. Typical ranges of construction equipment noise are shown in Figure 5-5.

Potential Effects and Mitigation

Noise levels will be temporarily increased during construction for all available alternatives due to the operation of heavy construction equipment. Residential areas will be affected more than commercial and undeveloped areas near the stream bank.

Implementation of BMPs and compliance with applicable Federal, state, and local laws as described above will mitigate construction noise levels to acceptable levels. Prior to the commencement of construction activities, a permit will be obtained from the HDOH for operation of construction equipment, power tools, and vehicles which will emit noise levels in excess of the allowable limits. There are no foreseeable long-term noise issues with any of the proposed alternatives.

5.5 AIR QUALITY

The Clean Air Act (CAA, 42 USC 7401, et seq.), as amended, authorizes the EPA to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment

Section 176 (c) of the CAA, requires Federal agencies to ensure that their actions are consistent with the CAA and with applicable air quality management plans (state implementation plans). Agencies are required to evaluate their proposed actions to make sure they will not violate or contribute to new violations of any Federal ambient air quality standards, will not increase the frequency or severity of any existing violations of Federal Ambient Air Quality Standards (AAQS), and will not delay the timely attainment of Federal AAQS.

Projects funded by the USACE are required to follow guidance from AR 200-1 and ER 200-2-3, to manage air emissions to protect human health and the environment as well as pollution prevention management, and to comply with all legally applicable and appropriate Federal, state, and local air quality control regulations.

Existing Conditions

The regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. There are no sources of criteria air pollutants associated with the project site.

Potential Effects and Mitigation

The major potential short term air quality impact of the project will occur from the emission of fugitive dust during construction. An effective dust control plan will need to be implemented in order to eliminate emissions of fugitive dust during project construction in order to comply with State of Hawai'i air pollution control regulations; HAR Title 11, Chapter 59 and 60.1 for AAQS and Air Pollution Control (APC) respectively. HAR 11-60.1-33 'Fugitive dust' lists the following as appropriate measures to take in order to prevent fugitive dust: "use of water or suitable chemicals for the control of dust generated from grading and moving of dirt; installation of hoods, fans, and other fabric filters to minimize dust when applicable; covering of open and moving-bodied trucks transporting materials which may result in fugitive dust; prompt removal of earth or other materials from paved roads that may result in fugitive dust".

During construction, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project site. Standards for nitrogen dioxide set by the NAAQS are on an annual basis, and short-term construction is not likely to contribute to the violation of set annual standards. Carbon monoxide emissions will be very low and should be insignificant compared to normal vehicular emissions.

5.6 TRAFFIC

The proposed alternative designs consist of modifications to the existing flood channel and do not consist of new land uses, structures, or developments that would require additional infrastructure needs. Therefore, the available alternatives will not affect existing traffic conditions.

As there are no foreseeable impacts to existing traffic conditions from the alternatives, a study was not conducted for this project.

5.7 RECREATION AND RESOURCE USE

Federal regulation 36 CFR 327, supplemented by ER 1130-2-405, contains guidelines for rules and regulations regarding USACE public use of water resource development projects. The policy of the USACE is to "…manage the natural, cultural and developed resources of each project in the public interest, providing the public with safe and healthful recreational opportunities while protecting and enhancing these resources." Determination of whether recreational and resource uses are substantially affected is based on the following: 1) degree to which uses of recreational resources are eliminated or

displaced; 2) duration of time that recreation and resources are inhibited; and 3) the cumulative effects of temporary disruptions of recreational use.

Existing Conditions

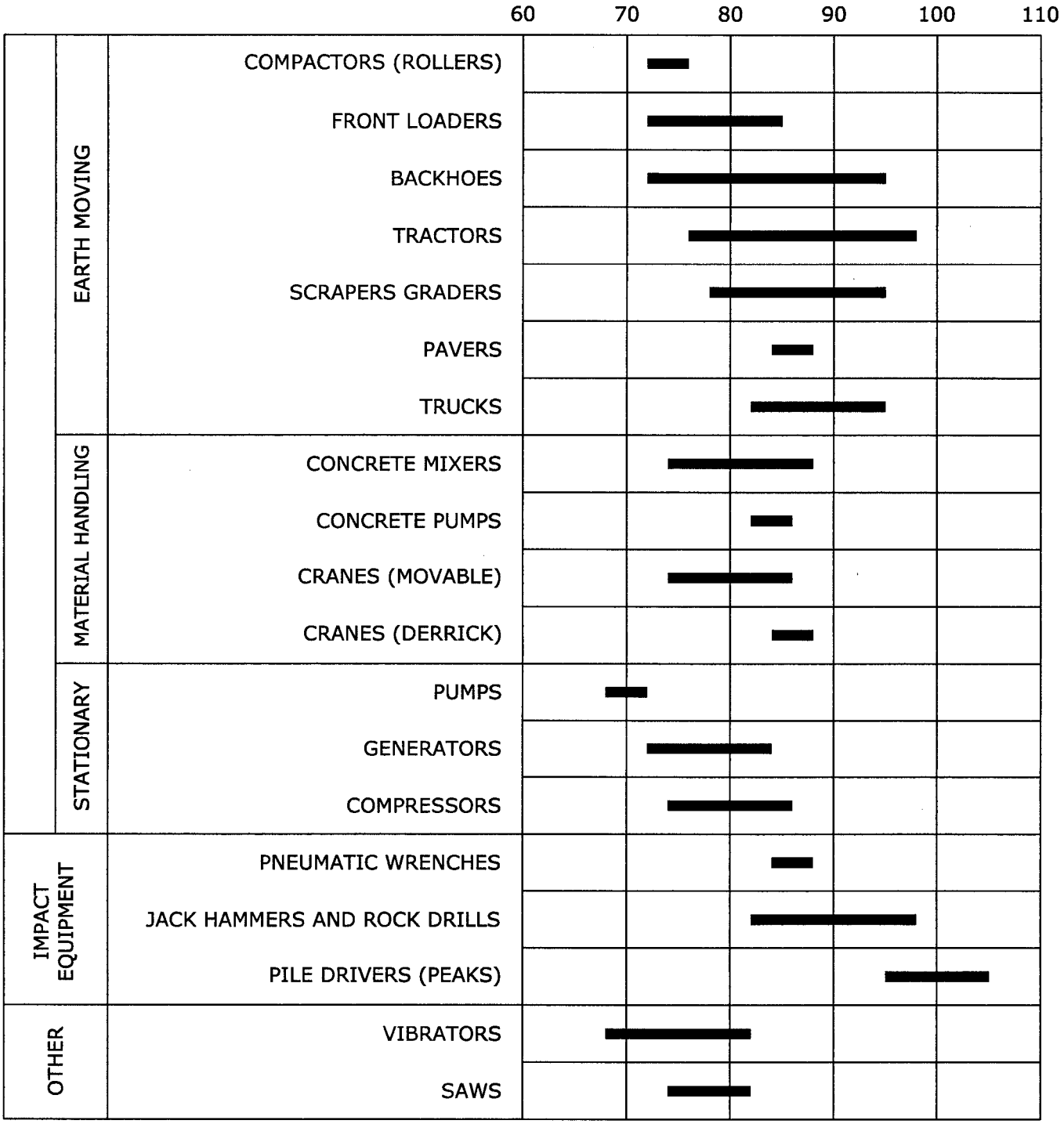
The ʻĪao Valley is a pristine area on Maui with important historical significance and visited by numerous people each year. It is a major tourist attraction featuring the ʻĪao Needle, a natural rock pinnacle, and the ʻĪao Stream. Surrounded by the walls of the Puʻu Kukui Crater, ʻĪao Stream offers a natural hiking environment with pristine views.

Potential Effects and Mitigation

Recreational areas surrounding the ʻĪao Stream will not be accessible to the public until construction to implement modifications to the stream is completed. This short-term access impact is inevitable for all available alternatives due to construction activities.

In response to public comment regarding added recreational features of the project, the USACE is currently working with PW to look into recreational possibilities to be incorporated with the chosen alternative, such as jogging and walking paths along the levees. This will provide additional recreational uses to the ʻĪao Stream area in the long-term.

Other long term impacts differ with respect to each of the available alternatives. Alternative I would replace 70% of the existing natural alluvial channel with concrete, which would create adverse impacts on the natural appearance of the ʻĪao Stream, as well as negative impacts on the aquatic biological habitat within the alluvial channel. This would impact recreational resources along the ʻĪao Stream in the long term. Alternative III provides a grouted boulder invert channel following the existing stream alignment, allowing for a more natural alternative to stream stabilization. In the long term, this low-flow channel will minimize (but not eliminate) the visual impact to the existing natural quality of the stream. More importantly, the proposed mitigation measures of Alternative III would enable survival of aquatic organisms. Alternative V would remove all man-made improvements and allow the ʻĪao Stream to return to its natural state, thereby enhancing the recreational quality of the stream area. With no flood control devices however, recreational activities may be restricted for safety reasons. Alternative VI would keep 7,200 feet of natural stream bottom, but would not protect against continued erosion and levee undermining.



NOTE: BASED ON LIMITED AVAILABLE DATA SAMPLES

ENVIRONET, INC. PRESERVING EARTH'S RESOURCES FOR THE FUTURE	DRAWN BY: I.K.N.	IAO STREAM FLOOD CONTROL EA	
	CHECKED BY: R.C.A.	TYPICAL CONSTRUCTION NOISE LEVELS	FIGURE 5–5
	REF: D.L. ADAMS & ASSOC.		

5.8 ECONOMIC AND SOCIAL RESOURCES

5.8.1 EO 12898 Environmental Justice

EO 12898 on Environmental Justice directs all Federal agencies to achieve environmental justice, by identifying and addressing disproportionately high adverse human health or environmental effects of its actions on minority and low-income populations within the US and its territories. Assessment of possible adverse impacts resulting from implementation of any of the available alternatives indicates there are no disproportionate negative impacts toward minority and low-income populations.

All available alternatives, with the exception of Alternative VI, will generate short-term economic vitality for the island by providing temporary construction opportunities for the duration of the project.

Alternative I would provide long term positive economic prosperity to the growing community of Wailuku by flood-proofing and eliminating ongoing stream bank erosion. As part of this alternative, the existing flood plain area is proposed to be utilized for future development opportunities. The proposed concrete channel lining, however, may negatively impact the visual quality of the ʻĪao Stream by creating a harsher, less natural environment.

Alternative III is designed to incorporate the existing flood plain as is, and channel lining proposed for this design will provide adequate flood-proofing and stream bank stabilization while incorporating design elements and mitigation measures to minimize or mitigate for impacts to the natural environment. In the long term, these measures will prevent damage to life and property, allowing for development and growth of the community with minimal modifications and will be less intrusive to the existing environment.

Alternative V would effectively remove all man-made flood control improvements installed since 1981. The Wailuku community would be provided with a state-of-the-art, flood-warning system in place of flood control improvements. Alternative VI would leave ʻĪao Stream in its current state, allowing for further streambank erosion, and the area would revert to a Flood Hazard Area. These alternatives do not provide tangible protection from flood and erosion related damages, and would hinder future development in the area. In the long term there is the possibility of loss of life and damage to property. Loss of life will affect all citizens, regardless of income status. Damage to property resulting from flood and erosion may have an adverse impact on minority and lower income populations that cannot afford flood insurance and will not be able to rebuild.

Potential Impacts and Mitigation Measures

Cultural impacts include potential negative reactions from the community to Alternatives I and III, a positive reaction to Alternative V, and no change in current reactions with Alternative VI. There is a cyclical history of water shortage on Maui, and water allocation between residential and agricultural use has always been a sensitive subject. In addition to the community's concern regarding social and recreational values of the ʻĪao Stream, any proposed flood control related project creates concern for residents regarding possible water diversion, erosion, and adverse impacts to the natural environment. Alternatives I and III, though the most beneficial to prevent continual erosion and flooding, would have a negative impact on tourism by detracting from the natural beauty that is associated with ʻĪao Stream and ʻĪao Valley. Alternative III mitigates this somewhat by incorporating an RCC lined channel with a low-flow channel using irregular boulder- and cobble-sized rock to form microhabitat and refuge for fish and invertebreates and to facilitate upstream migration of aquatic organisms. Alternative V appears to generate the most positive reactions from the community, as most residents in the high flood area have moved in after the initial completion of the ʻĪao Stream Flood Control Project and have not witnessed any severe floods in their lifetime. Alternative VI would likewise be more acceptable to the community as it retains 7,200 feet of natural stream bottom. Erosion, however, is a very real problem for many of the residents and they welcome erosion prevention improvements. A public scoping meeting was held on August 12, 2003 to address these public concerns. Consultation with resource agencies has been pursued throughout the course of this project, and will continue throughout the design and construction phases of the project to ensure all environmental concerns are being addressed and mitigated to the maximum extent practicable. This will be conveyed to the Wailuku community.

5.9 ACCESSIBILITY FOR MAINTENANCE

Ease and accessibility for maintenance can be important to COM as the local sponsor of the project. In its current state, the ʻĪao Stream requires regular channel repair by bulldozers, particularly after every storm event. Eroded material is also removed from the concrete channel located under the Waiehu Beach Road Bridge. The need for maintenance would be lessened if Alternative I or III were implemented. The resulting stream improvement in Alternative I trapezoidal concrete channel with a 40-foot bottom width would be the easiest to maintain by COM because the stream channel would be concrete lined and accessible to maintenance vehicles. Alternative III with its boulder invert channel would be somewhat difficult to maintain because the low-flow channel portion would not be accessible by maintenance vehicles, although the RCC areas would. This more naturally appearing stream improvement may necessitate some manual maintenance by COM personnel. Alternative V which requires removal of flood control improvements would not require any maintenance because the stream would be returned to its

natural state. Alternative VI would require continued placement of boulders at eroding levee toes in an attempt to temporarily slow or halt erosion.

While Alternatives I and V appear to offer the greatest ease of maintenance, both represent the extremes because Alternative I would not be environmentally acceptable, and Alternative V, while environmentally sensitive, would not meet the project objective of flood and erosion control. Alternative VI likewise does not meet project objective. Alternative III would be environmentally sensitive and would meet the project objective of flood and erosion control.

5.10 CUMULATIVE IMPACTS

Cumulative impacts are two or more individual effects which, when considered together, compound or increase the overall impact. Cumulative impacts can arise from the individual effects of a single action or from the combined effects of past, present, or future actions. Thus, cumulative impacts can result from individually minor but collectively significant actions taken over a period of time. The cumulative impacts of implementing the proposed action along with past and reasonably foreseeable future projects proposed were assessed based upon available information.

Two of the available alternatives, I and III, attempt to modify the existing flood channel system to prevent inevitable project failure, the loss of life, and extensive property damage. Positive cumulative impacts created by these modifications will allow for long term social and economic growth without hindrance from seasonal flooding. Government and local fiscal resources will not be strained to provide emergency and repair support for flood damage to properties and rescue teams responding to flood-related emergencies.

Alternative I would negatively impact the aquatic fauna of the 'Īao Stream by replacing 70% of the remaining natural alluvial channel with a concrete lined channel. This would lead to long-term deterioration of the scenic quality of the downstream portion of the 'Īao Stream, which may in turn affect tourism and the economy. It is important to note that the main tourist attraction is the 'Īao Valley, which is upstream of and separate from the project area.

There are few foreseeable negative cumulative impacts related to Alternative III. The proposed grouted boulder invert channel will follow the existing stream alignment, allowing for a more natural alternative to stream stabilization. With the incorporation of boulders, the low-flow channel is more environmentally acceptable, providing a habitable area for existing aquatic fauna, and will somewhat mitigate the visual impact to the existing natural quality of the stream caused by the RCC channel walls. In the long-term,

this would help preserve the existing natural resources and promote growth of terrestrial and riparian vegetation.

Alternative V would allow the 'Īao Stream to return to its natural state. With the use of a state-of-the-art flood warning system, lives can be saved, but continual erosion will cause property. The inconvenience and cost of repairs is a serious concern.

Alternative VI would retain 7,200 feet of natural stream bottom, but would not prevent against continued erosion and levee undermining. Structures along the left bank would continue to be endangered under this alternative.

COM is planning an upgrade to the existing 'Imi Kālā Street Bridge. This project has necessitated the inclusion of several revisions to the original Corps' constructed 'Īao Stream Flood Control Project. Notable revisions include the stream bank excavation and channel widening in the area directly upstream from the bridge to reduce WSELs and erosion potential on the right bank. There is the potential that buried cultural resources may be adversely impacted during construction associated with the widening of 'Īao Stream. The USACE will include monitoring by a qualified archaeologist to counter such potential adverse effects. Although the bridge upgrade project has slightly changed the scope of the proposed Flood Control Project, this is not considered a cumulative impact to the natural or social environment, other than the benefit to the community of having an improved bridge.

The County is also planning to extend 'Imi Kālā Street to connect to Kahekili Highway, as part of the development of the Hale Mua affordable housing subdivision. This may cause changes to traffic in the vicinity of the proposed project, but not as a result of any of the project design elements.

No other projects are planned for the channel or in the vicinity of the channel that would compound or increase the impact of the proposed project. Areas surrounding the channel are being developed into residential and commercial communities; however these developments are not anticipated to have a significant cumulative impact on the proposed project.

5.11 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The USACE believes that the project modification cannot be avoided due to the need to provide flood control for the Wailuku community. Implementation of the recommended alternative will prevent inevitable project failure, loss of life, and extensive property damage.

Alternative I – Long term negative impacts include and environmental degradation of the 'Īao Stream by creating a harsher, sterile environment thereby making it a less desirable visitor experience to the area. This overall effect could slow local economic growth in the long term. Natural resources are impacted as

existing aquatic species will not be able to adapt to the increased flow speed of water in the channel brought upon by the concrete lining.

Alternative III – Long term negative impacts of visual and environmental degradation of the stream is minimized by or compensated for by mitigation measures. A special low-flow channel is designed to minimize habitat loss for existing aquatic species in the stream. The grouted boulders in the low-flow channel will minimize, but not eliminate the negative visual impact to the natural character of the stream caused by the RCC channel lining. Proposed mitigation measures would enable native organisms to migrate up and down the stream via the low-flow grouted-boulder invert channel and several supplemental mitigation measures (Section 3.0).

Alternative V – Resources invested in the removal of all man-made flood control structures would be irreversible. Replaced by a state-of-the-art flood warning system, the natural environment of the 'Īao Stream would be returned, but at the cost of loss of property and possibly life in future flood events.

Alternative VI – Stream banks would continue to erode, and levees would be further undermined. This would lead to an eventual detrimental impact to structures along the stream banks, and potential loss of property and life in future flood events.

5.12 PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Alternatives I and III would impact the existing stream environment with flood control improvements, although the impacts of Alternative III would be mitigated to an acceptable level. Alternatives V and VI would impact the existing community with floods and related erosion. As stated in previous sections, temporary noise and sedimentation impacts during construction (e.g., a temporary increase in stream turbidity if water is flowing at the time of construction) are unavoidable. Noise and sedimentation problems will be mitigated to the extent possible through the use of BMPs during construction. For Alternatives I and III, there will be changes in the visual appearance of the stream, although the impact of Alternative III would be mitigated to the maximum extent practicable. Adverse environmental effects from noise and construction-related sedimentation will be temporary and mitigated through BMPs, and are thus not considered significant.

5.13 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

5.13.1 Direct, Indirect and Cumulative Impacts

Direct Impacts. Direct impacts are environmental effects that are caused by the action and occur at the same time and place. A typical example of direct impacts are effects of construction activities on the

immediate surrounding environment during the period such operations are taking place. During construction activities the proposed project would result in unavoidable, short-term, insignificant direct impacts.

Indirect Impacts. Indirect impacts are effects that may occur removed in distance or time from the proposed project. Indirect impacts may include growth inducing impacts and other effects related to changes in land use patterns, population density or growth rate, and related effects on air, water, and other natural systems.

The proposed project is intended to correct deficiencies associated with the existing Flood Control Project constructed in 1981, and to prevent further streambed erosion, loss of life, and property damage during flood seasons. By incorporating recommended mitigation measures, it is not expected to result in adverse secondary impacts on the area's resident population, land use patterns, facilities infrastructure, and natural environment.

Table 5-2 on the following page provides a summary of the environmental impacts associated with the three available alternatives proposed for the project. Alternative VI is not included in the table because it does not meet the project objectives.

Table 5-2: Summary of Project-Related Impacts

Environmental Attribute	Alternative	Direct Impact	Indirect Impact	Cumulative Impact
Oceanography, Hydrology, and Flooding	I	○	+	+
	III	○	+	+
	V	-	-	-
Terrestrial and Aquatic Biological Resources	I	-	○	-
	III	-	○	-
	V	+	+	+
Geology and Soils	I	○	+	+
	III	○	+	+
	V	-	-	-
Threatened and Endangered Species	I	○	○	○
	III	○	○	○
	V	○	○	○
Historic and Cultural Resources	I	○	○	○
	III	○	○	○
	V	○	○	○
Land Use and Aesthetics	I	-	-	-
	III	-	○	○
	V	+	○	○
Hazardous, Toxic and Radioactive Waste (HTRW)	I	○	○	○
	III	○	○	○
	V	○	○	○
Noise Quality	I	-	○	○
	III	-	○	○
	V	-	○	○
Air Quality	I	-	○	○
	III	-	○	○
	V	-	○	○
Water Quality	I	-	○	○
	III	-	○	○
	V	-	-	-
Traffic	I	○	○	○
	III	○	○	○
	V	○	○	○
Recreational and Resource Use	I	-	-	-
	III	○	○	○
	V	-	-	-
Economic and Social Resources	I	+	+	+
	III	○	+	+
	V	-	-	-
Environmental Justice	I	○	○	○
	III	○	○	○
	V	○	○	○

○ No significant impact anticipated

\+ Beneficial impact

\- Adverse (insignificant or significant) impact; mitigation required

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6.0 RISK AND UNCERTAINTY

Risk addresses differences between planned and actual outcomes and includes methods for quantifying risk in economic terms. Federal Flood Control Projects generally follow guidelines from the Flood Control Act of 1948, Section 205, PL 80-858, as amended, and USACE supplemental risk assessment, EM 1110-2-1619 on Flood Control Projects. The USACE believes that the project modification cannot be avoided due to the need to provide flood control for the Wailuku community. Implementation of the recommended alternative will prevent inevitable project failure and reduce the loss of life, and extensive property damage.

Alternative I may negatively impact the existing natural environment of the 'Īao Stream, leading to degradation of aquatic fauna and eventually the aesthetic quality of the stream as a whole. The proposed concrete lining of 70% of the remaining natural alluvial channel may affect tourism and economic viability of the 'Īao Valley, as it is a well-known location and major revenue-generating location on Maui. This is unlikely however, given the two mile distance between the project area and the valley itself, which is the tourist destination.

Alternative III will provide a more environmentally acceptable design with the integration of a low-flow grouted-boulder invert channel to mimic the natural habitat of the 'Īao Stream and to facilitate upstream and downstream migration of native organisms. The grouted boulders in the low-flow channel will minimize, but not eliminate the negative visual impact to the natural character of the stream caused by the RCC channel lining. Proposed mitigation measures include alignment of the low-flow channel along vegetated stream banks to allow overhanging vegetation to shade the channel and reduce water temperatures, and a retrofit of improved portions of the channel that are currently lacking low-flow design elements.

Alternative III is designed to facilitate upstream and downstream migration of aquatic organisms, given sufficient water flow. Stream flow restoration is a topic that is currently under discussion by the CWRM, state and federal resource agencies, community groups, and private entities that hold licenses for diversion and out-of-stream consumptive use of 'Īao Stream Water. This decision is outside the function and authority of the USACE, however. If and when stream flow is partially restored, the low-flow design elements of Alternative III will function to enhance passage of native stream fauna. To mitigate for unavoidable impacts to the affected natural environment, retrofit design elements have been included to facilitate the movement of native organisms through the modified channel area. These elements include a step structure at the 22-foot vertical drop (Station 97+23), widening existing low-flow channel areas, installing low-flow channel segments in existing flat-bottomed cement channel segments and in the center

of the existing debris basin, blocks along the sloped portions of the existing channel to provide a resting place for climbing organisms, and an alignment along the vegetated portions of the left bank to provide shade and reduce water temperatures. These mitigation measures have been proposed as compensation for unavoidable impacts, and have been agreed to in a revised mitigation recommendation letter by the USFWS (Appendix J).

Alternatives V and VI do not provide an acceptable level flood or erosion control, and are considered high risk options in the long term.

7.0 ECONOMIC ANALYSIS

The Water Resource Planning Act (WRPA) of 1965, supplemented by Principles and Standards (the P&S, 1973) and Principles and Guidelines (the P&G, 1983) provides guidelines for Federal water related resource projects.

> "The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements” (P&G, 1983).

Economic evaluations for this project were conducted in accordance with the P&G as well as USACE policy. The complete report entitled “Economic Update, ‘Īao Stream Flood Control Project, Wailuku, Island of Maui, State of Hawai‘i” (Appendix K) is included. The objective of the economic analysis is to determine the alternative that will reasonably maximize net National Economic Development (NED) benefits. This is accomplished by comparing the average annual benefits and costs of the alternatives being considered. The alternative that meets project objectives and has a benefit-cost ratio greater than one and the highest net benefits will be designated the NED alternative. Costs and benefits occurring at different points in time are converted to an average annual equivalent basis over the 50-year period of analysis using the federal discount rate prescribed for water resource projects.

This economic analysis compares the benefits and costs related to three of the five alternative plans proposed for ‘Īao Stream Flood Control Project. Cost Estimates and detailed discussions are provided in the Economic Update (Appendix K). Flood plain management, including flood control and prevention, contributes to the NED objective by improving the net productivity of flood-prone land resources, either by increasing the output of goods and services and/or by reducing the cost incurred in using those resources. These improvements in economic efficiency, or project benefits, are estimated by comparing the most likely future conditions without the project (the “without-project” condition) with the most likely future conditions resulting from the implementation of flood damage reduction measures (the “with-project” condition).

7.1 GENERAL

In this economic analysis, both costs and benefits are expressed at an estimated October 2007 price level. Costs and benefits occurring at different points in time are converted to an average annual equivalent basis over a 50-year period of analysis using the federal discount rate prescribed for water resources

projects. This rate is currently set at 4.875 %. The project base-year, or first year of project operation, is FY2013. The 50-year period of analysis is from FY2013 through FY2062, inclusive.

The objective of this economic analysis is to determine the alternative that will reasonably maximize net NED benefits. This is accomplished by comparing the average annual benefits and costs of the alternatives being considered. The alternative with a benefit-cost ratio greater than one and the highest net benefits will be designated as the NED alternative.

7.2 ALTERNATIVES.

The six alternatives initially considered in this study are summarized in Table 7-1. Of these, only the performance of Alternative III was evaluated in detail using the Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) computer program. Alternatives I and II are assumed to provide the same benefits as Alternative III when designed for the same degree of protection. Alternative IV, levee reconstruction, is not considered a viable solution since it does not address erosion and undermining of levees. It is therefore not included in the NED analysis. Alternative V, removal of the existing flood control improvements and the restoration of the stream to its original natural condition, will remove all existing project flood control features for flooding events of all frequencies. Although for the purposes of this comparison it is assumed to have zero benefits, it is likely to have negative benefits to the extent that flooding events with a return period of less than 25-years are likely to cause damage in excess of the without project condition. Consequently it was not analyzed in this NED analysis. Alternative VI is represented as the "without project" scenario in the Economic Analysis (Section 7).

Table 7-1: 'Īao Stream Alternative Plans

	Description
Alternative I	Trapezoidal Concrete-Lined Channel
Alternative II	Rectangular and Compound Channel
Alternative III	Roller Compacted Concrete and Boulder Invert Channel along Existing Alignment
Alternative IV	Levee Reconstruction
Alternative V	Removal of Flood Control Improvements
Alternative VI	No Action

7.3 METHODOLOGY.

Inundation damages are computed by combining an inventory of structures in the floodplain with the anticipated extent and effects of the flooding from various storms in the without-project and with-project alternatives. Flooding associated with 1-year, 10-year, 25-year, 20-year, 50-year, 100-year, the verify 222-year SPF, and 500-year events were estimated using the USACE' HEC-RAS computer software. The areas of flooding and the flooding depths associated with the different events were computed as discussed in the hydrology section of this report.

The analysis assumes that in the without-project condition the existing levees along the right bank of ʻĪao Stream will fail in a rainfall event of 25-year of greater return period but not in the case of smaller events. This is expected to cause flooding along the entire length of the over-bank as a result of levee and bank failure in one or two places. In order to represent this condition, levees were specified in the HEC-FDA model to represent both levees and river banks, with levee heights artificially set halfway between the 20-year and 25-year flood stages. For the with-project condition, levee heights were set to reflect the levee and river bank elevations of Alternative III, which are the same as those now existing along ʻĪao Stream. A list of the levee heights specified in the HEC-FDA model for the without-project and with-project conditions is provided in Table 7-2.

Table 7-2: Levee Heights in HEC-FDA Model

	Without-Project Levee Height (ft)	With-Project Levee Height (ft)
Reach 1	14.39	20.15
Reach 2	41.03	52.80
Reach 3	61.22	72.80
Reach 4	88.43	95.80
Reach 5	111.83	118.63
Reach 6	139.50	144.70
Reach 7	147.63	154.80
Reach 8	179.60	186.20

In order to determine the economic effects of flooding on structures in the floodplain, structure values, content values, first floor elevations, depth-damage curves, and the estimated water surface profiles for different frequency events were entered into the HEC-FDA computer program. HEC-FDA compares the flood heights for different events with the first floor elevations for each structure in the flood plain. This determines the expected height of flood waters at each structure for any given flood event. HEC-FDA analyzes the percent of damages to each structure and its contents associated with each level of flooding.

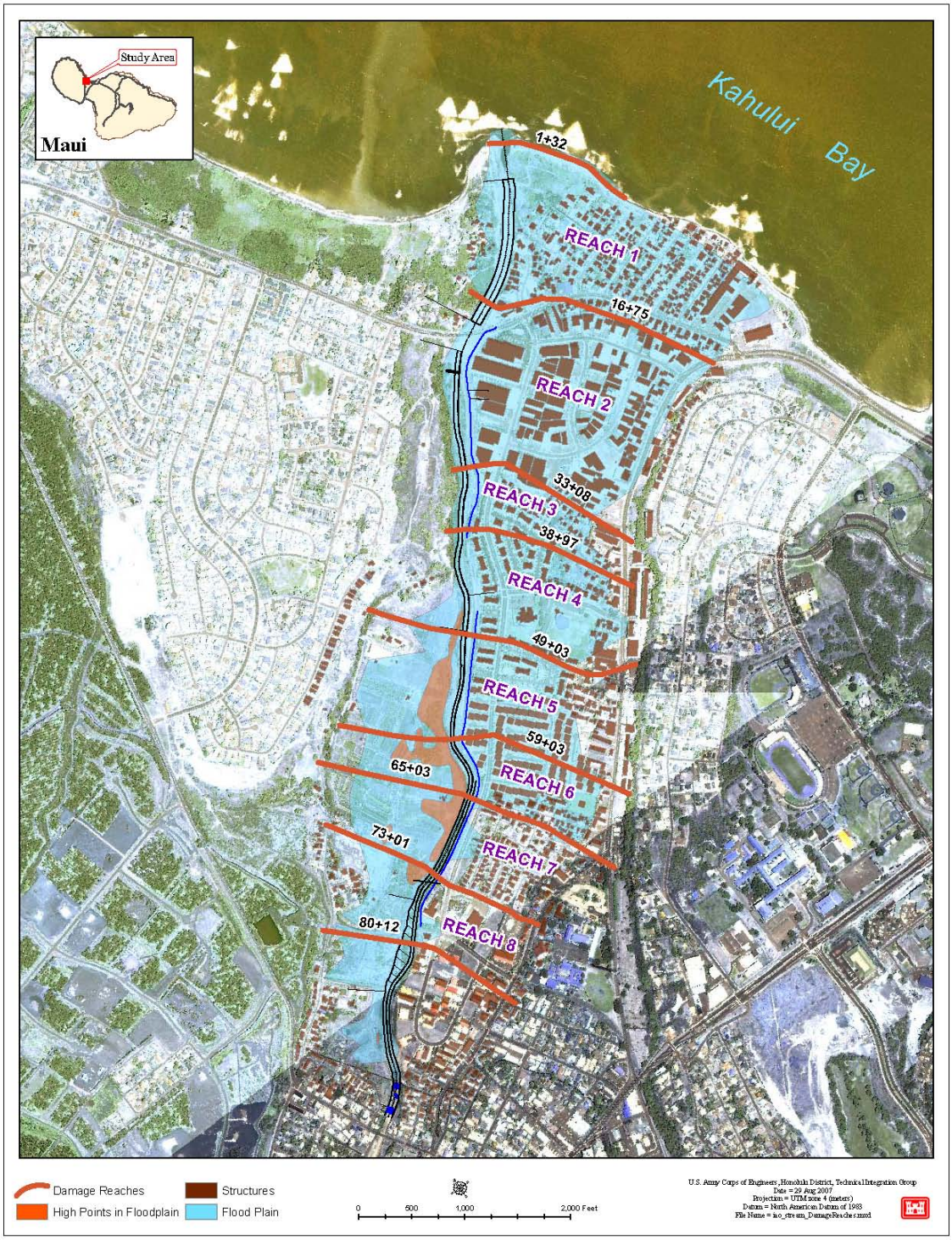
The percent damages are multiplied by the structure or content value to arrive at dollar damages. This procedure is performed for every structure in the flood plain with results consolidated by reach and then integrated over the range of probabilities that flooding of different intensities will occur. The HEC-FDA program also explicitly takes into consideration the uncertainty of the engineering and economic variables involved in calculating flood damages.

7.4 STRUCTURE INVENTORY.

The structure inventory for this economic analysis is composed of all residential and commercial buildings in the SPF (222-year) floodplain. Structures were identified by the use of a geographical information system (GIS) map with layers for TMK parcels, the SPF floodplain, an aerial survey topographic map with 5-foot contour lines, and aerial photographs of the project area. In this analysis, the residential category includes single-family residences, and also multi-unit low-rise condominium and apartment buildings. The commercial structures category includes buildings serving commercial, industrial, and public purposes.

The study area is located in Wailuku along 'Īao Stream on the north coast of the island of Maui. Structures in the SPF-floodplain are located within an area approximately bounded by 'Īao Stream to the Northwest, Lower Main Street and Mill Street to the Southeast, 'Imi Kālā Street to the Southwest, and Kahului Bay to the Northeast. The ground elevations range from about 186 feet above msl at the upstream end of the study area to about eight feet above msl near Kahului Bay. There are about 362 single family residential structures (SFRs) in the 222-year floodplain. The average age of SFRs is about 31 years, and about a third were built after 2000. In addition to the SFRs, 45 multi-unit residential structures containing 464 condominium units were built between 1993 and 2002. The total replacement cost less depreciation value of residential structures in the SPF floodplain is about $111 million and total contents value is about $43 million. The total replacement costs less depreciation of commercial structures in the 222-year floodplain is about $83 million and the total commercial contents value is about $121 million. The residential and commercial structures together have a replacement cost less depreciation value of about $194 million and damageable contents worth about $164 million. For the purposes of this analysis, the flood plain was divided into eight reaches, all on the right bank of 'Īao Stream (refer to Figure 7-1).

Figure 7-1: Damage Reaches



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7.5 DEPTH-DAMAGE FUNCTIONS.

The depth-damage functions or "curves" used in this study for SFRs are from the Economic Guidance Memorandum 04-01, "Generic Depth-Damage Relationships for Residential Structures with Basements (Institute for Water Resources (IWR), 2004)".

Because the multi-unit residential structures in the 'Īao Stream floodplain are similar in structure to large two story residential homes (although significantly larger), the IWR depth damage curves for SFR structures with two or more stories without basements were used to estimate structure and content damages.

Depth damage functions for commercial structures and contents developed for the New Orleans District of the Corps of Engineers (MVN) were used to evaluate damages to commercial structures and contents (Gulf Engineers and Consultants (GEC), "Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSVRs) in Support of the Jefferson and Orleans Flood Control Feasibility Studies," Baton Rouge, Louisiana, June 1996). Depth-damage functions developed for MVN were also used to assess damages to parked vehicles.

7.6 EVALUATION OF OTHER DAMAGE CATEGORIES.

In addition to inundation damages to structures and vehicles, three other damage categories were evaluated. Damages to yards and outside property were evaluated using data from previous Corps of Engineers studies of flood damages in Niu Valley on the Island of Oahu in 1988. These data were also used to evaluate the costs of emergency services. Reduction in the operating cost of the National Flood Insurance Program was evaluated using average operating costs per policy of $192 as specified in Economic Guidance Memorandum 06-04.

7.7 BENEFITS SUMMARY.

Table 7-3 summaries the without-project and with-project damage and the resulting benefits. Total without-project damages are about $2,579,000. With-project damages are about $7,000. The total benefits for these damage categories are about $2,572,000. As noted earlier, Alternatives I and II, although not evaluated, are assumed to have the same benefits as Alternative III. Alternative VI is represented as the "without project" scenario in the economic analysis.

Table 7-3: Damage Summary

	Without Project Damages and Costs ($)	With Project Damages and Costs ($)	Benefits (Damages or Costs Prevented) ($)
Residential structures and contents	923,000	4,000	919,000
Commercial structures and contents	1,438,000	2,000	1,436,000
Vehicles	88,000	1,000	87,000
Yard and Outside Property Damage	73,000	0	73,000
Emergency Assistance Costs	38,000	0	38,000
Flood Insurance Operating Costs	19,000	0	19,000
Total	2,579,000	7,000	2,572,000

7.8 PROJECT COSTS.

Table 7-4 lists the various costs involved in constructing and maintaining the improvements to the 'Īao Flood Control Project and changes in annual operating and maintenance costs associated with each alternative.

Table 7-4: Project Costs

	Alternatives			
	I	II	III	IV
Project First Cost[1]	$40,641,882	$55,187,961	$30,809,128	$40,641,882
Months of Construction	30	30	22	30
Interest During Construction (months, 4.875%, EOY)	$1,607,371	$2,208,762	$691,982	$1,607,371
Investment Cost	$42,249,253	$57,396,723	$31,501,110	$42,249,253
Amortized Investment Cost	$2,269,726	$3,083,483	$1,692,312	$2,269,726
Difference in Annual O&M[2]	-$61,175	$0	$122,352	-$61,175
Total Average Annual Cost	$2,208,551	$3,083,483	$1,814,664	$2,208,551
Total Average Annual Cost (Rounded)	$2,209,000	$3,083,000	$1,815,000	$2,209,000

[1]Includes PED, S&A, EDC, and LERRD.
[2]The difference between without-project operation and maintenance (O&M) of $147,307 per year and O&M for with-project alternatives.

7.9 BENEFIT-COST RATIOS AND NET BENEFITS.

Two criteria are applied in order to choose the plan that reasonably maximizes NED benefits: the plan must have a benefit-to-cost ration greater than one, and must also have the greatest net benefits. Table 7-5 shows the average annual benefits, the average annual costs, the benefit-cost ratios and the net benefits of the four alternatives considered in the analysis. Alternatives IV and VI were eliminated from consideration because they do not meet project objectives. Alternative V was not analyzed because it is assumed to have a benefit/cost ratio of zero or less.

Table 7-5: Benefit Summary

	Alternatives		
	I	II	III
Average Annual Benefits	**$2,572,000**	**$2,572,000**	**$2,572,000**
Average Annual Costs	$2,209,000	$3,083,000	$1,815,000
Benefit/Cost Ratio	1.2	0.8	1.4
Net Benefits	$363,000	($511,000)	$757,000

7.10 NATIONAL ECONOMIC DEVELOPMENT PLAN.

According to the information in Table 7-5, Alternative III has a benefit-cost ratio greater than 1 and the highest net benefits. Therefore, the recommended plan is Alternative III, with a benefit-cost ratio of 1.4 and net benefits of $757,000.

7.11 RISK AND UNCERTAINTY.

As noted above, the HEC-FDA software program explicitly takes into consideration the uncertainties related to the variables involved in calculating flood damages. The uncertainties of elevations, depth-damage functions, project performance of Alternative III, and frequency/discharge and stage/discharge functions are described in the economic appendix.

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8.0 COMMENTS AND COORDINATION

NEPA of 1969, as amended, CEQ regulations (40 CFR 1500-1508); ER 200-2-2, Environmental Quality Procedures for Implementing NEPA; and Chapter 343, HRS and Act 50, as amended, require public involvement and agency consultation at various stages of the development of the EA process.

8.1 PUBLIC INVOLVEMENT

Public participation is organized in the form of public posting and agency consultations.

8.1.1 Agency Coordination

Public posting as well as individual notices were mailed to Federal, State, and county resource agencies in 1996 through 1997. Comments and feedback from various agencies are included in Appendix H. Throughout the development of the EA document, resource agencies have been consulted for concurrence with the preferred alternative and all proposed mitigation measures. A site visit to the project area was conducted in March of 2008 with representatives from COM, USACE, USFWS, and DLNR-DAR to discuss potential mitigation measures for Alternative III impacts. A copy of the trip report has been included as Appendix I. A revised mitigation recommendation letter from the USFWS, in which they confirm their concurrence with proposed mitigation, has been included as Appendix J.

8.1.2 Public Scoping Meetings

A public scoping meeting was held on August 12, 2003. Notification of the meeting was circulated via posting of the meeting notice in the daily paper, the *Maui News*. Meeting notices were mailed to potential stakeholders and community associations. The scoping meeting was held at the Wailuku Community Center, 395 Waena Place, Wailuku, Maui, Hawai'i.

A summary of questions and comments made during the public scoping meeting is provided in Table 8-1. A second, informational public meeting is planned for the review of this draft environmental assessment report.

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Table 8-1: Summary of Comments, Public Scoping Meeting

Name	Affiliation	Comment	Response
Charmain Tavares	Maui County Council	Will stream restoration be evaluated in the EA? Need to contact Water Dept. Recreational components should be considered. Economic evaluation needed before proceeding w/engineering improvements	Stream restoration is currently a topic being pursued by several community organizations and the County. Any decisions about stream flow restoration must be made by the CWRM. The preferred alternative is designed to facilitate up-stream migration of aquatic organisms and maintenance of habitat supportive of aquatic life, should restoration of stream flow be achieved.
Joe Bertram III	Greenways Maui	Will Cultural Assessment involve considering stream restoration as far as what kind of flow is desirable in ʻĪao Stream area? And what will protection of left bank entail? Planning Commission recommended natural stream - does it matter? Property owners have been unable to develop areas within the floodplain because of the flood designation. Also suggested that recreational components/opportunities be included as another alternative to restore the stream as a cultural resource. Need to contact Water Department because this agency draws from this resource and can capture some of the volumes when the flow is large. Mr. Bertram cited reference: "History of the Wailuku River"	Stream restoration is currently a topic being pursued by several community organizations and the County. Any decisions about stream flow restoration must be made by the CWRM. A natural stream was evaluated as Alternative V, but was found to not meet the project objectives. The floodplain may remain as is if Alternative III is pursued. The left bank will be designed for flood protection of existing structures. Recreational components have been evaluated for inclusion with Alternative III.
Glenn Shepard	none provided	Use this project to augment the water that can get into the aquifer; build percolation basins to allow water to percolate down into the aquifer—"cheap" to construct and maintain. He said he talked to United States Geologic Survey (USGS) on Maui; Mr. Shepard quoted USGS as saying the, '56 million gpd flowing (quoted USGS) downstream into the ocean. ' Suggested an Option 5; i.e., do the least amount to the stream to allow water to "cycle back down."	Alternative III has been revised to include a groundwater recharge basin that would facilitate percolation of surface water down into the aquifer.
Lucienne deNaie	Maui Sierra Club	Alternative V: Look at this as a resource rather than a "destructive force" This is "sacred" in that the stream	Alternative V was considered, but it does not meet the objectives of protecting

Name	Affiliation	Comment	Response
		supported streamside agriculture as well as stream life. Need to look at other examples from elsewhere (she said she's aware of one example) that reversed concrete channelized streams. The project should offer open recreation areas on the banks as a community benefit.	human life and property, and it also had one of the highest costs of all the alternatives. This alternative was thus eliminated from consideration.
Nik Hilananda	none provided	Glenn's (Shepard) suggestion should be labeled "Alternative VI." Should get rid of all 4 alternatives (that were presented tonight) and look at (a new) Alternative V and Alternative VI. Existing stream sides should remain a floodplain. Utilize the water and put back the stream to how it was. Maintain a natural state and show how community can use it as recreational area and access it; + Cultural and historical significance of the area—return to Wailuku Stream (i.e., pre-improvements).	The preferred alternative (III) retains the flood plain along the left bank, and also includes a groundwater recharge basin to help facilitate percolation of surface water down into the aquifer. Community use is planned in the form of running/jogging paths. Removal of all flood control improvements was evaluated as an alternative, but would found to not meet the project objectives of protecting human life and property.
Claire Cappelle	National Marine Sanctuary	EA to look at fast flowing stream's impact on the receiving waters vs. slow-flowing Now that she knows a heiau is located in the project area; this may need to become an EIS.	The EA evaluated potential impacts to surface water, hydrology, and oceanographic patterns in the vicinity of the project. The heiau is located adjacent to the project, but is not in the actual project corridor. The proposed project will prevent the erosion that is currently undermining the banks and might eventually impact the heiau.
Duke Sevilla	Project area resident for 47 years.	Stressed the stream's Cultural values; kūpuna believed that the waters of the stream gave longevity-- longer life.	Thank you for the additional insight. The proposed alternative is designed to be protective of human life in the vicinity of the stream.
Ed Lindsey	none provided	Cultural values: self-sustaining. ʻĪao Valley =believes this was designated for burials for ali'is. Upper part of stream channelization (valley) = taro farming. Need to look at recharge above the area to optimize resources.	A qualified archaeologist will be on-site to monitor excavation of the stream banks in the vicinity of the ʻImi Kālā Street bridge. Groundwater recharge has been incorporated into Alternative III with a proposed groundwater recharge basin.
Elaine Wender	none provided	Please detail developed areas on the right side that are at	Please refer to the appropriate portions of

Name	Affiliation	Comment	Response
		risk of no action is taken. How big an area? Cost of purchasing? Why was development allowed in this area? Estimated cost of alternatives I to IV. Who owns land in left bank flood plain?	the EA, the EDR, and supplemental appendices for detailed answers to these questions.
Ann (no last name provided)	none provided	Does the county pay for part of the project besides maintenance?	
Glenn Shepard	none provided	Break up concrete channel bottom or drill holes to recharge the aquifer.	The preferred alternative (III) will include weepholes in the concrete that will facilitate recharge. The RCC material will also have irregular cracks for expansion that will facilitate recharge.
No name		Remove all ‘improvements’ installed by the Corps and come up with a plan that restores a vibrant river as major economic recreational cultural and environmental resource. Start community partnerships to build and maintain. Recognize cultural gathering practices. Use a cultural agricultural attraction for economic development. No recreational Hawaiian streambed when can we start a new way? Since original improvements created this erosion would removing these improvements improve flows?	Removal of flood control improvements was an alternative evaluated as part of this EA. The alternative did not project objectives. Removing the improvements would not improve flows. Only changing the current water diversion patterns will change stream flow.

Source: Environet, Inc.

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9.0 PERMITS AND APPROVALS

The USACE must comply with the provisions of various Federal, state, and local regulations. Executive Order 12372, Intergovernmental Review of Federal Programs, provides that Federal agencies shall rely upon the coordination and review processes established by each state. Federal and local regulations pertaining to the proposed project are as follows:

9.1 SECTION 401 STATE WATER QUALITY CERTIFICATION

Under the Federal CWA, Section 401, WQC is required. Pursuant to HAR 11-54, a State WQC is required for activities when proposed construction or operation may result in discharge into state waters. This certification is in place to regulate water quality during and after the construction phase of the project to assure discharge will meet State Water Quality Standards. The WQC application will be submitted to the HDOH Clean Water Branch after completion of the EA process.

9.2 SECTION 404(B)1 FEDERAL CLEAN WATER ACT

Under the Federal CWA, Section 404(b)1 requires that "except as provided under section 404(b)2, no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." A Section 404(b)1 writeup has been completed, and is included as Appendix G.

9.3 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

Under the CWA, Section 402, a NPDES permit is required. Administered under HAR 11-55, a permit is required for the regulation of point source discharges into surface waters of the U.S. Separate Notices of Intent are required for NPDES permit coverage for discharges to surface waters of construction related storm water runoff or dewatering on sites sized five acres or greater.

9.4 COASTAL ZONE MANAGEMENT

Hawai'i Coastal Zone Management (CZM) Program, Chapter 205A, HRS, was promulgated in response to the Federal Coastal Zone Management Act of 1972. The objective of the program is to protect, preserve, and restore scenic, historic, and recreational resources as well as implementing the state's ocean resources management plan and protecting coastal ecosystems. The CZM designated area consists of the entire state of Hawai'i, as well as all marine waters to the extent of the state's police power and management authority boundaries.

The original ʻĪao Stream Flood Control Project did not require CZM evaluation, as the original project commenced before the CZM program was implemented in the State of Hawaiʻi. The State Office of Planning references this fact in a letter dated June 18, 1996 (Appendix H), and recommended a full evaluation of the ʻĪao Stream Flood Control Modification Project for consistency with HRS Chapter 205A to ensure that proper procedures are taken in regards to possible impacts to the state's resources.

A full evaluation of the proposed project under the Coastal Zone Management Act Chapter 205A, HRS is available in Appendix F

9.5 STREAM ALTERATION PERMIT

A Stream Channel Alteration Permit (SCAP) is required for the proposed project from the State of Hawaiʻi, DLNR, CWRM. Pursuant to HAR 13-169-50, "Stream channels shall be protected from alteration whenever practicable to provide for fishery, wildlife, recreational, aesthetic, scenic, and other beneficial in stream uses."

9.6 STATE CONSERVATION DISTRICT USE APPLICATION (CDUA)

A Conservation District Use Permit (CDUP) application will be prepared upon the selection of a preferred alternative for construction.

9.7 SPECIAL MANAGEMENT AREA USE PERMIT (SMP)

The COM Department of Planning will determine the need for a SMP when a preferred alternative is selected.

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11.0 LIST OF PREPARERS

Margaret Chang, Environmental Planner, Environet, Inc.

B.S. Environmental Science, University of California at Irvine

Ida K. Namur, Environmental Scientist, Environet, Inc.

B.S. Environmental Science, Hawaii Pacific University

Andy Hall, Environmental Scientist, Environet, Inc.

B.A. Environmental Science and Policy, Duke University

Branden Ibara, Environmental Scientist, Environet, Inc.

B.S. Global Environmental Science, University of Hawaii: Manoa

Sonia Garcia, Project Manager, Environet, Inc.

B.S. Biology; Environmental Science and Policy, Duke University

M.S. Biology, University of Guam

Colette M. Sakoda, Senior Environmental Planner, Environet, Inc.

M.C.P. City and Regional Planning, University of California at Berkeley

Roger C. Aoki, P.E., Senior Project Manager, Environet, Inc.

M.S. Environmental Engineering, Purdue University

Lianne Mitsui, Executive Administrator, word processing, Environet, Inc.

A.A. Business Management, Honolulu Community College

SCS/CRMS, Inc., Historic and Cultural Resources.

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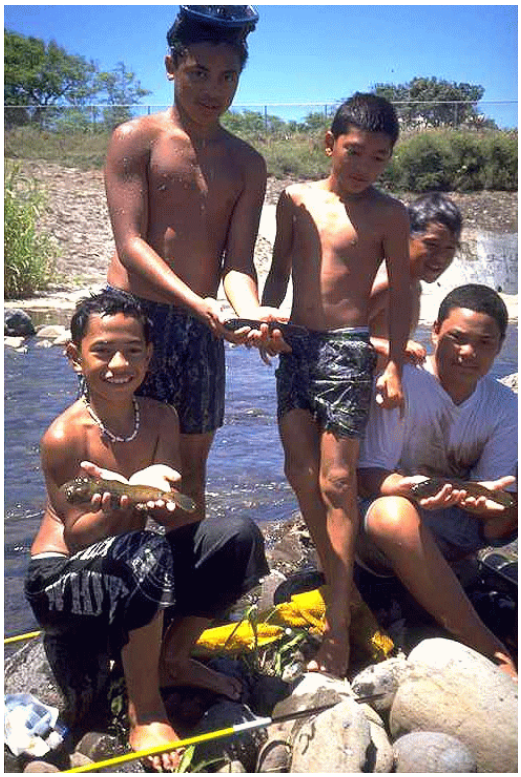
Appendix A*:*

Fish and Wildlife Coordination Act Report

REVISED DRAFT
FISH AND WILDLIFE COORDINATION ACT REPORT
for the
IAO STREAM FLOOD CONTROL PROJECT,
MAUI, HAWAII



Prepared by

U.S. Department of the Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawaii

Prepared for

U.S. Army Corps of Engineers
Pacific Ocean Division
Honolulu Engineer District
Fort Shafter, Hawaii

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INTRODUCTION

Authority, Purpose and Scope

This is the U.S. Fish and Wildlife Service's (Service's) draft report on the proposed Iao Stream Flood Control Project, Island of Maui, State of Hawaii. This project is being developed by the U.S. Army Corps of Engineers, Honolulu Engineer District, on behalf of the County of Maui, Department of Public Works and Environmental Management.

This report has been prepared under the authority of the Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 et seq.; 48 Stat. 401], as amended (FWCA), and other authorities mandating Department of the Interior concern for environmental values. This report is also consistent with the National Environmental Policy Act of 1969 [42 U.S.C. 4321 et seq.; 83 Stat. 852], as amended (NEPA). The purpose of this report is to document the significant fish and wildlife resources existing throughout the proposed project site and to ensure that fish and wildlife conservation receives equal consideration with other project objectives, as required under the FWCA. The report includes a description of the significant biological resources at the proposed project site, an assessment of potential resource impacts associated with the proposed project, and recommendations for avoiding and minimizing impacts to the fish and wildlife resources in the project area.

Between 1968 and 1981, the lower reaches of the Iao Stream channel were subjected to extensive physical alterations due to a major flood control project authorized by the Flood Control Act. The uppermost component of this previous project is located approximately 4 kilometers (km) (2.5 miles [mi]) upstream of the Iao Stream mouth. Modifications to the natural stream channel associated with the previous project consisted of the following (listed from upstream to downstream): a debris basin; a concrete channel segment that is 335 meters (m)(1,100 feet [ft]) long; a straightened stream channel segment with a natural stream bottom that is 2,195 m (7,200 ft) long and bounded by a levee on the east bank and a managed floodplain on the west bank; and a concrete channel segment that is 427 m (1,400 ft) long and ends near the stream's confluence with the sea (Figure 1).

The proposed Iao Stream Flood Control Project is intended to correct apparent deficiencies associated with existing Corps-designed and County-operated flood control infrastructure. In 1981, and again in 1989, high stream flows resulted in downcutting of the natural stream bed and erosion of the base of the east bank levee structure at the approximate mid-point of the straightened stream channel segment. This area of erosion is 1,700 m [5,550 ft] upstream of the stream mouth. Erosion has occurred at the toe of the levee structure, which consists mostly of earthen embankment, across an area approximately 100 yards in length. Project planning to date has identified five alternatives in addition to the "no-action alternative." Three of the five alternatives under consideration envision placement of concrete lining over the 2,195 m (7,200 ft) of stream channel that is currently natural substrate. A fourth alternative retains the existing substrate but includes significant reconstruction of eroded

levies and additional channel alteration. A fifth alternative considers removal of the original existing flood control infrastructure and the installation of a flood warning system.

The downcutting and erosion are the result of several factors, principally the combined effects of increased water velocity due to channel straightening and a rigorous maintenance regime that calls for operation of heavy equipment in the stream to perform "channel clearing" by removing obstacles and smoothing the cobble and boulder substrate that make up the natural stream bed (USCOE 2002). The results of this maintenance include a significant loss of channel complexity and the creation of conditions that accelerate water flow, which increases flood capacity but also increases the erosion potential of the flowing water during periods of high flow. In addition, and perhaps as an added result of the artificially smooth channel and high flow velocities, lateral forces have increased and a noticable meander has been reestablished by the stream in this location. The meander is not of concern on the floodplain (west) bank, however, as the stream rebounds toward the east bank, bed material is being removed from the base of the levee. The erosion caused by high flow events has been partially repaired with concrete rubble masonry (CRM), however, these repairs have subsequently suffered from additional erosion.

Coordination with Federal and State Resource Agencies

Service biologists have exchanged correspondence on the proposed project with staff from the Hawaii Department of Land and Natural Resources' Division Aquatic Resources (DLNR–DAR) and the Commission on Water Resource Management (DLNR–CWRM). Personnel from the DLNR–DAR Maui District office contributed significantly to this report by assisting with site visits and providing quantitative information on aquatic resources currently found in Iao Stream. Additional information was obtained from the U.S. Geological Survey's Water Resources Division (USGS–WRD), which currently is performing in-depth studies of surface and ground water resources on Maui.

Other important natural resource information was obtained from researchers familiar with Iao Stream and affiliated with the University of Hawaii Center for Conservation Research and Training, and Michigan State University. Concerns expressed by biologists and other natural resource technical staff with regard to the project have been considered in this draft FWCA report. Copies of this draft report will be provided to the U.S. Environmental Protection Agency; the Hawaii Department of Health's (HIDOH) Clean Water Branch and Environmental Planning Office; the DLNR–DAR and DLNR Division of Forestry and Wildlife; and the Hawaii Department of Business, Economic Development and Tourism's Coastal Zone Management Program.

Prior Fish and Wildlife Service Correspondence, Site Visits, and Reports

The environmental review process for the original Iao Stream Flood Control and Related Improvements Project began in 1966 and continued until a Final Environmental Impact Statement was completed in 1975. The studies and reports associated with the review of the

original project pre-date much of the currently accepted policy, guidance and standards under which NEPA and Clean Water Act (CWA) project review is undertaken today. A review of Service files indicates that serious concern was repeatedly expressed regarding resource impacts anticipated to result from the original project, and that these concerns were transmitted in writing to the Corps by the Service, other Department of the Interior bureaus, and other Federal and State resource agencies. These concerns included: 1) threats to populations of fish and invertebrates due to reduction or elimination of instream and riparian habitat and substrate; 2) recreational fishery impacts; and 3) visual and aesthetic impacts. With regard to native aquatic resources, there was early recognition that a minimum flow recommendation was a critical component in appropriately mitigating anticipated impacts to aquatic resources in Iao Stream. The following list of prior correspondence describes Service letters, site visits and reports associated with the current proposal to correct perceived deficiencies in the existing Iao Stream flood control project and does not include correspondence, site visits and reports for the original project:

March 3, 1996 The Service provided a FWCA Scope of Work (SOW) letter to the Corps concerning the proposed project.

March 8, 1996 The Corps provided a letter to the Service initiating the FCWA investigation and consultation under section 7 of the Endangered Species Act (ESA).

May 13, 1996 A site visit and initial aquatic resource survey was made to the project area by Service biologists accompanied by a DLNR-DAR representative.

July 1, 1996 The Service provided a Planning Aid Letter (PAL) to the Corps along with a revised SOW and transfer fund cost estimate for additional aquatic resource surveys. The letter expressed concerns for aquatic life due to anticipated effects of lining the channel with cement and concurred that no endangered species were known to be found in the project area. The letter noted that impact avoidance and mitigation features recommended in 1975 appeared not to have been implemented in the existing project.

September 9, 1996 An additional aquatic resource survey was conducted by Service biologists accompanied by DLNR-DAR representatives.

October 31, 1996 The Service provided a Supplemental PAL to the Corps with additional specific information on potential project-related effects. The PAL highlighted the existence of significant gaps in quantitative data regarding stream flow conditions.

November 14, 1996 The Corps provided a letter to the Service regarding hydrologic and engineering considerations for the proposed project. The lack of information regarding stream flow duration characteristics and flow

diversion was noted, however, no additional research was initiated to address these gaps in available data.

March 7, 1997 Public Notice CW97-0003 was issued by the Corps pursuant to section 404 of the CWA regarding the intent to discharge fill into Iao Stream channel as a result of implementation of the Iao Stream Flood Control Modifications Project.

April 2, 1997 The Service Provided the Corp with a response letter to Public Notice CW97-0003 and indicated that insufficient data was available to provide adequate comments on the potential effects of the proposed project.

August 8, 2000 A site visit to resurvey habitat conditions was made to the project area by Service biologists. At the time, Iao Stream was flowing in the channel in the vicinity of Imikala Street bridge but flowing water did not extend to the sea on this date.

July 28, 2003 A site visit to survey upstream migrating native organisms in the lower project area and observe water diversion structures throughout the watershed was made by Service biologists accompanied by the DLNR-DAR District Aquatic Biologist.

November 30, 2005 A site visit with Environmental Protection Agency personnel was conducted to discuss environmental review of the proposed project. The stream was flowing in the channel in the vicinity of Imikala Street bridge but flow did not extend to the sea on this date.

DESCRIPTION OF THE PROJECT AREA

The Iao Stream watershed is located on the northeastern side of the West Maui mountains (Figure 1). The watershed encompasses approximately 26.4 km^2 (6,500 acres [ac]) and is 12.4 km (7.7 mi) in length. The upper reaches of Iao Stream originate in the wet, windward interior of West Maui, which receives a mean annual rainfall of approximately 303 centimeters (cm) (120 inches [in]). The stream flows generally northward to its confluence with the sea at Waiehu, an area that receives substantially less precipitation, approximately 76 cm (30 in) per year (Giambelluca et al. 1986; Shade 1997). Due to the steep slopes, porous basalt geology, and soil characteristics of the valley, Iao Stream can experience flash floods during relatively brief rain events (Shade 1997; Benbow et al. 1997; Benbow 1999). As is typical for a Hawaiian stream, Iao Stream is characterized by having great variability in its daily, monthly, and yearly natural flow regime, making stream flow conditions highly unpredictable and “flashy” (Kinzie et al. 1986; Benbow 1999).

Iao Stream is the largest of Maui's altered streams on the basis of stream length and watershed area. Seven percent of all Maui streams are reported as being either straightened, realigned or modified with concrete lining (Timbol and Maciolek 1978). Diversions are reported on 59 percent and road crossings on 96 percent of Maui's streams. A total of five km (3.1 mi) of modified stream channels occur among the seven "channelized" perennial streams identified on Maui. Only one percent (one stream) of Maui streams were reported to be physically pristine in the Timbol and Maciolek study.

Iao Stream is the largest Maui stream to be extensively altered with regard to both its physical structure and its flow regime (Norton et al. 1978, Parrish et al. 1978). Three significant water diversion structures entrain approximately 189,270 cubic meters per day (m^3/day) (50 million gallons per day [mgd]) of Iao Stream water into three large ditch systems (the Maniania Ditch, the Iao-Waikapu Ditch, and the Kama Ditch) that carry water away from the stream for consumptive use, primarily for sugarcane and other agricultural crops. These diversions are located upstream of the channelized portion of the stream. A smaller diversion for a fourth ditch, the Waihee Ditch, originates a short distance downstream of the debris basin, within the cement-lined channel constructed under the previous project (Figure 4). A USGS gauging station (gauge number 16604500) is located approximately 0.5 km (0.3 mi) upstream of Kepaniwai Park, above the first diversion. The catchment area above this gauge is 15.5 km^2 (3,830 ac).

Upstream of the diversions and at typical flow levels, Iao Stream can be characterized as having ample stream flow, with numerous riffle, pool and cascade habitats (Benbow et al. 1997; Benbow 1999). Downstream of the diversions, Iao Stream can be characterized by the absence of water about 80 to 90 percent of the time, punctuated by infrequent high flows when stream discharge volume is sufficient to overtop the four water diversion structures. Occasionally, conditions are such that moderate flows exist in the lower stream, which create riffle and pool habitat in areas of natural substrate, but these episodes are relatively short-lived. The natural substrate of Iao Stream can be characterized as a heterogeneous mixture of boulder and cobble. Other substrate types such as exposed bedrock, gravel, and sand are rare in the lower stream.

In addition to agricultural use of surface waters, groundwater resources in the Iao Stream area are an increasingly important municipal water source for central Maui. This area is subject to increasing demand for domestic water due to a growing population and associated urbanization (Shade 1997).

FISH AND WILDLIFE RESOURCE CONCERNS AND PLANNING OBJECTIVES

The primary project-related concern of the Service is the potential for adverse impacts to fish and wildlife resources resulting from: 1) elimination of natural substrate from the stream channel; 2) degradation of quality and quantity of water that forms the in-stream pathway required by native migratory aquatic organisms; and 3) the elimination of stream-side riparian vegetation, which provides temperature-moderating shade to the stream for aquatic organisms and habitat for terrestrial wildlife. Secondary concerns include potential adverse water quality impacts to the nearshore coastal marine environment that may result in detrimental changes to marine fish and invertebrate communities.

Specific Service planning objectives are to maintain and enhance the native migratory fish and aquatic invertebrate populations and the habitat conditions that support them in the Iao Stream watershed by: 1) evaluating and analyzing the impacts of proposed-project alternatives on fish and wildlife resources and their habitats; 2) identifying the proposed-project alternative least damaging to fish and wildlife resources; and 3) recommending compensatory mitigation for unavoidable project-related habitat losses consistent with the FWCA and other applicable policy.

The Iao Stream Flood Control Project area consists of an interupted perrenial stream that exhibits a series of riffles and pools formed on boulder and cobble substrate. From a regulatory standpoint, the CWA specifically places a high relative value on riffle-pool complexes. This status is conferred in the CWA section 404(b)(1) guidelines and implementing regulations (40 CFR Part §230.44). This authority identifies riffle-pool complexes as one of several types of "special aquatic sites" which are defined as:

> "*...geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region.*"

These guidelines identify a number of well-recognized impacts that can result from elimination of riffle-pool complexes such as: reduction of the aeration and filtration capabilities at the project site and downstream; reduction of stream habitat diversity; reduction of fish and wildlife populations at the project site and in downstream waters through sedimentation and the creation of unsuitable habitat; scouring or sedimentation of riffles and pools; and reduction of water-holding capacity of streams resulting in rapid runoff from a watershed. In addition, these hydrologic alterations usually result in increasing the volume and timing of surface runoff, which can cause the delivery of large quantities of flood water in a short time to downstream areas and result in the destruction of natural habitats, property loss, and the need for subsequent further hydraulic modification (40 CFR Part §230.45(b)[b]). We note that the proposed project is, in fact, largely a hydrologic modification response to the inadequacy of and problems caused by the original flood control

project. The cumulative extent of riffle-pool habitat loss due to both the original and the proposed actions has increased significantly. The original project eliminated 762 m (2,500 ft) of stream channel, and the proposed subsequent modification is envisioned to alter or outright eliminate an additional 2,195 m (7,200 ft) of channel. The combined result, if the project is implemented, will be 2957 m (9,700 ft) of riffle-pool habitat permanently altered or lost.

The terminus of Iao Stream is located near the western end of Kahului Bay and discharges into marine waters that are colonized by a variety of corals and other reef-building marine organisms. The institutional significance of coral reefs is also established through their designation as special aquatic sites under the CWA (40 CFR Part §230.44, 45 FR 249). In addition, Executive Order on Coral Reef Protection (EO 13089) further specifies that all Federal agencies whose actions may affect U.S. coral reef ecosystems shall: 1) identify their actions that may affect U.S. coral reef ecosystems; 2) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and 3) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.

In 2002, the Corps reaffirmed its national commitment to maintaining the reach and extent of aquatic habitats that fall under its jurisdiction. The most recent technical guidance on this topic is Regulatory Guidance Letter (RGL) 02-2. This guidance outlines conceptual criteria for development of mitigation to replace aquatic resource functions unavoidably lost or adversely affected by Corps permits and activities. The RGL clarifies and supports the national policy for no overall net loss of wetlands, streams, and other aquatic habitats and reinforces the Corps' commitment to protect waters of the United States. The guidance further clarifies the requirement that project proponents must provide, as a integral project component, and concurrent with project implementation, appropriate and practicable mitigation for authorized impacts to aquatic resources in accordance with applicable laws and regulations. Further, this guidance recommends early planning to regularly review mitigation projects and flexibility to adapt mitigation efforts to ensure their success.

Recently, the Corps Honolulu District Regulatory Branch issued proposed Compensatory Mitigation and Monitoring Guidelines (PN # 200400448). The guidelines acknowledge the regional applicability of CWA regulations for aquatic resource preservation throughout the Honolulu District and reaffirm the District's commitment to require adequate compensation for authorized impacts to aquatic habitats. The proposed guidelines highlight the importance of mitigation planning based upon watershed-scale evaluations of lost environmental functions and values, and describe required components of mitigation planning such as site identification, monitoring, performance evaluation, adaptive management and reporting.

Both RGL 02-2 and the proposed regional guidelines require the use of watershed and ecosystem approaches when determining mitigation requirements, including consideration of the resource needs of the entire watershed as a whole within which the impacts are anticipated to occur. In the case of Iao Stream, a planning process that is based first upon avoidance and minimization of impacts, and secondly upon compensatory mitigation to replace unavoidable

functional losses to aquatic resources is required. This approach is assumed to be appropriate and practicable for most cases. A watershed-based approach to aquatic resource protection considers entire systems and their constituent parts. In the case of Iao Stream, the guidance set forth in RGL 02-2 requires that mitigation planning incorporate avoidance, minimization, and compensation for potential impacts of the project in the context of the entire watershed. This implies factoring in the condition of the stream due to cumulative effects of the previous Corp project, and requires simultaneously considering hydrologic effects that result from off-stream diversions of water.

A multiparty effort is required to implement this approach to aquatic resource conservation, and project proponents must recognize and rely on the expertise of State, local, and various Federal resource management programs to achieve this level of resource protection. During the project evaluation process, the Corps must coordinate with these entities to take into account State and local land use regulations, County initiatives, special area management rules and regulations, and other factors of local public interest. The RGL and proposed mitigation guidelines reinforce policies mandating the use of performance standards, post-project monitoring, and enforcement to ensure mitigation requirements are met in perpetuity to maintain adequate ecosystem function.

The Service's Mitigation Policy (Service 1981) also outlines guidance for evaluating project impacts affecting fish and wildlife resources. The Mitigation Policy complements and supports the Service's responsibilities under NEPA, CWA section 404, and FWCA. The Service's Mitigation Policy was formulated with the intent of protecting and conserving the most important fish and wildlife resources through encouraging equitable multiple use of the nation's natural resources. The policy focuses primarily on habitat values by identifying four resource categories and providing mitigation guidelines that include avoidance and minimization of unnecessary impacts, and compensation for impacts anticipated to be unavoidable. The four resource categories are:

a. Resource Category 1: Habitat to be impacted is of high value for selected evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section;

b. Resource Category 2: Habitat to be impacted is of high value for selected evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section;

c. Resource Category 3: Habitat to be impacted is of high to medium value for selected evaluation species and is relatively abundant on a national basis; and

d. Resource Category 4: Habitat to be impacted is of medium to low value for selected evaluation species.

The Service considers the potentially affected stream and nearshore coastal environments to be habitats of high value. Using the criteria above, lower Iao Stream is considered to be Resource Category 2 habitat due to the severe degradation of stream habitat across the north shore Maui landscape and statewide. The marine waters adjacent to the Iao Stream terminus at Waiehu are also considered to be Resource Category 2 due to the presence of coral reef habitat throughout the area. The Service's resource goal for Category 2 habitat is no net loss of in-kind habitat values. Under this designation, the Service will recommend ways to avoid or minimize losses. If losses are unavoidable, mitigation measures to immediately rectify, reduce, or eliminate these losses over time will be recommended. As necessary, compensation by replacement of the in-kind habitat values may be incorporated as integral project features.

For the purposes of categorization of the freshwater aquatic habitats in Iao Stream, eight species of migratory native Hawaiian stream organisms, which are known to occur in the stream, are considered to be evaluation species (Table 1). These organisms are particularly well-suited to serve as biological indicators because they require cold, clean, high-quality stream water that is relatively free of excessive land-derived nutrients and suspended particulates. This group of animals includes five species of fish and three aquatic invertebrates. All of these species require passage through the stream at two significant and vulnerable time periods in the course of their life histories.

All eight species are reported from the Iao Stream watershed (DLNR-DAR 1999, DLNR-DAR 2001). All of these species are migratory and are dependent upon a free-flowing connection to the sea, via the stream channel, to complete their development and reproduction. These species exhibit a diadromous life cycle known as amphidromy in which adults live and spawn in the stream environment. Newly-hatched larvae are dispersed by stream flow to the ocean where the planktonic larvae feed and grow in the marine environment until they re-enter a stream and undertake a remarkable upstream migration (McDowall 1988, Kinzie 1990). Because the pelvic fins of the fishes are modified to form a suction cup, several of these species, such as the gobies *Lentipes concolor* and *Sicyopterus stimpsoni*, are capable of ascending vertical or overhanging waterfalls and can be found at higher elevations in the streams as adults. Occasionally, these species may be found in high-elevation perennial sections of intermittent or interrupted (diverted) streams, above reaches that do not contain perennially flowing water. This is the case in Iao Stream where upstream migration to these intermittently isolated upper reaches appears opportunistic and is successfully accomplished by a few individuals as flowing water conditions allow. All of these stream-dwelling species are rarely found as adults in man-made waterbodies such as ditches, flumes, or impoundments. If juveniles are entrained into these types of structures and survive to adulthood, they are effectively removed from the breeding population because their reproductive success is zero without a connection to the sea for downstream dispersal of larvae.

In addition to the larger stream-dwelling fish and invertebrates, a number of other less conspicuous native invertebrate species are found in these systems. Many of these are

endemic to the Hawaiian Islands or limited in distribution to Maui itself, such as the unusual freshwater sponge (*Hetermyenia baileyi*), a genus of moths that exhibit an aquatic larval stage (*Hyposmocoma sp.*), and the torrent midges (*Telmatogeton sp.*, Benbow et al. 2003; Yamamoto and Tagawa 2000, pers obs).

Table 1. Native migratory freshwater organisms of Hawaiian streams.

Scientific name	Hawaiian name	Biogeographic status	Type of organism
Awaous guamensis	O'opu nakea	indigenous	Freshwater fish (family Gobiidae)
Lentipes concolor	O'opu alamo'o	endemic	Freshwater fish (family Gobiidae)
Stenogobius hawaiiensis	O'opu naniha	endemic	Freshwater fish (family Gobiidae)
Sicyopterus stimpsoni	O'opu nopili	endemic	Freshwater fish (family Gobiidae)
Eleotris sandwicensis	O'opu akupa	endemic	Freshwater fish (family Eleotridae)
Atyoida bisulcata	Opae kala'ole	endemic	Freshwater shrimp Crustacean
Macrobrachium grandimanus	Opae 'oeha'a	endemic	Freshwater prawn Crustacean
Neritina granosa	Hihiwai	endemic	Freshwater snail Mollusc

The embayment and open coastal marine environment downstream and adjacent to the Iao Stream watershed is the ultimate discharge point of Iao Stream. Although not specifically selected as evaluation species for this report, the biological communities found in the nearby marine environment may be affected by stream channel alteration in the Iao Stream watershed. In marine waters of the Hawaiian Islands, corals and reef-associated fish are of fundamental importance to biological community diversity and abundance. Although corals are small and sensitive organisms, healthy coral colonies are important for providing the basic foundation for habitat that supports diverse communities of other highly specialized aquatic organisms. Corals contribute the bulk of the calcareous raw material that forms and maintains

the basic structural framework of the reef. Reef fishes are of importance in the ecological function of nearshore environments (e.g., grazing of algal biomass and higher order predator/prey relationships) and as sources of food and recreational opportunities for people. Marine waters adjacent to the mouth of Iao Stream support sport fisheries for a variety of nearshore species, notably jacks (Carangidae) including *Caranx melampygus* and *C. ignobilis* (called omilu or ulua as adults and papio as juveniles) *Selar crumenopthalmus* (called akule as adults and halalu as juveniles); and goatfish (Mullidae) such as *Mullodichthys vanicolensis* (called weke as adults and oama as juveniles).

EVALUATION METHODOLOGY

Current and historical information on aquatic species and habitats that may be affected by the proposed action were gathered through literature searches and a review of our files. In addition to Service records, information was solicited from several agencies and a non-governmental organization that have undertaken field investigations of aquatic resources in the area, including the USGS–WRD, DLNR–DAR, and The Nature Conservancy.

Field surveys of fish and wildlife resources by the Service were primarily qualitative in nature. The goals of the surveys were to develop a reasonably complete list of the significant larger taxa that inhabit the stream within the project area and to better understand the needs of these organisms for upstream and downstream migration through areas that will be directly or indirectly impacted the project. A variety of survey and analysis methods were used for this report, including straightforward enumeration of organisms observed at selected locations in the field to the application of a habitat evaluation methodology based upon a weighted scoring regime. These are described in the sections below. Although the marine environment is directly downstream and adjacent to the project area and receives surface and ground water input from Iao Stream on a constant basis, field surveys did not include a marine component. Potential impacts to the marine environment were evaluated based upon a literature review and through contact with State, academic, and non-governmental organization subject matter experts.

The DLNR–DAR Maui District Office contributed substantial quantitative data for inclusion in this report. These data were collected at several locations in lower Iao Stream during flowing and non-flowing conditions. The results of these quantitative observations are presented in the tables below. Also included in this evaluation are results of recent academic research on occurrence and distribution of organisms as a result of flow characteristics (Benbow et al. 2003; McIntosh et al. 2003).

DESCRIPTION OF FISH AND WILDLIFE RESOURCES

Existing Conditions

Channel and Substrate Features

Habitat conditions are the result of the complex interplay between natural land and water processes, biological influences, and human landscape alteration. Analysis of habitat is important because support of viable habitat is a key element of the protection of biological integrity. Habitat can be evaluated on a relative scale based upon the concept of "reference conditions," which are assumed to represent minimally impaired natural conditions. Biological assessments using scored habitat characteristics are supported by a growing body of literature both nationally and in Hawaii (Barbour et al. 1996; Karr and Chu 1999; Kido et al. 2001). These relative comparisons can illustrate whether waterbody impairment is a result of biological effects (such as shifts in community composition due to non-native species introductions) or physical effects (streambank alteration, water diversion), or a combination of both. Hawaiian streams are not greatly impacted by point-source discharges or resource extraction activities such as heavy industry or mining. Habitat degradation is, therefore, often a significant factor contributing to overall stream degradation. The larger Hawaiian stream fauna require suitable habitat conditions throughout their migratory pathways (moving downstream as just-hatched larvae and then upstream as postlarval juveniles). Channel straightening, channel lining, and other stream bank and riparian modification have incrementally combined to reduce or eliminate the occurrence of native species in many Hawaiian watersheds.

A semi-quantitative scoring method was used to evaluate habitat characteristics in Iao Stream near Imikala Street bridge. The habitat characterization was based on scoring a number of individual elements, each of which represents an important habitat feature of the aquatic environment (Table 2). The scores are weighted to reflect the effects different habitat characteristics impart to fish or macroinvertebrate living space. Nine habitat characteristics were chosen specifically because of their importance to the biological integrity of Hawaiian streams and especially to the native Hawaiian aquatic fauna (Kido et al. 2001; HIDOH 1998). Two characteristics are quantitative in that they are directly measured (pool-riffle ratio and width-to-depth ratio) and two are semi-quantitative in nature (substrate composition and substrate embeddedness). The remaining five habitat characteristics are evaluated qualitatively. The scoring for these characteristics was developed from other bioassessment protocols; however, each characteristic was analyzed separately to produce scoring ranges applicable to Hawaiian streams.

"Reference conditions" are defined as the set of highest habitat characterization scores computed in a region, as determined from a representative sample of least impaired streams. Subsequent comparisons of stream reaches under assessment are then made on a relative basis. For example, a habitat characterization score that is 90 percent of the reference condition score would be considered nonimpaired, and a habitat characterization score that is

only 10 percent of reference would be considered severely impaired. The development of habitat characterization scores, and the basis for comparison of characterization values, is done on an ecoregional scale using a data set that includes sites that range in condition from least-impaired to highly degraded.

For the scoring method used in Iao Stream, the reference condition score (highest expected value) for the sum of all scored characteristic is 135. Sites scoring above 75 percent of the reference score are considered to have habitat that is supportive of aquatic life, sites with scores between 50 percent and 75 percent have habitat that is partially supportive, and sites that score below 50 percent do not have habitat considered to be adequate to sustainably support aquatic life. A habitat evaluation data sheet is included in Appendix I.

Habitat characterization of Iao stream was performed at a representative location below Imikala Street bridge. Because water diversions upstream of the site, this section of the stream is considered to be an "interrupted" perennial stream. Approximately 0.2 cubic meters per second (m^3/s)(4.5 mgd) of water was flowing in the stream on the date of the survey.

Table 2. Habitat characterization scores, Iao Stream Flood Control Project area.

Character	Max Score	Iao Stream Score
Substrate	20	18
Embeddedness	20	18
Velocity-depth	20	7
Channel shape	15	9
Width to depth ratio	15	2
Pool to riffle ratio	15	12
Soil stability	10	4
Vegetation	10	9
Riparian zone	10	4
TOTAL SCORE	135	83 (61.5%)

The substrate at the survey location was clean and largely free of fine sediment. The cobble/boulder substrate was loose and unconsolidated. This generated high scores for substrate composition and substrate embeddedness. The channel configuration was broadly u-shaped which did not allow for deep flowing water or deep pools, and this habitat limitation is reflected by moderate to low scores for the characteristics of velocity-depth, channel shape,

width-to-depth ratio and pool-to-riffle ratio. Soil stability and riparian zone scores were low, but the score reflecting riparian plant biomass was high (Figure 1) due to favorable growing conditions (principally the absence of grazing or vegetation clearing activities such as herbicide use) for weedy species such as Job's tears *(Ciox lachryma-jobi).*

While we recognize that the habitat survey is limited because it was performed at a single location in the project area, the results indicate that physical habitat conditions in the currently-unlined channel areas of Iao Stream exhibit values that fall in between a highly impaired, straightened but unlined stream on Oahu (Waimanalo Stream) and scores from sites in the Waiahole-Waianu watershed, also on Oahu. The latter is considered to represent one of the least impaired large watersheds on Oahu, and is considered a regional reference stream (HIDOH 1998).

The human-made substrate built into the original Iao Stream Flood Control Project is a combination of concrete and CRM. This accounts for a total channel length of 762 m (2,500 ft), of which 335 m (1,400 ft) is in the upper section of lined channel and 427 m (1,100 ft) is in the lower section. There is a "low-flow channel" present in some of the concrete-lined areas, although this feature does not extend throughout the entire lined channel. The low-flow channel appears most functional in the upper section adjacent to Happy Valley.

Throughout much of the concrete-lined channel, exposed basaltic cobble and small boulders are found (Figure 3). Apparently, these features were installed to provide areas with "more natural" microhabitat conditions to assist upstream migrating organisms. The total surface area with cemented-in exposed cobble and boulder substrate material ranges from zero to 90 percent of the total channel surface area.

Flow Characteristics

The streams of West Maui have been significantly altered for over a century by diversion of water out of natural stream channels for agricultural use. These extensive modifications to surface water environments have profoundly altered natural hydrologic regimes. Plantation diversion and ditch systems, built to support the cultivation of sugarcane, transfer large volumes of water out of natural watercourses and into extensive irrigation systems composed of ditches, tunnels, flumes, and reservoirs (Wilcox 1991). The extent of stream alteration in the Hawaiian islands is remarkable, with at least 58 percent of the estimated 366 perennial streams in Hawaii exhibiting some type of stream flow alteration due to diversion or source water withdrawal (DLNR 1991). On the more populated and urbanized islands of Maui and Oahu, the compounding effect of channel alteration is also significant because the majority of these streams are straightened or cement-lined in their lower reaches for flood control purposes (Parrish et al. 1978).

At the time of their construction, agricultural diversion structures were built to be highly efficient in their ability to entrain water. These dams divert all flowing stream water out of the stream channel during moderate to low flow periods, often leaving the stream channel

below the dam completely dry. Historically, no structural modifications were incorporated into the design of these dams and weirs to facilitate passage of aquatic organisms within natural stream channels, nor have more recent environmental considerations led to maintenance of stream flows in the reaches below the dams. To the contrary, these diversion structures are expressly designed and maintained to be highly efficient in capturing and diverting as much of the stream flow as possible, particularly during periods of moderate and low flow. This time period usually corresponds to when agricultural demand for water is high, and coincidentally, when the need for water to support aquatic life is most acute.

After more than a century of plantation-style agricultural operations by Wailuku Agribusiness (a subsidiary of C. Brewer & Co.) and its predecessors, the largest licencee of diverted stream water on West Maui is undergoing a transformation of corporate assets. This includes liquidation of its landholdings, ventures into commercial and residential real estate, and various forms of alternative "diversified" agriculture such as seed corn and macadamia nuts grown on former sugarcane lands. However, the acreage devoted to new agricultural ventures is relatively small, and replacement crops require only a small fraction of the amount of irrigation water that sugarcane required. Existing water diversion infrastructure is being maintained, however, and it continues to remove very large volumes of stream water from natural stream channels for agriculture, domestic use, and unspecified future uses.

Despite the reduction in agricultural need, an extensive system of surface water diversions, ditches, tunnels, and impoundments continue to exist in and around the Iao watershed. The 1989 water use declaration with the DLNR–CWRM submitted by Wailuku Agribusiness is 3.7 m^3/s (84.8 mgd) from Iao Stream alone (this volume was submitted and recorded pursuant to requirements of Hawaii Revised Statutes 174C, also known as the State Water Code). Although current water use has diminished somewhat due to minor ditches being taken out of service, the present diversion capacity of the Wailuku Agribusiness water system is at least 2.2–2.6 m^3/s (50–60 mgd). This total capacity (reported in 1978 and based on a 23-year period of record) includes some well water and water derived from horizontal shafts. Therefore, the long term average for total surface water diversion alone is closer to 2.1 m^3/s (48 mgd). This value would include flow volumes entrained by the Iao-Waikapu Ditch (0.34–0.50 m^3/s, 7.76–11.52 mgd); and the Maniania Ditch (0.37–0.53 m^3/s, 8.40–12.13 mgd), which are the largest diversions currently removing water out of Iao Stream. (Because of local convention and historical factors, ditch names are notoriously difficult to standardize, for instance there are two "Spreckels Ditches" on Maui, including one that traverses the Iao Stream watershed; see Wilcox 1991 for discussion. In this report, ditch names illustrated on USGS 1:24,000 topographic maps are used.)

Iao stream is the largest and most significant freshwater aquatic feature of the west Maui landscape. Mean annual discharge in the stream above the diversions is 1.9 m^3/s (43.2 mgd) (USGS data, 14-year period of record). The detrimental effects to aquatic resources in the stream due to water withdrawal is profound (DLNR-DAR 1999; DLNR-DAR 2001; McIntosh 2003). Although no stream gauge is present in the lower stream, monthly observations by DLNR-DAR staff of conditions in the lower channel and mouth of Iao Stream over a period

of nearly 10 years provide reasonably accurate estimates of the number of days that the stream flows throughout the extent of the channel and reaches the sea. These estimates are shown in Table 3.

Other factors function to limit aquatic life in the proposed project area. Flow duration characteristics are also a critically important factor of the Iao Stream hydrograph for the support of aquatic life. This is because upstream migrating individuals require continuous flow to be of sufficient duration to traverse the 4.5 mile section of stream that is regularly dewatered. If flow terminates when post-larvae are midway up this section, of stream they will desicate and die. In fact, this is assumed to occur with each successive episode of flow, and as a result, large numbers of upstream migrants may begin their migration only to become stranded and lost from the population when flow terminates. No quantitative data is available to estimate flow duration characteristics or numbers of organisms killed due to flow cessation. At the opposite extreme is the number of days of excessively high flows. For the duration of each high flow event, conditions are not suitable for passage of aquatic fauna because of high water velocity, turbidity, and violent motion of the substrate (rolling cobbles and boulders). The extent of time during which these periods exist further limit the actual number of hours during which successful upstream migration occurs. The estimate of total days of flow and other stream characteristics indicate that conditions for the migration of native stream fauna are severely impaired by reduction in flow, which is further compounded by elimination of supporting habitat as a result of the flood control project as it currently exists.

Table 3. Iao Stream discharge and estimated days of continuous flow to ocean.

YEAR	Mean Discharge (mgd)	Days of flow to ocean (approx.)	Percent of days per year of stream flow to ocean
1993-94	89	72	20
1994-95	63	33	9
1995-96	61	35	10
1996-97	59	39	11
1997-98	70	48	13
1998-99	60	34	9
1999-00	43	18	5

Biological Resources

As described above, the larger migratory native stream fauna undergo a period of development in the open ocean where they are planktonic. The process by which these larvae recruit to the mouths of streams, undergo metamorphosis to their post-larval form, and begin their upstream migration is poorly understood. A 1988 study (Radtke et al. 1998) found that the period of time these organisms spend as larvae appears rather long (3–6 months) in comparison to larval reef fish and invertebrates (typically days to weeks, although sometimes several months). The chemosensory signals that the larvae use as directional cues for finding a stream mouth is only now becoming a topic of serious research (DLNR–DAR 2001). Anecdotal evidence seems to indicate that groundwater entering the sea in the vicinity of the stream terminus also provides a sufficient chemosensory signal to attract larvae to the Iao Stream mouth (DLNR pers. comm.). These recruits then aggregate at the stream mouth and begin moving upstream almost immediately when suitable flowing water conditions begin. Table 4 presents results of monitoring by DLNR–DAR staff of upstream migration attempts over a period of five years.

Because the Iao Stream channel is dry for long periods of time in the project area, the lower stream channel currently functions as only a temporary conduit through which upstream migrating post-larvae attempt to reach perennially flowing water when conditions allow. A limited number of these upstream migrants are able to successfully complete the journey, but large numbers are lost in their attempt to ascend the lower reaches of the stream.

Table 4. Number of most abundant upstream migrating post-larval native fish and invertebrates trapped at Iao Stream mouth 1996 – 2001 (DLNR-DAR data).

YEAR	*Lentipes concolor*	*Awaous guamensis*	*Sicyopterus stimpsoni*	TOTAL FISH	*Atyoida bisulcata*	Stream flow to ocean (days)
1996-97	1,050	77	176	1,303	13,589	39
1997-98	775	29	51	855	11,883	48
1998-99	316	16	22	354	2,121	34
1999-00	214	0	71	285	3,364	18
2000-01	61	3	10	74	2,162	(no data)

The large numbers of post-larvae entering the lower stream channel during the relatively brief periods when there is sufficient flow represent a potentially huge pool of recruits that are capable of restoring native aquatic life to the stream, provided adequate instream flows exist.

Another recurring impact resulting from the current regime of hydrologic and habitat conditions in Iao Stream stems from the unusual and poorly-understood spawning behaviors

of *Awous guamensis*. During flood-level flows, especially at the onset of winter season rains, at least some of these fish appear to move down stream to spawn *en mass* (Ego 1956; Kinzie 1990; Ha and Kinzie 1996). Whether all or only some mature adults do this, or if spawning is followed by an attempt to return to upstream habitat, are not known with certainty. In any event, there appears to be periodic downstream movement of adult *A. guamensis* in Iao Stream (DLNR–DAR pers. comm.). These larger, mature *A. guamensis* support a small recreational and subsistence fishery that includes spearing and trapping of fish that are left stranded in temporary pools as flows rapidly recede (Figures 4 and 5). Individual fish that are left stranded as flows terminate due to water withdrawals dessicate and perish. This results in an ongoing elimination of large and sexually mature individuals from the stream-wide population.

Future Without the Project

In the absence of the proposed project, substrate conditions, flow characteristics and biological resources are not expected to change in the near future. The erosion that has occurred due to down-cutting of the channel bed could continue if stream discharges of sufficient volume reoccur. Limited-scale erosion control efforts using CRM repairs to the levy would be perfomed when future erosion damage occurs. Iao Stream would continue to act as a "population sink" resulting in the loss of many hundreds of native organisms due to stranding and dessication during upstream and downstream migration. Over the long term, there is some potential for minimum instream flows to be established in Iao Stream under administrative direction of the DLNR–CWRM. Recent policy development and judicial decisions at the State level support establishment of conservation flows, despite the continued regional demand for water for agriculture and domestic consumption.

DESCRIPTION OF ALTERNATIVES EVALUATED

Four project alternatives have been developed for review. They include Alternative 1: a trapezoidal concrete channel following existing alignment that would eliminate the use of the managed floodplain on the west bank; Alternative 2: a rectangular and compound channel along a straight alignment which also discontinues use of the managed floodplain on the west bank; Alternative 3: a roller-compacted concrete and boulder invert channel following the existing alignment; Alternative 4: which proposes levee reconstruction to rebuild the base of damaged levees and to raise levee height at key locations, the managed floodplain would be retained under this alternative; and Alternative 5: which proposes removal of all existing flood control infrastructure and installation of a flood warning system. A "no action" alternative (Alternative 6) will be an element of project planning and NEPA review; this status quo condition, described above, is considered one of the viable alternatives for project planning and for baseline comparative purposes in this report.

Alternative 1 consists of a trapezoidal, concrete-lined channel with a bottom width of 12.2 m (40 ft). The channel would follow the existing stream alignment over a distance of about

2,195 m (7,200 ft). The top width is approximately 27.4 m (90 ft) and includes interior splitter walls at all channel curves. All design flows would be contained within the channel, eliminating the managed floodplain on the west bank of the project. This alternative would achieve the project objectives and is feasible from an engineering and construction standpoint. The primary disadvantage of this alternative is that the long reach of existing natural substrate which functions as intermittent habitat for aquatic life would be lost. Secondary impacts include the continued alteration of the hydrologic water quality characteristics of the system, which will result in impacts to nearshore marine waters.

Alternative 2 consists of a rectangular and compound, concrete-lined channel with a bottom width of 6.1 m (20 ft). It would include a straightened alignment and a shallower grass-lined channel (16.8 m [55 ft] wide) adjacent to it to handle larger storms. Total top width of this channel is approximately 44.2 m (145 ft). Design flows would be contained within this channel. This alternative also would achieve the project objectives and has the added benefit of being easy and inexpensive to maintain. However, it is the most expensive alternative because of the extensive channel straightening required for this design. This alternative would also result in the loss of natural substrate due to the need to line the straightened channel with concrete, and may cause impacts to nearshore marine environments due to altered hydrology and water quality.

Alternative 3 follows the alignment of the existing stream and contains up to the 10-year flood event within the structural improvements. Higher flows would be directed into the adjacent managed floodplain on the west bank. This alternative incorporates existing levees as part of the project. The median base width of the channel would be 6.1 to 15.2 m (20 to 50 ft). The typical stream stabilization improvements would consist of large stones in the main channel low-flow section with roller compacted concrete stream bank protection on the bank slope. Channel lining, retaining walls, and raised levee walls would be necessary due to excessive flow velocities and to contain high flood levels. Although feasible and not more expensive than the other alternatives, this design would be the most expensive to maintain due to the irregular shape of the embedded boulder design of the low-flow channel. Growth of vegetation in the vicinity of the low-flow channel would be an integral part of the design. This mid-channel vegetation would function to reduce potential project impacts by creating shade and keeping stream water cool but would add to maintenance costs.

Alternative 4 undertakes repair and reconstruction of damaged levee toes and increases levee heights in key flood-prone areas. The alternative consists of widening the basal stream area, flattening the slope of the west bank, and reconstructing the levee toe with concrete riprap to fill the void under the levee toe. A cutoff wall would be constructed adjacent to the existing levees. This alternative would retain existing natural stream bottom throughout the project area and would retain the managed floodplain extending from the west bank. Management of the natural stream bottom would continue in its present form, with minimally managed vegetation allowed to grow in the channel between levees. Alternative 4 would require less than half the total cost of the Alternatives 1, 2, 3 or 5 ($6 million vs. $20-35 million), however, this channel configuration is anticipated to be difficult and costly to maintain due to

continued exposure of earthen levee structures to high-velocity water. According to Corps technical documents, this design may not be capable of containing design flows, therefore, this alternative is limited to addressing channel stabilization requirements but not flood containment objectives.

Alternative 5 consists of complete removal of existing flood control infrastructure and includes installation of a flood warning system. This alternative was put forward in response to public support for restoration of natural ecosystem function in the Iao Stream watershed. However, "natural function" of the channel implies that erosion and deposition is allowed to occur to the extent that natural stream meanders can be re-established throughout the stream corridor and into the flood plain. In order for this to occur, Alternative 5 would need to include a land acquisition component whereby, in addition to flood containment, certain lands are identified and aquired to accomodate the requirement for the stream to meander within its floodplain. Natural resource features associated with Alternative 5 could be maximized with active vegetation management in the riparian zone. In the last twenty years or so, housing and business development has occurred adjacent to the lower Iao Stream channel (in part due to the original flood control project, which is now deemed deficient). A restored, vegetation-lined channel that is allowed to meander could be re-established throughout lower the Iao Stream channel with sufficient funds for real estate acquisition. However, land costs in Hawaii are extraordinarily high and the associated project costs could make the project cost-prohibitive. Furthermore, degradation of ecosystem function in lower Iao Stream is a result of several factors including severe water withdrawal, as described above. Elimination of all existing flood control features and channel restoration would not address the extensive loss of water that results in a lower stream channel that may be dry for 80 to 90 percent of the time.

POTENTIAL PROJECT IMPACTS

All project alternatives share the potential for temporary construction-related impacts. During the period of construction, earthmoving and related activities would create a risk for the entry of terriginous sediments into the stream channel and adjacent nearshore marine waters. This is especially the case during periods of wet weather. A variety of voluntary and regulatory controls function to minimize this risk. However, even the best construction site management practices are inadequate to control runoff during torrential rains, which occur regularly but unpredictably in Hawaii. Development of site-specific Best Management Practices (BMPs) are integral elements in the planning and application process for CWA section 404 permits and the concurrent CWA section 401 Water Quality Certification administered by the HIDOH Clean Water Branch.

Alternatives 1 and 2 would have the greatest impact due to outright loss of habitat that is currently used by native aquatic species during periods of flowing water. Under these alternatives, the existing natural boulder and cobble stream bottom substrate would be permanently converted to a flat concrete channel. The stream flow throughout this reach would form a thin flowing sheet of water. This would severely limit or eliminate the existing

intermittent pool/riffle flow characteristics that function to provide refugia from high flows, shelter from predators, and suitable substrate for invertebrate and algal food resources for upstream migrating post-larval amphidromous species.

Both alternatives 1 and 2 also would eliminate the riparian vegetation that is currently found along the unlined section of the stream. This vegetation, although consisting of introduced "weedy" species such as java plum (*Syzygium cumini*) and haole koa (*Leucaena leucocephala*) provide shade to much of this section of stream. The shade results in lower water temperatures during periods of water flow. Native fauna are quite sensitive to elevated temperatures and associated changes in dissolved oxygen and pH (Parrish et al. 1978). If constructed, the entire lower 2, 957 m (9,700 ft) of Iao Stream would flow entirely over unshaded cement. In this condition, the increase in water temperatures alone could make the channelized lower stream an impassable barrier to native species, at least during periods when sun exposure is high.

Alternative 3 represents an attempt to reduce the impacts anticipated under Alternatives 1 and 2. During periods of moderate to low stream discharge, water would be entrained in a low-flow channel that is envisioned to be of sufficient rugosity to create microhabitat conditions that are more suitable than flat unshaded concrete for upstream migrating organisms. Schematic drawings submitted for Service analysis indicate that vegetation would be allowed to grow among the grouted boulders that form the low-flow channel. This vegetation, if appropriately managed, would function to provide critical shade and maintain lower water temperatures. Even with the implementation of design features intended to reduce impacts to the aquatic environment, cementing an additional 2,195 m (7,200 ft) to eliminate a total of 2,957 m (9,700 ft) of natural stream will result in a highly significant impact to Iao Stream itself and cumulatively to the hydrologic landscape of north-shore Maui.

Potential project impacts due to Alternative 4 are anticipated to result from reconfiguration the stream bottom, alteration of the channel slopes and in-channel reconstruction of levee toes with rip-rap. These alterations will increase water velocities during periods of moderate flows due to confinement of the lower channel due to the levee repairs. Existing stream channel substrate and vegetation would be left as is. The rebuilding and repairing of eroded levee structures would not extensively alter existing aquatic habitat features, however some maintenance activities, such as vegetation management, would necessarily undergo minor changes in response to a slightly different shape and layout of the levee walls.

Alternative 5 would result in a significant increase in usable stream habitat that could support native fish and invertebrates, particularly if there was an effort to appropriately reconstruct the natural channel specifically for habitat value. This alternative would result in removal of 762m (2,500ft) of existing cement-lined stream channel. A secondary benefit could be the re-establishment of a riparian plant community in currently cemented areas that would function to shade the stream channel and moderate temperatures for migratory fish and invertebrates. Removal of the existing Iao Stream Flood Control Project would result in one the largest stream channel restoration projects ever undertaken in the State and would result in a

precedent-setting benefit to the entire stream ecosystem. Over the long-term, neighborhoods with homes and businesses located within the newly unprotected flood plain would be subject to major flood events. Although infrequent, major floods are expected to occur with regularity. Recurring floods will result in deposition of large amounts of debris (flood-demolished homes and other structures, vehicles, etc.) either into the stream channel itself or into the nearshore marine environment. This debris will contain contaminants such as sewage, petrochemicals, lead paint, and other materials. Flood-related input of contaminants and debris could be minimized with sufficient acquisition of land along the Iao Stream corridor and within the floodplain, and relocation of residential and business structures.

SERVICE RECOMMENDATIONS

The alternatives under consideration vary widely: from removal of the entire project, to limited repairs of the damaged portion of the levy, to a 2 mile-long, 145 foot-wide concrete channel. As a result, our recommendations are presented in order of acceptability for fish and wildlife resources commensurate with realistic cost and implementation considerations.

The most important resource considerations include the following: 1) unavoidable loss of natural stream bottom habitat due to Alternatives 1, 2 and 3; 2) the excellent quality and quantity of stream habitat in mid and upper Iao Stream; 3) the large numbers of potential upstream migrating organisms ready to immediately begin colonizing the mid-elevation reaches of the stream with the onset of sufficient flow; and 4) the designation of Iao Stream as Category 2 habitat under the Service mitigation policy.

Based on these considerations we recommend the following:

> Recommendation A. If sufficient lands are acquired throughout the stream corridor for both floodplain function and for restoration of natural channel processes (meandering, erosion, and deposition), we recommend that Alternative 5 be chosen for implementation. Because there would be a net gain of natural stream bottom under this scenario, no mitigation requirement would be recommended for this project alternative.
>
> Recommendation B. We recognize that Alternative 5 may not be chosen because of the high costs of real estate acquisition. If that is the case, we recommend that Alternative 4 be selected for implementation and that unavoidable natural resource impacts resulting from the proposed project be mitigated through restoration of stream flow. We recommend that mitigation flows be re-established to provide continuous flow throughout lower Iao Stream to the sea no less than 50 percent of the time. We recommend that flow restoration be actively managed to enhance episodic flow duration in order to maximize survival of migratory aquatic organisms. Because we lack hydrologic data for the Iao Stream system we cannot estimate the specific volume of water that would be required to achieve this 50 percent goal at the present time.

Recommendation C. Because Alternative 4 does not fully meet project requirements for flood control, we recognize that it may be removed from consideration upon further analysis. In the event that neither Alternative 5 nor Alternative 4 are viable, we recommend that Alternative 3 be selected, and as above, that unavoidable natural resource impacts resulting from the proposed project be mitigated through: 1) restoration of stream flow, and 2) restoration of riparian vegetation throughout the project corridor. The goal of the mitigation flow would be to re-establish continuous flow of Iao Stream to the sea no less than 80 percent of the time and to enhance flow duration to maximize survival of migratory aquatic organisms; the goal of the riparian vegetation management would be to provide shade to the stream water to minimize the effect of temperature increases that inhibit survivorship of upstream migrating fish and invertebrates.

Mitigation planning to achieve flow restoration adds three additional elements to the flood control project: 1) creation and implementation of a flow restoration agreement between a number of partners including the Corps, DLNR–CWRM, the County of Maui, and private entities that hold licences for diversion and out-of-stream consumptive use of Iao Stream water; 2) engineering and reconstruction of at least four existing diversion structures to allow managed minimum stream flows to remain in the stream and allow for passage of aquatic organisms; and 3) management in perpetuity of the flow restoration conditions to enhance support of aquatic organisms, including instream water volumes and in-channel riparian vegetation by the County as an integral element of the flood control project.

Just as the current project proposes to correct engineering and design deficiencies in the original Iao Stream Flood Control Project, this mitigation scenario will address what we believe to be parallel mitigation deficiencies in the original project. A variety of correspondence in our files indicate that flow restoration was repeatedly suggested by resource agencies to compensate for unavoidable habitat loss due to channelization during environmental review of the previous project. These suggestions were not adequately pursued at that time by the Corps. Because the Corps is reaffirming its commitment to compensate for impacts to aquatic habitats regionally and nationally, and because of regional changes in priorities for water resource allocation, we again recommend that project mitigation be achieved through a program of flow restoration.

Finally, we recommend stringent application of effective best management practices (BMPs) throughout project construction. A comprehensive set of BMPs should be tailored to specifically recognize the challenges posed by the location of and climatic conditions found within the Iao Stream watershed in the vicinity of Wailuku. A variety of sources should be consulted regarding BMP development and standard operating procedures for the construction phase of the project, particularly the Corps Regulatory Branch and the HIDOH Clean Water Branch. At a minimum, the Iao Stream Flood Control Project BMPs should incorporate the standard Service BMPs listed in Appendix II.

SUMMARY AND SERVICE POSITION

The results of our assessment show that there would be a clear natural resource benefit from removing the existing 762m (2,500ft) of cement-lined channel under Alternative 5. These benefits would be maximized if the project incorporates sufficient land acquisition to re-establish natural channel function (erosion and deposition). Our analysis also provides a strong indication that substantial detrimental impacts to aquatic resources are anticipated under Alternatives 1, 2 and 3, although we recognize that project features under consideration as part of Alternative 3 are intended to reduce these impacts. Alternative 4 essentially retains the status quo condition of the existing Iao Stream channel, with a moderate effort expended to repair and rebuild damaged levee toes and raise levee heights in areas likely to overtop under design flow conditions.

Under Alternative 4, unavoidable direct impacts to the aquatic environment would include reconfiguration (straightening and widening) the stream bottom, reducing the steepness of the west channel slope and in-channel reconstruction of levee toes with rip-rap. These alterations will increase water velocities during periods of moderate flows, and will allow for water to encroach onto the neighboring floodplain at lower flows than at the present time. During design flow conditions (the highest flows anticipated) water may overtop the rebuilt levees on the east bank near the Waiehu industrial area under this alternative. We recommend that unavoidable impacts to the stream ecosystem be mitigated by flow restoration. To offset the anticipated loss of ecosystem function due to channel modification, the Service recommendation is to restore flows sufficient to create a continuously flowing stream throughout the lower stream to sea at least 50 percent of the time. In the absence of mitigation, project-related habitat loss and severe dewatering of the lower Iao Stream channel will persist. Flow restoration will require that the Corps and local project sponsor cooperate with a variety of other parties to retain adequate volumes of water that is currently diverted out of the stream, thereby restoring flow.

In the event that Alternative 3 is selected, it will result in the elimination of natural cobble and boulder substrate and intermittent pool-riffle habitat in the 2,195 m (7,200 ft) reach of stream lying within the project area. The proposed construction under this alternative, in combination with the existing channel alteration, results in a total of 2,957 m (9,700 ft) of natural channel of Iao Stream being eliminated and replaced with man-made material (primarily cement). Alternative 3 will create one of the longest cement-lined stream channels in the State. This channel modification will create a significant loss of natural ecosystem function and will greatly inhibit, and possibly eliminate, successful upstream migration by several native aquatic species. To mitigate this anticipated impact, we recommend that the stream's flow characteristics be restored to a condition whereby the channel contains flowing water from the headwaters to the sea at least 80 percent of the time. This period of time is considered adequate to allow successful upstream migration of sufficient numbers of native stream species, and downstream dispersal of newly-hatched larva.

We recognize that determination of the corresponding volume of water needed to support the recommended flow-duration benchmarks may require a lengthy technical analysis. These benchmark recommendations are based upon increasing the amount of time that Iao Stream flows from its headwaters to the sea, and they assume that volumes would be sufficient to support adequate depths and water quality characteristics for instream migration of fish and invertebrates. Because of a lack of hydrologic data regarding flow in the lower watershed, flow-duration benchmarks are surrogate for the actual *quantity* of water that would be required to achieve appropriate compensatory mitigation. Despite potential technical and water resource management challenges, we strongly recommend that flow restoration be made integral to the flood control project. This mitigation feature is consistent with the resource protection requirements of the CWA and the FWCA. A foray into water resource allocation and management by the Corps and the County may be complex and fraught with a variety of legal and administrative challenges. However, in order to achieve success in many projects across the nation, the Corps has grown into and accepted its role as a principal Federal agency in instream flow management and stream ecosystem restoration. The expansion of the Corps into this role in Hawaii is consistent with this national precedent, and the Service recommends that this proposed mitigation requirement be strenuously pursued in concert with planning and development of other features of the Iao Stream Flood Control Project.

Consistent with Corps mitigation guidance, we recommend that flow restoration be subject to long-term monitoring and evaluated according to clearly defined performance standards. These standards should be integral to an adaptive management approach so that the mitigation plan may be modified to ensure resource protection goals are achieved. For example, management of flow duration to prolong success of upstream migration of aquatic organisms should be a critical goal of the restored flows. Likewise, changes in management strategies to better support riparian vegetation to provide shade to flowing water within the channel should be subject to modification in response to changing conditions, such as rainfall.

Other mitigation scenarios, including off-site mitigation, are possible. However, finding opportunities to adequately compensate for and restore the impaired ecosystem functions specifically lost due to the proposed project in the Iao watershed would require more extensive, and potentially more expensive, mitigation in order to comply with Service and Corps mitigation policy and guidance such as the CWA section 401(b) regulations, RGL 2-02, and proposed regional compensatory mitigation guidelines described in PN # 200400448. If an alternative mitigation plan is deemed most appropriate and pursued by the Corps, the Service is willing to provide technical assistance in scoping and planning various alternative mitigation plans.

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FIGURES



Figure 1. Iao Stream Flood Control Project.



Figure 2. Habitat characterization scores for Iao and other representative Hawaiian streams.

Figure 3. Basaltic cobble and boulder inclusions in existing concrete-lined channel, these features were an attempt to create microhabitat for upstream migrating native organisms.

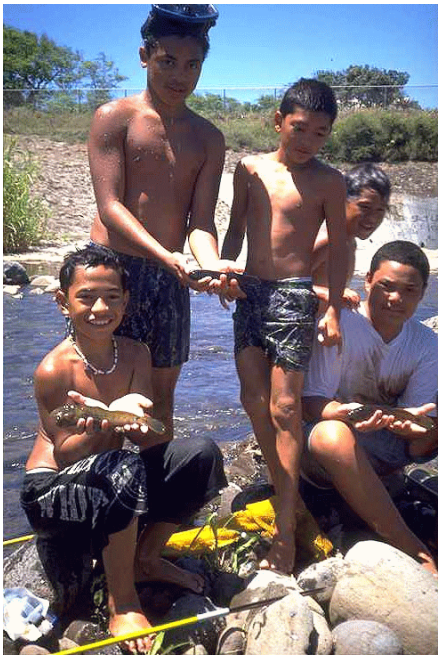

Figure 4. Large *Awaous guamensis* speared at Waiehu Street bridge. These adult fish have moved downstream into the dewatered and channelized section of Iao Stream and then became stranded as flows terminate due to water withdrawal.



Figure 5. Fish trap installed by local residents near Waiehu street bridge. Fish such as those in figure 3 will become stranded and then captured in this depressional feature when flows terminate due to water withdrawal.

APPENDIX I

Habitat Assessment Data Sheet

Primary Habitat Characteristics -- Possible score of 0 - 20 .

SUBSTRATE

Sand/sediment rare and localized. 0-9% of wetted substrate	Sand/sediment uncommon. 10-19% of wetted substrate.	Sand/sediments widespread. 20-49% of wetted substrate.	Sand/sediments widespread. 50-100% of wetted substrate
SCORE (16-20)	(11-15)	(6-10)	(0-6)

EMBEDDEDNESS

Large interstitial spaces having high volume water flow.	Interstitial spaces limited in size and extent. 25-50% embedded.	Interstitial spaces small and uncommon. 50-75% embedded.	Interstitial spaces rare, >75% embedded.
SCORE (16-20)	(11-15)	(6-10)	(0-6)

VELOCITY-DEPTH

Fast deep, fast shallow, slow deep, slow shallow -- all flows present.	3 of the 4 conditions present.	2 of the 4 conditions present.	One dominant velocity-depth condition.
SCORE (16-20)	(11-15)	(6-10)	(0-6)

Secondary Habitat Characteristics -- Possible score of 0 - 15 .

CHANNEL SHAPE

Deep U-shaped.	Shallow U-shaped.	Broad, flat.	Man-made channel.
SCORE (12-15)	(8-11)	(4-7)	(0-3)

WIDTH TO DEPTH RATIO

Less than 1:8.	Ratio of 1:8 to 1:13.	Ratio of 1:13 to 1:23.	Greater than 1:23.
SCORE (12-15)	(8-11)	(4-7)	(0-3)

POOL TO RIFFLE RATIO

Frequent alternation of habitat types. Ratio of 1:1 to 1:2.	Some alteration of habitat types. Ratios of 1:2 to 1.5.	Habitat types rarely alternate. Ratios of 1:5 to 1:20.	Homogeneous habitat. Ratio <1:20.
SCORE (12-15)	(8-11)	(4-7)	(0-3)

Tertiary Habitat Characteristics -- Possible score of 0 - 10 .

SOIL STABILITY

Stable, no erosion evident.	Little erosion, older eroded areas recovered.	Eroded areas moderate in size and extent.	Unstable, many eroded areas.
SCORE (9-10)	(6-8)	(3-5)	(0-2)

VEGETATION

Vegetation disruption not evident, all "potential plant biomass" intact.	Vegetation disruption has occurred in small localized areas, most "potential plant biomass" remains.	Disruption obvious, widespread, patches of bare soil: little "potential plant biomass" remains	Plant removal severe, mostly bare soil or closely cropped plants; lawns, hedges, crops.
SCORE (9-10)	(6-8)	(3-5)	(0-2)

RIPARIAN ZONE

Riparian zone >4 times stream width, no human impacts.	Riparian zone 2-4 times stream width, minimal human impacts	Riparian zone 1 times stream width, widespread human impacts	Little or no riparian zone (pavement, lawn, cement channel lining, etc)
SCORE (9-10)	(6-8)	(3-5)	(0-2)

	TOTAL SCORE:

APPENDIX II

BMPs developed for construction of the Iao Stream Flood Control Project should incorporate specific guidance on the following:

- in-stream construction should be scheduled to occur during low-flow time periods; at the onset of periods of persistent or torrential rain in any season, construction should be halted, and exposed erodible areas should be secured;

- project-related materials (fill, revetment rock, pipe etc.) should not be stockpiled in a stream channel or adjacent riparian zone;

- all project-related materials and equipment (backhoes, trucks, etc) placed in the water should be free of pollutants;

- contamination (including alien species introductions or disposal of trash or debris) in stream channels, riparian areas, or adjacent marine environments should not result from project-related activities;

- fueling of project-related vehicles and equipment should take place away from the water and a contingency plan to control petroleum products accidentally spilled during the project should be developed. Absorbent pads and containment booms should be stored on-site to facilitate the clean-up of petroleum spills; and

- turbidity and siltation from project-related work should be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse weather conditions.

Appendix B:

Archaeological Reconnaissance Survey and Limited Subsurface Testing

ARCHAEOLOGICAL RECONNAISSANCE SURVEY AND LIMITED SUBSURFACE TESTING FOR THE ALTERNATIVE CHANNEL ALIGNMENT, `ĪAO STREAM FLOOD CONTROL, `ĪAO VALLEY, ISLAND OF MAUI, HAWAI`I

Prepared by:
Bee Burgett, B.A.
and
Robert L. Spear, Ph.D.

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Prepared for:
U.S. Army Engineer District
Corps of Engineers, Building 252
Fort Shafter, Hawai`i 96858-5440

FINAL REPORT
Delivery Order No. 041

SCS / CRMS, Inc.
Scientific Consultant Services / Cultural Resource Management Services • 711 Kapiolani Blvd., Suite 975 • Honolulu, Hawai`i 96813

CONTRACT NO. DACA83-95-D-0004

ABSTRACT

SCS/CRMS, Inc. was contracted by the U.S. Army Corps of Engineers, Pacific Ocean Division (CEPOD) to provide archaeological reconnaissance survey and limited subsurface testing for the alternative channel alignment, ʻĪao Stream Flood Control Project within ʻĪao Valley, Island of Maui, Hawaiʻi. Research goals centered upon initial identification and mapping of any archaeological sites or features occurring within a portion of ʻĪao Stream Valley and second, if sites were identified, to conduct subsurface testing at the sites to examine the age and extent of cultural deposits associated with a particular site. Excavations were also to be conducted to determine the temporal and spatial relationship of architectural features on intra-site and inter-site scales.

A 100% reconnaissance survey of the project area revealed only one site (State Site Number 50-50-04-4755; TMK 3-4-32:1). The site is composed of three features. The three features (designated as Features A, B, and C) consist of a concrete foundation with concrete troughs, a soil-filled terrace and retaining wall, and wall remnant, respectively. These features form a small, presumably historic habitation complex-activity area. A majority of these features, particularly the basalt cobble and boulder-formed walls, exist in state of poor-fair preservational condition. The excavation of three test units at the site's three features revealed predominantly historic and recent materials, the latter likely being associated with modern debris strewn across the surface of the site. Structurally and materially, the site is most probably a post-Contact, late 19th or early 20th century, agricultural site. Local residents suggest the site was associated with a former piggery.

Overall, the project area was relatively void of visible architectural and/or surface remains, this being the effect of heavy landscape modifications, both cultural and natural processes, to the project area within the last 100 years. However, floodplain agriculture has likely been practiced in the area for hundreds of years with archaeological signatures to these activities being buried in the present floodplain. After an assessment of the project area's archaeological features and materials, it appears fair to state that the surface of the project area is of low archaeological sensitivity. Remnant agricultural soils and/or botanical information related to traditional and historic-period agriculture may yet occur within subsurface contexts of the ʻĪao Valley floodplain.

The identified site, 50-50-04-4755, is significant under Criterion D and has provided a modest amount of information pertaining to post-Contact agricultural use and limited habitation the ʻĪao Valley project area parcel. Sufficient information has now been obtained from recording and excavations at the site. No further work is considered necessary or is recommended for the one site.

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1.0 INTRODUCTION

SCS/CRMS, Inc. was contracted by the U.S. Army Corps of Engineers, Pacific Ocean Division (CEPOD) to provide archaeological reconnaissance survey and limited subsurface testing for the alternative channel alignment, ʻĪao Stream Flood Control Project within ʻĪao Valley, Island of Maui, Hawaiʻi (Figures 1 and 2). Fieldwork was conducted over a five day period between November 30 and December 4, 1998 by Ms. Bee Burgett and Mr. John Riesdorf. Dr. Robert L. Spear was the overall project supervisor.

The focus of research centered upon initial identification and mapping of any archaeological sites or features occurring within a portion of ʻĪao Stream Valley and second, if sites were identified, to conduct subsurface testing at the sites to examine the age and extent of cultural deposits associated with a particular site.

Briefly, a 100% reconnaissance survey of the project area revealed one historic site (State Site Number 50-50-04-4755) composed of three features (Figure 3). Excavation at the site revealed only historic items. It will be further proven below that the site is most probably a post-Contact, late 19th or early 20th century, agricultural site. Local residents suggest the site to be associated with a piggery. No other testing was done on the flood plain to assess the presence/absence of traditional-period taro agriculture sites as may be gleaned through agricultural soil horizons or botanical analysis. Overall, the project area was relatively void of visible architectural and/or surface remains, this being the effect of heavy landscape modifications to the project area within the last 100 years. Sugar cane, road construction, and other activities occurring in the recent past are quite evident across the parcel and may have caused disturbance or disruption to other archaeological sites that may have previously occurred within the project area. There remains the possibility that traditional and historic-period agricultural signatures could be present within flood plain strata.

In general, the project area lies within ʻĪao Valley, Wailuku Ahupuaʻa [TMK 3-3:02 through 3-4:36], and runs between the upvalley Spreckels Ditch location to a point some 4,700 feet (1,422 meters) downstream (see Figure 1). Project area elevations range from 210 to 80 feet (64 to 24 meters) amsl (above mean sea level) and extend for approximately 13 acres from the southwest to northeast, the *makai* extent of the parcel being some 0.50 to 0.75 kilometers from the ocean and Kahului Bay. The northern portion of the project area occurs adjacent to existing family dwellings while the southern extent lies within the valley, below other existing dwellings. The eastern and western boundaries of the project area are both contained within ʻĪao Valley, below existing housing units (see Figure 1).

More specifically, the alternative channel alignment extends from the concrete-lined stream channel located beneath the Spreckels Ditch flume (Figure 4), at the upslope end to c. 1,220 m from the ocean at the northeast end of the corridor (Figures 5 and 6). A leveled area between the end of the concrete stream channel and the stream spillway, the latter occurring some 251 m to the northeast, consists of a fenced flood plain. The level area between the flood plain fence and an unsurfaced road leading northwest from ʻĪao Stream to Piʻihana Road is currently utilized as pasture land.

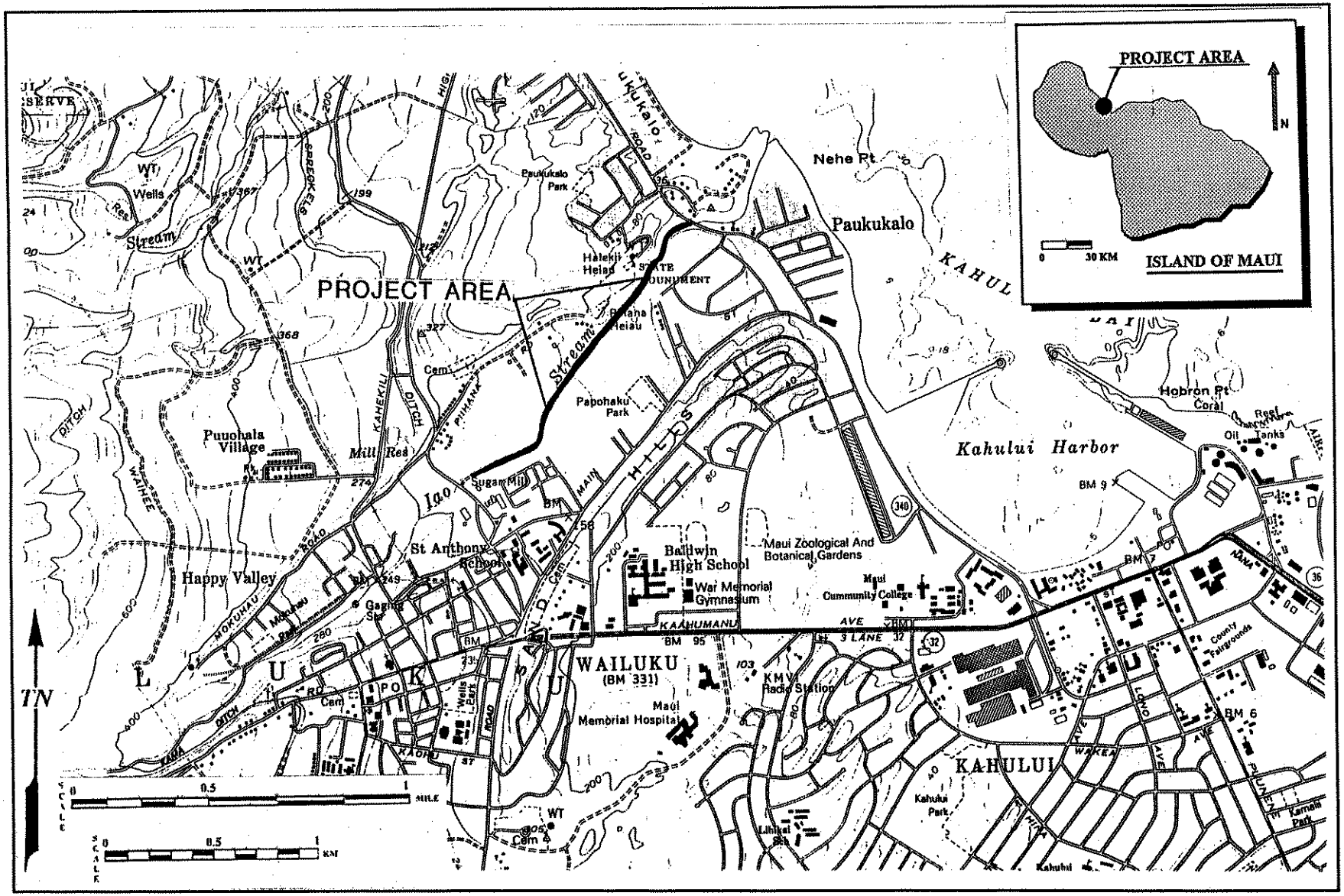

Figure 1: USGS Wailuku Quadrangle Showing Project Area.

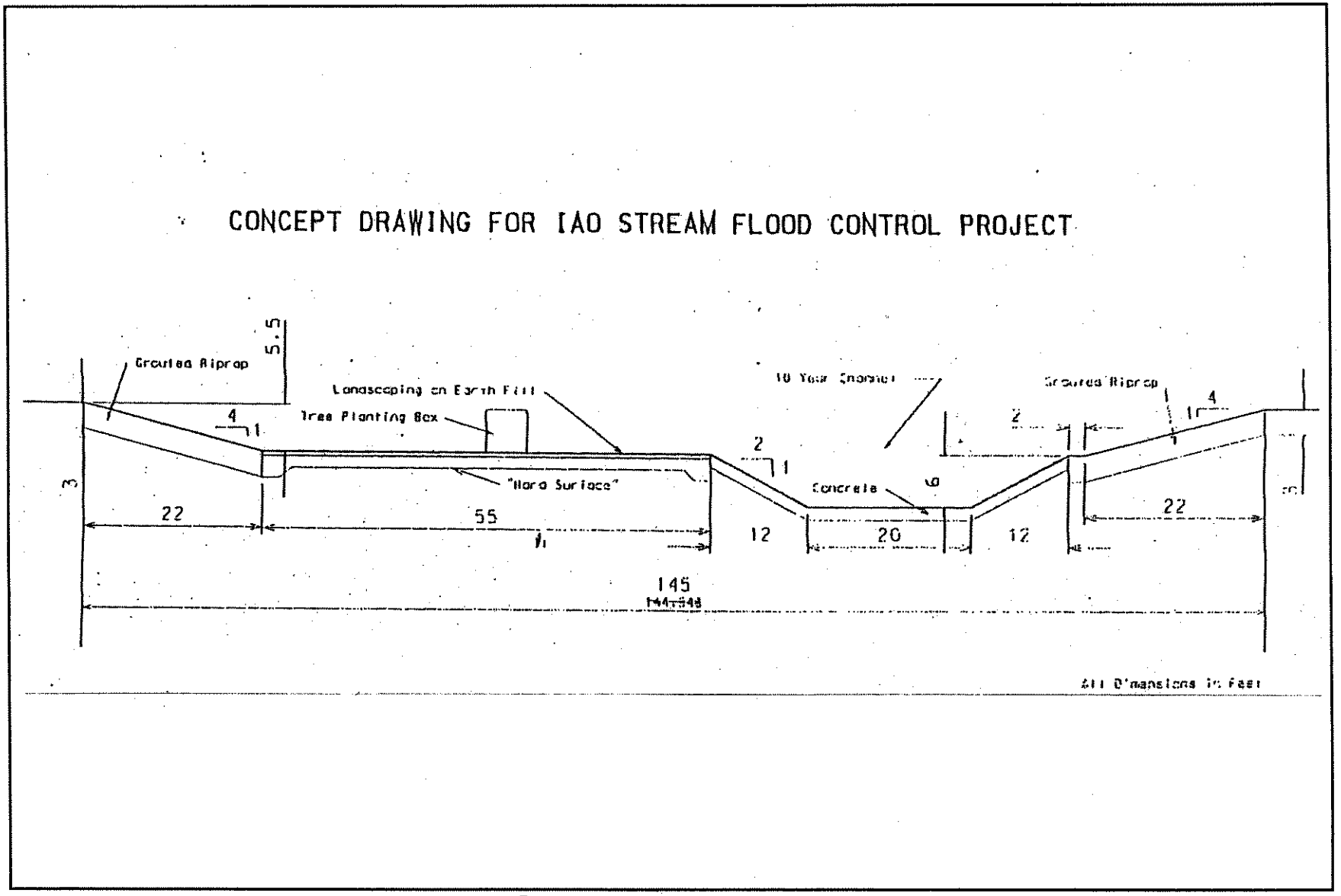

Figure 2: Profile of the Concept Drawing for the ``Īao Stream Flood Control Project. (Map by U.S. Army Corps of Engineers)

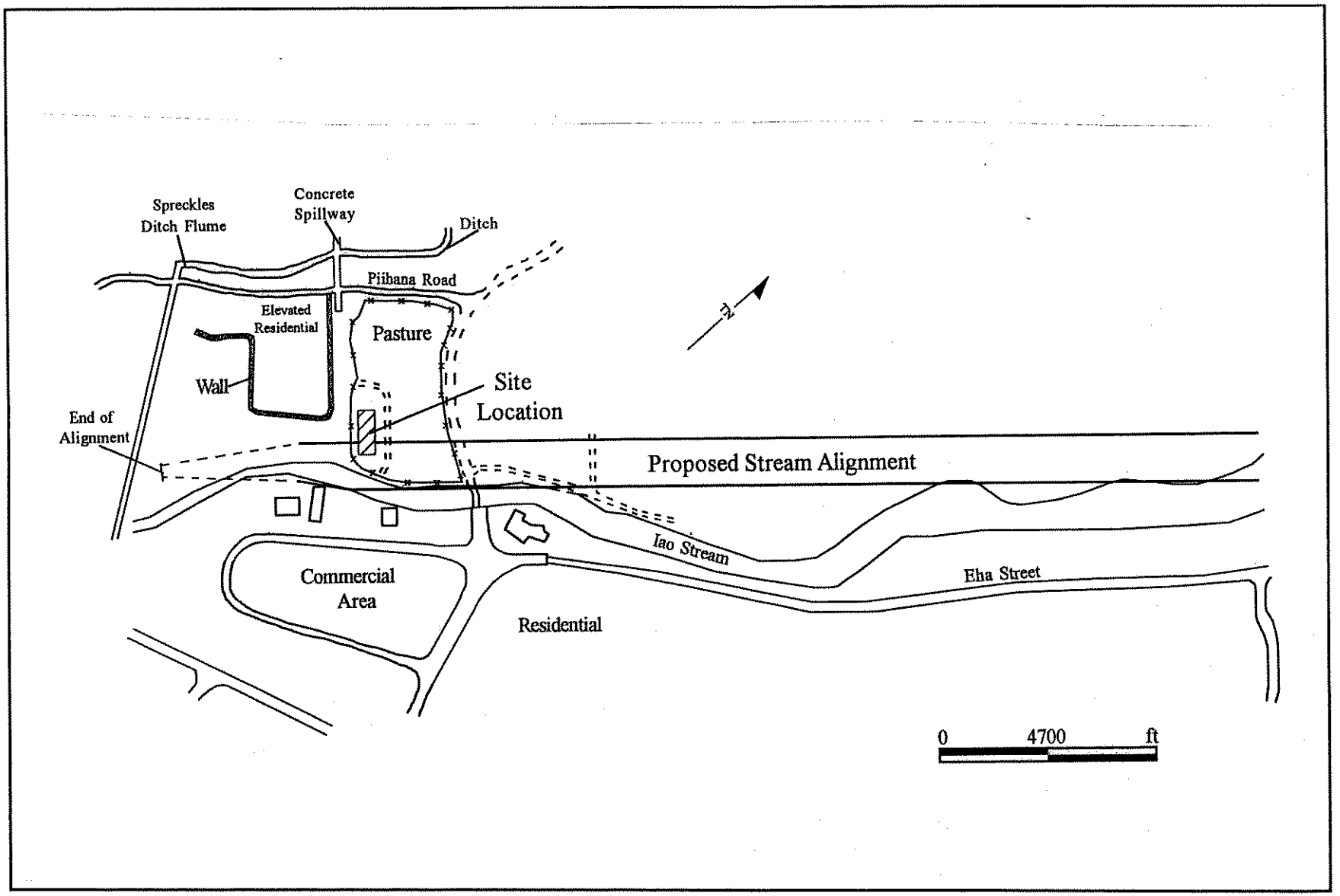

Figure 3: Planview Map Showing Project Area.



Figure 4: Photograph of Spreckels Ditch Western Survey Area, West of the Stream Alignment Corridor. View to West.

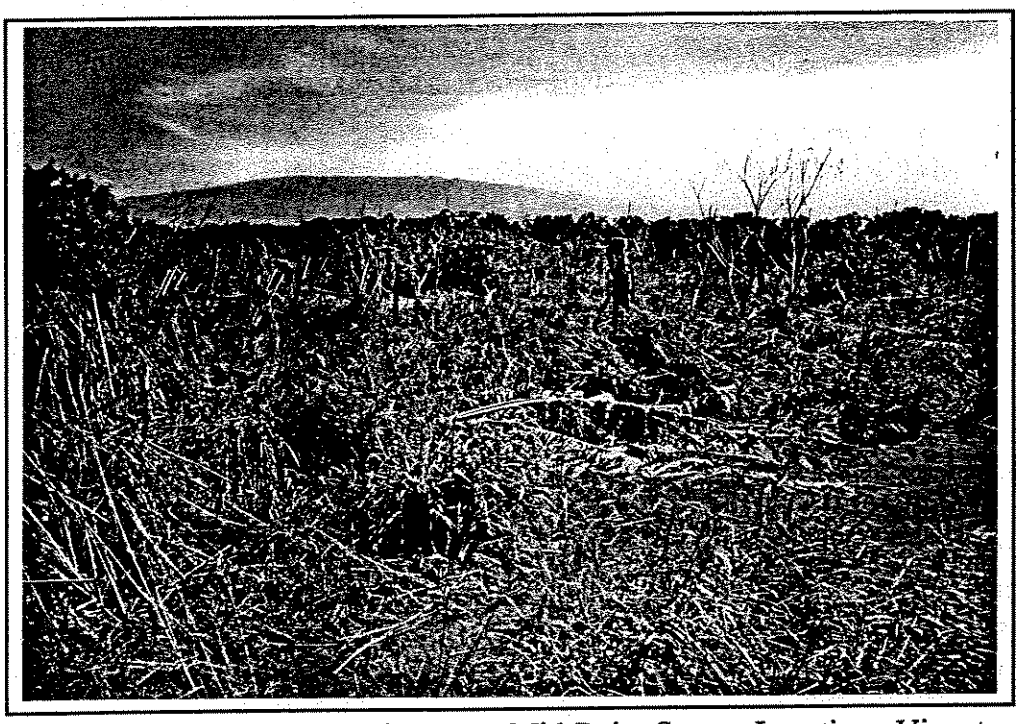

Figure 5: Photograph of Project Area Mid-Point Survey Location. View to East.

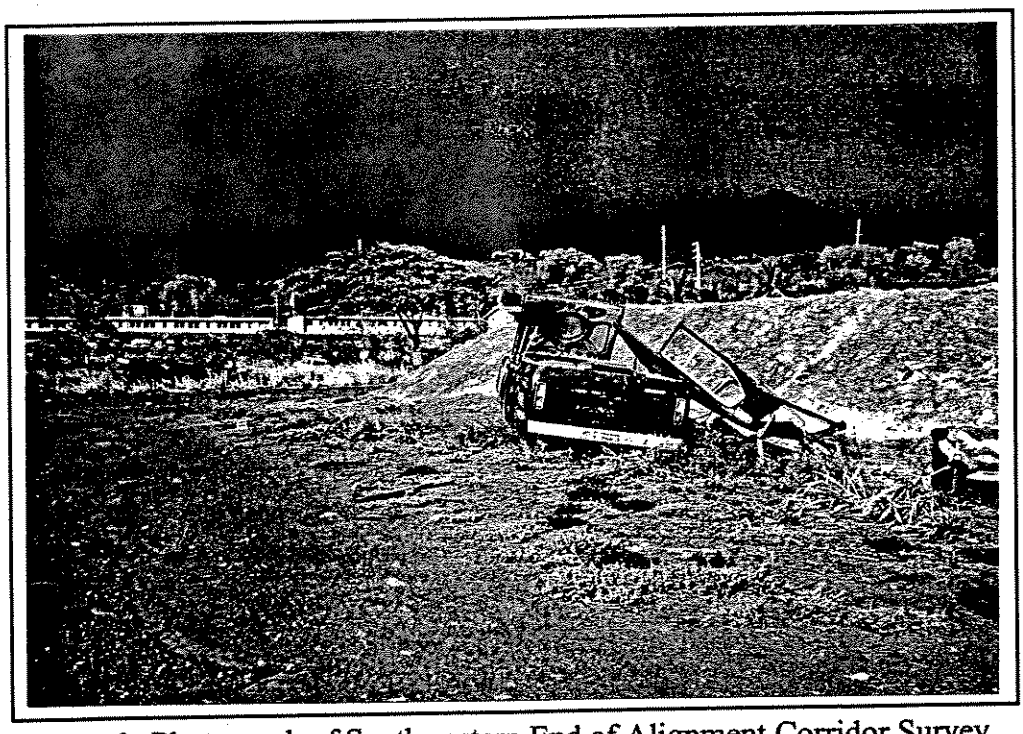

Figure 6: Photograph of Southwestern End of Alignment Corridor Survey Area. View to Southwest.

Cultivated gardens occupy approximately 162 m of the corridor on the northeast side of the road (Figure 7), the gardens terminating at the intersection of a service road, the latter of which is oriented northwest-southeast through the parcel. Northeast of this overgrown service road, the project area is covered with tall dry grass and scattered *koa haole* (*Luceana glauca*) trees. Uneven ground surfaces, pushed and piled cobbles and boulders, and a small bulldozed building depict one example of intensive ground alteration activities occurring on the project parcel (Figure 8). A small corral and a piggery, presently in use, are located on the southeast side of the corridor alignment, approximately 650 m from the northeastern end of the corridor (Figure 9). Beyond the piggery, the ground cover consists of dense, dry grass and small to medium sized *koa haole* trees that proceed to the berm above Ĭao Stream at the northeastern end of the corridor alignment. Additionally, throughout the stream alignment corridor, from the project area's southwest end to the piggery, short sections of sugar cane field drip lines are visible in open areas that do not have significant ground cover.

1.1 ARCHAEOLOGICAL SENSITIVITY

As the present project area had not been previously exposed to systematic archaeological research in the past, a conservative approach to archaeological sensitivity determinations was taken. It was assumed, *a priori*, that the project was sensitive for several reasons. First, archaeologically unknown areas should typically be ascribed as being sensitive simply to the enigmatic nature of the land parcel being investigated. The second *caveat* supporting a high sensitivity designation is from information gleaned from previous archival research and

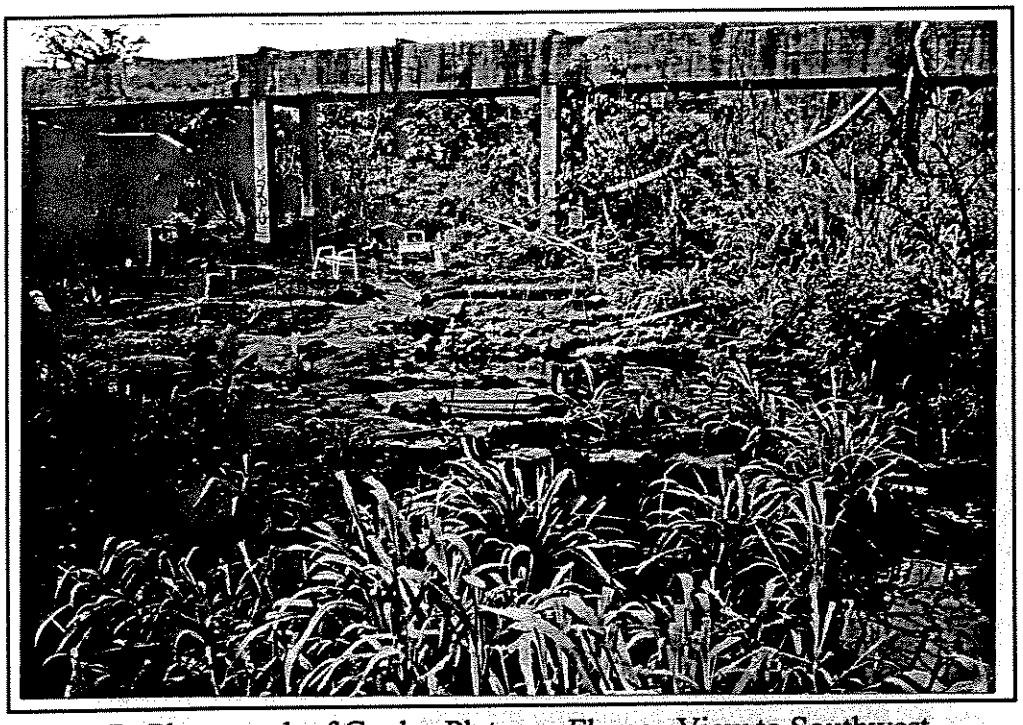

Figure 7: Photograph of Garden Plot near Flume. View to Southwest.

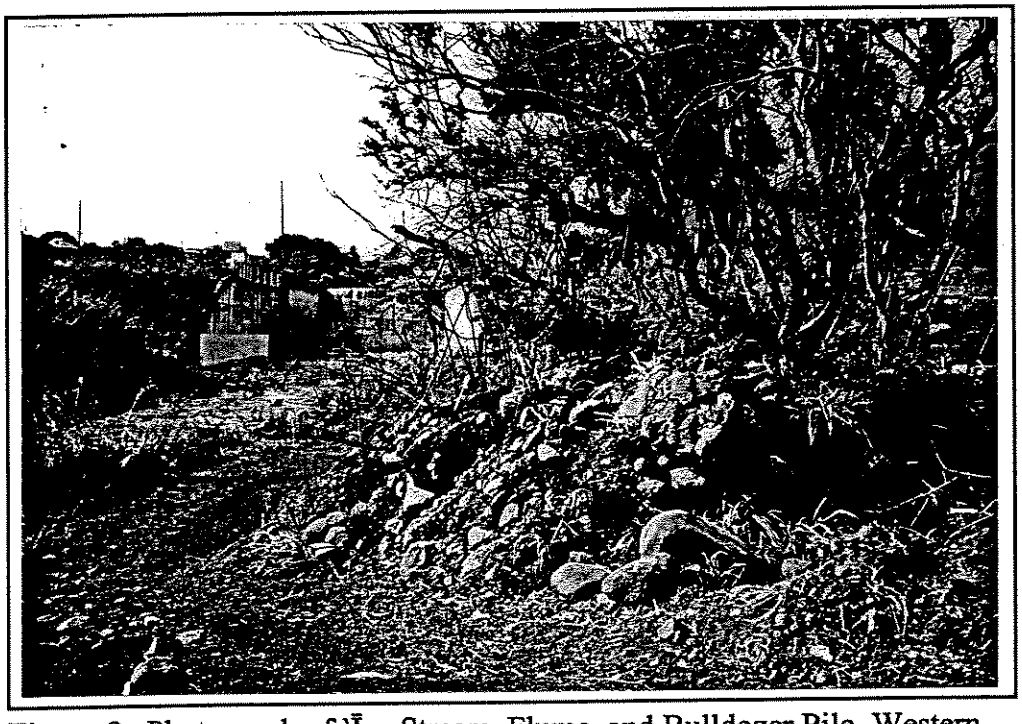

Figure 8: Photograph of ʻĪao Stream, Flume, and Bulldozer Pile, Western Survey Area. View to South.

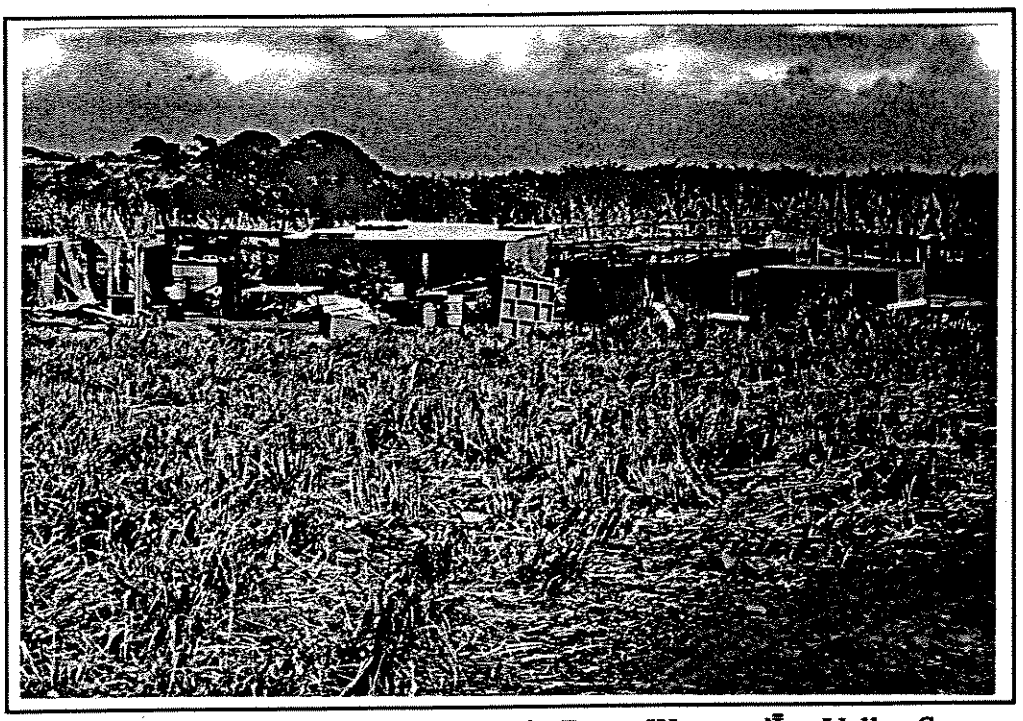

Figure 9: Photograph of Present-Day Pig Farm, Western ʻĪao Valley Survey Area. View to North.

archaeological work near the project area. The large concentration of Land Commission Awa (LCA) bounding the present project area lends credence to the interpretation that the project parcel and environs were subject to, at the least, historic-period activities such as taro cultivati It seems reasonable to assume that specific LCAs associated with agriculture and such likely represent pre- Māhele land utilization as well. Foremost among recorded LCAs are features a structures associated with traditional agricultural areas and historic-period land use and habitation. Thus, the present project area was deemed as archaeologically sensitive prior to fieldwork.

2.0 ENVIRONMENTAL SETTING

The project area is wholly located within 'Īao Valley, Wailuku District, Island of Maui, Hawai'i. The project parcel encompasses a sum total of approximately 13 acres in Wailuku Ahupua'a, the project parcel extending upvalley from the coastline (see Figure 1). Topographical undulation and elevational variation across the narrow project area reveals slightly different climatic, vegetative, and hydrological regimes. Wailuku Ahupua'a itself covers an area of approximately 1,395 acres and is bounded by the Pacific Ocean to its northeast, Waiehu Ahupua'a and Waiehu Valley to the northwest, Waikapu Ahupua'a and Wailuku Town to the southeast, and, at upper 'Īao Valley reaches, is bounded by Lahaina District (Kauaula Ahupua'a) (see Figure 1).

2.1 CLIMATE

Rainfall within the project area averages 20 inches per month during winter months and 3 to 5 inches per month during the summer season (Price 1983:62). Giambelluca *et al.* (1986) note that the Wailuku area, in general, receives some 500 mm of precipitation per year. Importantly, precipitation increases with ascending (upvalley) distance from the coastline. This variation follows normal orographic patterns noted for windward areas of Maui, the prevailing wind throughout the year being east-northeasterly trade winds. The winter months also bring a corresponding decrease in average daily temperatures while summer months see the highest mean temperatures.

2.2 TOPOGRAPHY AND SOILS

The topography of the project area is moderately sloping within the valley, the sidewalls of the valley being generally U-shaped erosional cuts. Project area elevations range from 210 ft. amsl (64 m) at its most *mauka* location to approximately 80 ft. amsl (24 m) at its most *makai* location. The coastline is approximately 0.50 to 0.75 km from this *makai* extent. 'Īao Valley stream, a perennial stream, is only slightly meandering and runs through the center of the valley and the project area parcel (see Figure 1). Two narrow flood plain areas lie on either side of the stream, a modest amount of flood plain amenable to small-scale agricultural pursuits if so desired. Suggestive of land use, the stream has in the past, and continues to, deposit young alluvial soils along its banks, these silty clay soils having likely been profitably utilized for agricultural pursuits (e.g., sugarcane cultivation, taro production) in the past.

Geologically, 'Īao Valley is composed of younger alluvium with lithified calcareous sand dunes resting on alluvial fans near the shoreline and along the eastern and western borders of the project area. Macdonald *et al.* (1983:387) state that the cliffs forming the back of 'Īao Valley coincide with the former boundary of a caldera, and lavas which formerly filled the caldera have been partly gouged by stream erosion. In addition, the geologists reveal that the rough terrain on the sides and floor of the valley is composed of moderately well consolidated colluvium and alluvium deposited at a former stage of higher base level and now is being removed by renewed stream erosion. More graphic geologic characteristics of the area are summarized by Macdonald *et al.* (1983:380-401).

Foote *et al.* (1972:Plate 99) provide specific information regarding soils and sediments occur within the ʻĪao Valley project area. The subject area and environs are dominated by three soi series: Pulehu cobbly clay loam, ʻĪao cobbly silty clay, and ʻĪao silty clay. The Pulehu series generally occurring on slopes with a gradient of 0-3%, consists of well-drained soils on alluvi fans, stream terraces, and in basins. These soils developed in alluvium washed from basic igneous rock and are commonly utilized for sugarcane cultivation, pasture, and homesites. ʻĪ cobbly silty clay also occurs within the project area. This series occurs on slopes with a gradi of 3-7% and consists of well-drained soils (with cobblestone intrusions) on valley fill and allu fans. Also derived from basic igneous rock, this soil series of most often associated with sugarcane cultivation and housesites.

The third soil series within the project area, ʻĪao silty clay, occurs on slopes with a gradient o 3% and is essentially the same as the ʻĪao cobbly silty clay series described above. The difference between the two is that ʻĪao silty clay contains few, if any, cobble intrusions and is characterized by slow runoff. This soil series, considered to have only a slight erosional haza is predominantly utilized for sugarcane cultivation. These three soil series, combined with th fact that ʻĪao Stream is a perennial or permanent stream, provide an area conducive to agricul pursuits, as was likely the case from traditional through modern times.

As will be shown below, excavations at Site -4755 revealed several subsurface strata compos of silty clay, these likely being associated with the Foote *et al.* (1972) designation of the soil series "ʻĪao silty clay." Few clastics occurred within the excavated matrix, the latter of which was very compacted. The compaction of the silty clay may have been a function of traditiona and/or historic use of the area, most likely the latter however, as the site was most probably utilized as a piggery. Continued utilization of the surface led to a compaction of the soil. It i possible, however, that the site's surface was compacted by mechanical means at some point time, even though lower layers remained compacted yet undisturbed by machinery.

2.3 VEGETATION

The vegetative regime within the project area, as is also described above, generally consists o many naturalized species. The project parcel may be best characterized as coastal dry forest (Wagner *et al.* 1990:62) and consists of at least nine plant species: Bermuda grass (*Cynodon* bristly foxtail (*Setaria verticillata* L.), finger grass (*Chloris* L.), *kiawe* (*Prosopis pallida*), klu (*Acacia farnesiana* L.), lantana or *lakana* (*Lantana camara* L.), *koa haole* (*Leucaena leucocephala*), sand bur (*Cenchrus* L.; endemic), and natal red top (*Rhynchely trum repens* Wild.). Connolly's (1974) archaeological survey of portions of ʻĪao Valley (upvalley from th present project) revealed the presence of twenty-nine plant species, the largest concentration vegetation being represented by *koa haole*, *kukui* nut trees (candlenut tree or *Aleurites moluccana*), and *lakana*. Reconnaissance of the project area in 1998 revealed that the primar vegetation occurring throughout the alignment corridor consisted of grasses and *koa haole.*

It is absolutely reasonable to state that the paleo-environment differed substantially from the present vegetative regime of ʻĪao Valley. Besides the numerous introduced plants (during bo

prehistoric and historic times), traditional land use and agricultural practices may have resulted in a shift from a *Pritchardia* sp. (*Loulu* palm) dominated forest to a grass, shrub, and fern dominated coastal plain from A.D. 1000 to 1200 (Athens and Ward 1993; see also Athens 1997). In addition, much historic-period vegetation in the area was presumably cleared prior to the cultivation of sugarcane. As seen above, a majority of the flora species listed above are naturalized species, those having been introduced from outside the Hawaiian Islands. Initial human contact and settlement of the Hawaiian Island chain initiated alterations of the floral landscape, these changes having increased multifold through present times.

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3.0 TRADITIONAL AND HISTORICAL SETTING

ʻĪao Valley and by extension, Wailuku Ahupuaʻa and Wailuku District, are frequently mentioned in historical texts and oral tradition accounts as being politically, ceremonially, and geographically important areas during traditional times (Cordy 1981, 1996; Kirch 1985). Wailuku was considered a "chiefly center" (Sterling 1998:90) with many of the chiefs and much of the area's population residing near or within portions of ʻĪao Valley. The many *heiau* constructed in the area point to the ceremonial and/or religious importance of the area during pre-Contact times. During historic times, after the numerous battles in the area, the large concentration of Land Commission Awards granted in lower ʻĪao Valley also attest to a sizeable population base and the importance of the lands for cultivation through time. More recent land use in the area included sugarcane cultivation, this practice being intensified during the late 19th century, military use of the area during World War II times, and at present, the lands being utilized for family housing and water channels, among other pursuits.

3.1 PREHISTORY

Archaeological settlement data indicates that initial colonization and occupation of the Hawaiian Islands first occurred on the windward sides of the main islands, with populations eventually settling into drier leeward areas at later periods (Kirch 1985). In the Waiheʻe and Waiehu areas of Maui, adjacent to and northwest of the current project area, Kirch (1985:87) notes that "a number of coastal dune midden sites have been reported, and at least one of these contained pearl-shell fishhooks similar to those from the Bellows Site, eroding from the wave-cut midden." The Bellows site, located on the windward coast of Oʻahu, has yielded dates of occupation, albeit controversial, from A.D. 300-600 (Pearson *et al.* 1971), one of the earliest dated sites in the Hawaiian Islands. Research within Wailuku Ahupuaʻa and especially near ʻĪao Valley (windward locations) indicates that the area was likely settled between c. A.D. 1100 (Kirch 1985:142) and A.D. 1200 (Fredericksen and Fredericksen 1996).

One of the earliest references for ʻĪao Valley itself refers to a Maui king in power during the A.D. 1400s (Sterling 1998:84). The king, Kakaʻe, was held in such reverence that commoners could not look upon him or suffer punishment by death. King Kakaʻe thus became a hermit within ʻĪao Valley during the 1400s so that his subjects could live without fear of condemnation. It was supposedly this king that also created a royal burial grounds (*Kapela*), an enigmatic place that was designated for himself and worthy successors as a sacred burial area.

Connolly (1974:5) states that the pre-Contact valley [ʻĪao] had a large population base with "most people residing in a settlement near ʻĪao Needle". Supposedly, the subsistence base of this population consisted of fish and taro, with Kahului Harbor and the coast close by and *loʻi* systems lining ʻĪao Valley's stream banks. Prehistoric ditches or *ʻauwai* were utilized in taro cultivation (Connolly 1974:5). Sterling (1998:86) adds that two *ʻauwai* within the valley "have existed immemorially and were evidently constructed for the purpose of irrigating *kalo* on the plains which stretch away to the northward and southward of the [ʻĪao] river. Several minor *ʻauwai* have, since ancient times, tapped the river at different points lower down and spread the

water through the lands in the gulch on either side of the river bed." Handy (in Sterling 1998 further notes that "From Waihee and Wailuku Valley, in ancient times, was the largest continuous area of wet taro cultivation in the islands." Cheever (1851:124) writes: "The wh valley of Wailuku, cultivated terrace after terrace, gleaming with running waters and standing pools, is a spectacle of uncommon beauty to one that has a position a little above it."

Recent archaeological research (Fredericksen and Fredericksen 1996:52) has revealed that habitation sites along what is now Lower Main Street in Wailuku, "are associated with the ric taro producing lands in the Lower ʻĪao River flood plain, and the extensive cultivation system present in ʻĪao Valley." These habitation sites have been dated to the A.D. 15th through 17th centuries. The ʻĪao Valley area was not only renowned for its agricultural base during prehist times but its ceremonial and political base as well (see also Cordy 1996; Donham 1996).

During the mid and late 18th century, the Halekii-Pihana *heiau* complex was constructed, Hal Heiau itself supposedly designed by a Hawaiian named "Kiha" (Sterling 1998:89). These monuments, designated as State Site No. 50-50-04-522 and occurring along the northwest fla of the current project area, are described as very important *heiau* within Hawaiian history. Ye (1983:7) notes an interesting cycle where Kamehameha I's wife was born there, Kahekili live there, and Kekaulike died there. Thrum (1909:46) reported that Kamehameha I evoked his w god at Pihana Heiau after his warriors defeated Kalanikupuli's forces during the Battle of ʻĪao 1790. The two *heiau* are primarily associated with Kahekili, who is connected with the Halek Pihana complex between c. A.D. 1765-1790, and Kamehameha, during his conquering of Ma in 1792 (Yent 1983:18).

Importantly, Halekii and Pihana Heiau are the only remaining pre-Contact Hawaiian structure religious and historical importance in the Wailuku-Kahului area that are easily accessible to t public (Estioko-Griffin and Yent 1986:3). As stated, the area within and adjacent to the curre project is known not only for its religious and/or ceremonial significance, but for its political prominence as well.

The Fredericksen's (1996:52) report that politically, Wailuku [village] was known as a central settlement for high ranking chiefs and their retinue. The Wailuku area was also witness to ma battles, from the Battles of ʻĪao and Sand Hills to the Battles of Kepaniwai and Kakanilua. Th most famous battle was that of Kepaniwai where Kamehameha I, in July, 1790, finally wreste control of Maui Island. Kamehameha I and his warriors landed at the Kawela portion of Kah Bay and proceeded up ʻĪao and other valleys to score a decisive victory. "Wailuku", meaning "water of destruction", succinctly describes the area in which many of these major battles occurred. Of additional note is that in the Kauahea area of ʻĪao Valley (southeast of ʻĪao Stre below Pihana Heiau-supposedly within the current project area), warriors apparently dwelt an were "trained in war skills and there was a boxing site in the time of Kahekili" (Sterling 1998:89).

Thus, the present project area was, during prehistoric times, within and adjacent to cultivated lands, battle grounds, political and population centers, and spiritual loci. Traditional use of th lands continued uninterrupted through historic times, albeit on a less intensive scale.

3.2 HISTORICAL `ĪAO VALLEY

The Wailuku area, as Kirch (1985:134) also notes, was an important center of political development during late prehistoric and early historic times and was the seat of powerful chiefs, including Kahekili, arch-rival of Kamehameha. Kamehameha I's unification of the Hawaiian Islands in 1790 brought Maui under the political control of its first non-Maui chief during July of that year. The last king of Maui was Kahekili II, son of King Kekaulike, both supposedly having been interred at the sacred burial grounds in upper `Īao Valley. By the early historic period, significant natural and cultural changes had taken place, not only due to contact with westerners, but also because of internal social and environmental restructuring and external social and environmental factors (e.g., foreign species being introduced as well as foreign ideologies). These combined to have a severe impact on Hawaiian environments, land-tenure, and social structures.

Several periods of various land utilization strategies occurred within `Īao Valley and more succinctly, within and near the present project area. Between 1778 and 1848, traditional land use occurred within `Īao Valley, albeit on a smaller scale, as the "Conquest" period began and the Sandalwood and Whaling trades dominated political and commercial activity within the islands (see Kirch and Sahlins 1992). Quite another conspicuous effect of the growing influence of foreigners in the Hawaiian Islands was the systematic division of lands, the Great Māhele. The Land Commission oversaw land divisions of three groups: Crown Lands (king), Konohiki Lands, and Government Lands, all of which were, in theory, open to the prerogative of native tenants. The awarded land claims bordering `Īao Valley, particularly those adjacent to the project area, were numerous in quantity and concentrated on the plateau above the stream valley, along the top of its sidewalls.

Sterling (1998:86) notes that "The district of Wailuku was once thickly settled, *kuleanas* to the number of over 400 were granted to natives and others. A large portion of these cultivated *kalo* with the aid of water from the river." Archival research of the current project area and environs (TMK 3-4-20, 21, 22, 23, 24, 30, 31, 32) has revealed that in 1848, Wailuku area residents submitted 199 land claims, 127 of these being awarded by the Land Commission (Waihona `Aina Corporation 1998). As such, an immense number of LCAs were encountered during archival research of the project area and environs. Only a small representative sample of the awards are listed, the LCA information provided by the Waihona `Aina Corporation (1998). The representative, random sample consists of LCAs 407, 3255, 3464, 3890, and 4452, all located on the south side of `Īao Valley. LCAs 3891 and 6409 are located on the north side of `Īao Valley (Note: N.T.=Native Testimony; N.R.=Native Register).

No. 407, Kaauwai, N.R. 136v2

> Lot 4. I forgot the fourth of our lots, from Kahauolopua. I am his heir and executor. It is makai of the Government Road going to the sugar mill. Owa is the name of that land. This place will be surveyed as one of my places to farm. It adjoins my place, and it is the government's and I have thought to occupy for a long time, if it is agreed to.
> KAAUWAI
> Wailuku, Island of Maui

N.T. 140-141v2

No. 407, Kaauwai

Napela, sworn by the Word of God, This place is at Owa. I have not known who had given this land to Kahauolohua, but we know the characteristics of konohiki. We can never refuse his idea for he is the konohiki of Owa. He had lived there in the year 18: and from that time to the day W. Richards asked me to survey that land because all o: those places is an acre and is for sugar cane cultivation. Kehanolohua built his enclos when the sugar cane planting was over. From the time the lot was completed to this d the length of time he has lived at Umieu and at Halaula together with the things made Kaauwai's hands.

Malaihi, sworn, by the Bible, It [Kaauwai's land] is on the west of the footpath to Kahawai, on the north is K. Ana's property, on the east is Namakeha's place and on th south is the road for cattle wagons. This was idle land formerly and a portion of it has extended into a portion which is said to be an acre. From the year 1839.

Later in the month of October in the year 1846 was the hookupu of the land month. A this time Nailiili gave me the responsibility to ask the farmers to give in dollars for th patches and when they did not comply, the patches may be returned. At a later time I to Kauhapa for he was a farmer under a mooaina overseer, "Nailiili has told me to ask you for the tax of your patches." Kauhapa said, "Wait, when the patches are complete will return [them]" and I agreed with him. Later after this I reported to Nailiili that Kauhapa had returned the patches and he told me that the patches were for Ane ma to which I had said, "Yes." I told Keahi, "Kauhapa's patches have been returned", then h told me to take those patches.

At that time Kauhapa returned [patches] to Ane because he had received his land from her, so Ane's husband began to cultivate the land with the presumption that the patche were for them. So I told Keahi what was happening to the patches and he requested th work on those patches. I hired some men from the prison to work in those patches and land was acquired by the Konohiki Keahi, so I said to Keahi that he would have to do work on the l that I could not do because of my close relatives who might probably te me to do as I please and I would do likewise. Later my wife would chide me and beca she would not part with things belonging to her parents, I had ceased engaging in Frid work.

When I was a Friday overseer, Puniho was a Friday man and on the Fridays he did no come, I would check off for his day's work. Later when I met him I would ask him, "I you paid for your Friday obligation?" "Yes," he would say with a request that I give h some patches in order to increase his number of patches. I refused [him] by saying the was no extra patch and that he had only working days; therefore, he came on some da and would compensate for other working days. He did tell me that his patches were ve small and I was very sorry about it. He also said that his working day would be profit

if I would give him more patches. "I have only three patches and three small pools", he continued to say. I asked him whether he had some patches at some other locality and that they may be large ones He answered that they were not large, and were of the same size as the ones we have here.

Where are those patches? They are at Kalua which is a "ku", then I asked him, "What do you think, Would it be right with you to return the patches? He answered, "I have been thinking about a sale with Malaihi because we have talked with each other and he wants some of my patches.

[Award 407; R.P. 5530; Halaula Wailuku; 7 ap.; 2.41 Acs; Imiau Wailuku; 1 ap.; .32 Ac.; Kalua Wailuku; 3 ap.; 1.25 Ac. 29 rods; Owa Wailuku; 3 ap.; 8.25 Acs 21 rods; Pohakuuhi Wailuku; 1 ap.; 1 rood 19 rods

No. 3255, Hoopiiaina, N.R. 50v6

Greetings to the Land Commissioners: I hereby state my claim. It was good of you to send your message in the Eleele, to make claims for land, lo`i and kula. There is a small mound - the house is there. The total number of lo`is at Pohoiki is 23, given by Opu. One kula is at Pohoiki. At Kaulupala are 25 /lo`i?/, 1 kula.
That is my claim.
HOOPIIAINA
Wailuku, December 25, 1847

F.T. 415v7

Cl. 3255, Hoopiiaina

Keahi, sworn, I know the lands of the claimant. They consist of two pieces in Wailuku, Maui.
No. 1 is one moo of kalo land in the ili of Kaulupala.
No. 2 is one loi in the ili of Kukuikalimaka.
The claimant received these lands from his parents and has held it [them] ever since the days of Kamehameha I. His title has never been disputed. There are 5 poalimas in it.

No. 1 is bounded
Mauka by the ili of Kiwela
Waihee by the creek of Wailuku
Makai by Kealoha & Kaumu's land
Maalaea by the ili of Kukuialamana.

No. 2 is bounded:
Mauka by the ili of Kiiwela
Waihee by Peahi's land
Makai by Lelo's land
Maalaea by Paele's land.

N.T. 608-609v9

No. 3255, Hoopliaina
Keahi, sworn, I know his two parcels of land in Wailuku.
Parcel 1. Taro mo`o at Kaulupala.
Parcel 2. 1 lo`i at Kukuialaimaka.
His land was from the makuas, from the time of Kamehameha I. He has occupied thes continuously. There is no opposition.

[No.] 1 is bounded:
Mauka by the `Ili of Kiwela
Waihee, by stream
Makai by Kealoha and Kaumu
Maalaea by the `Ili of Kukuialaimaka.

[No.] 2 is bounded:
Mauka by the `Ili of Kiwela
Waihee by Peahi
Makai by Lelo
Maalaea by Paele.

[Award 3255; R.P. 3347; Kaulupala Wailuku; 1 ap.; 5.8 Acs]

No. 3464, Kamakaoolea, N.R. 85v6

Hear ye, ye Land Commissioners: I hereby tell of mylo`is. In Nehe are 8 lo`i and a ku which I received from Kakumanaana. from Kahula I received 3 lo`i. from Kaianui I received 4 lo`i. From Paele, at Papohaku, I received 2 lo`i and 3 hala clumps.
Farewell to the Land Commissioners.
KAMAKAOOLEA
Wailuku, 10 January 1848

F.T. 415-416v7

Cl. 3464, Kamakaoolea
Nalehu, sworn, I know the lands of the claimant. They consist of 6 pieces of land in Wailuku, Maui.
No. 1 is a house lot & kalo & kula land in the ili of Neha.
No. 2 is one loi in the ili of Nehe.
No. 3 is one loi in the ili of Nehe.
No. 4 is three loi of kalo in the ili of Nehe.
No. 5 is a section of kalo & kula in Nehe.
No. 6 is two lois in the ili of Papohaku.

The claimant received the first 5 pieces from Kumamaawa in the days of Kamehameh His title has never been disputed. The last piece he received from Paele in the year 18 and his title there has not been disputed.

No. 1 is bounded:
Mauka by Kahula's land
Waihee by pa aina
Makai by paahao
Maalaea by my land.

No. 2 is bounded:
Mauka by Kaiakailoa's land
On the other three sides by Kahula's land.

No. 3 is bounded:
Mauka by Paele's land
Waihee by Kahula's land
On the other two sides by Kaianui's land.

No. 4 is bounded:
Mauka by Kaianui's land
Waihee by the same
Makai by Kalaiwehea's land
Maalaea by my land.

No. 5 is bounded:
Mauka & Waihee sides by the pa aina
Makai by Kaiakailoa's land
Maalaea by Kalaiwehea & Naea's land.

No. 6 is bounded:
Mauka by Kalawaianui's land
Waihee by paahao
Makai by Moo's land
Maalaea by Paele's land.

N.T. 609v9

No. 3464, Kamakaoolea, July 9, 1849
Nalehu, sworn, I know his six parcels of land at Wailuku.
Parcel 1. 2 lo`i and house site and kula at Nehe.
Parcel 2. 1 lo`i in the `Ili of Nehe.
Parcel 3. 1 lo`i in the `Ili of Nehe.
Parcel 4. 3 lo`i in the `Ili of Nehe.
Parcel 5. 1 pauku of taro in the `Ili of Nehe.
Parcel 6. 2 taro lo`i in the `Ili of Papohaku.

The first five parcels in the `Ili of Nehe were from Kekuamamaawa, from the time o Kamehameha II. Parcel 6 in the `Ili of Papohaku was from Paele in 1845. There is n opposition.

[No. 1] is bounded:
Mauka by Kahula
Waihee by the land boundary wall
Makai by lo`i pa`ahao
Maalaea by Nalehu.

[No.] 2 is bounded:
Mauka by Kaiakailoa
Waihee by Kahula
Makai by the same
Maalaea by the same.

[No.] 3 is bounded:
Mauka by Paele
Waihee by Kahula
Makai by Kaianui
Maalaea by the same.

[No.] 4 is bounded:
Mauka by Kaianui
Waihee by the same
Makai by Kalaiwehea
Maalaea by Nalehu.

[No.] 5 is bounded:
Mauka by the land boundary wall and stream
Waihee by the same
Makai by Kaiakailoa
Maalaea by Kalaiwehea also.

[No.] 6 is bounded:
Mauka by Kalawaianui
Waihee by lo`i pa`ahao
Makai by Mao
Maalaea by Paele.

[Award 3464; R.P. 5446; Nehe Wailuku; 4 ap.; 1.405 Acs]

No. 3890, Paoa, N.R. 133v6

Greetings to the Land Commissioners: A claim for lo`i and kula land in Wailuku. I, Paoa, hereby state that I have 38 lo`i and a kula at Lamalii iki, lying as follows: on the north, the seven lo`is, on the east, the sand ridge and the road, on the south, Lamalii nui, on the west, Lemukee. My right of occupancy was from Kalawaiahonu.

PAOA

Wailuku, 17 January 1848.

F.T. 458v7

Cl. 3890, Pooa

Kanekoa, sworn, I know the land of the claimant. It is one piece of kalo land in the ili of Lamalii iki, Wailuku, Maui. The claimant received it from Boaz Mahune in 1840 and he from the King. His title was never disputed. There are 2 poalima lois in it.

It is bounded:

Mauka by the ili of Lamalii Nui

Waihee & Makai sides by Kalawaiahonu's land

Maalaea by the Government lot.

N.T. 645v9

No. 3890, Pooa, July 12, 1849

Kanekoa, sworn, I know his land, one parcel of taro in the `Ili of Lamalii iki, Wailuku. It was from B. Mahune in 1840, and B. Mahune had it from the Mo`i. Two po`alima are in it.

It is bounded:

Mauka by Lamalii nui, an `Ili

Waihee by Kalawaiahonu

Makai by the same

Maalaea by Government lot.

[Award 3890; Lamaliiki Wailuku; 1 ap.; 2.45 Acs]

No. 3891, Paia, N.R. 133v6

Greetings to the Land Commissioners: I, Paia, hereby state my claim for 15 lo`i and a kula, at Pohakuli, lying as follows: on the north is the stream, on the east is Kaina's mo`o, on the south is Pohakea, on the west is Aimakalani's land. My right of occupancy was from Kanemano.

PAIA

Wailuku, 17 January 1848

F.T. 430v7

Cl. 3891, Paia, Wailuku, July 10th 1849

Kalimahauna, sworn, the claimant's land consists of two pieces in Wailuku, Maui but know one, which is 10 lois in the ili of Pohakuuli. The claimant received it from Kalawaiahonu, the konohiki in 1844. His possession has ever been peaceable. There poalima loi in it.

It is bounded:
Mauka by Auimakalani's land
Waihee by the creek
Makai by Auimakalani's land
Maalaea by Paele's land.

Puhululu, sworn, I know the claimant's other piece of 4 lois. It is in the ili of Pauniu. received it from me in 1844 and I received it from Kanoii who received it from his parents in ancient times. The claimant's title is not disputed.

It is bounded:
Mauka by Kalawaiahonu's land
Waihee & Makai sides by Kanoii's land
Maalaea by the creek of Wailuku.

N.T. 620-621v9

No. 3891, Paia, Wailuku, July 1O, 1849
Kalimahauna, sworn, I know of his one parcel of land in the `Ili of Pohakuuli, in Wailuku. It was from Kalawaiahonu in 1844. There is no opposition. One po`alima is it.

It is bounded:
Mauka by Auimakalani
Waihee by Kahawai
Makai by Auimakalani
Maalaea by Paele.

Puhululu, sworn, I know of four lo`is in the `Ili of Pauniu, in Wailuku. There is no opposition. His land was from Kanoii in 1844, and Kanoii got it from his makuas The no opposition.

It is bounded:
Mauka by Kalawaiahonu
Waihee by Kanoii
Makai by Kanoii and Naea
Maalaea by Kahawai.

[Award 3891; R.P. 7003; Pohakuuli Wailuku; 2 ap.; 1.04 Acs; Pauniu; 1 ap.; .15 Ac.]

No. 4452*M, [Hazaleleponi Kalama], C. Kanaina (for Kalama) Honolulu, Jan. 19, 1848
N.R. 603-605v3

To the President of the Land Commissioners, William L. Lee, Respectfully: By direction of Queen Hazaleleponi Kalama, I hereby present her claims for house lots which have not previously been given. Therefore I hereby describe her house lots and her right to them.

N.T. 187-188v10

No. 4452, Hazaleleponi Kalama

COPY HAZALELEPONI KALAMA'S DIVISION

Kula ahupuaa, Puna, Hawaii
Kapalaalaea ahupuaa, Kona, Hawaii
Kalahuipuaa ili of Waimea, Kohala, Hawaii
Anaehoomalu ili of Waimea, Kohala, Hawaii
Waipio ahupuaa, Hamakua, Hawaii

Kaohe ili for Wailuku, Maui
Puhiawaawa ili for Wailuku, Maui
Lemukee ili of Wailuku, Maui
Puohala, Wailuku, Maui
Manienie, Wailuku, Maui

Waikahalulu, Honolulu, Kona, Oahu
Kailua ahupuaa, Koolaupoko, Oahu
Kaneohe ahupuaa, Koolaupoko, Oahu.
Hakipuu ahupuaa, Koolaupoko, Oahu.

I have approved this land division, the lands listed above are for Hazaleleponi Kalama, and they may be presented to the land officeres.
(Sign) Kamehameha
Copied by S.P. Kalama (for H. Kalama) Secretary
Royal Palace, 11 February 1848
See page 358

[Award 4452; (Maui) R.P. 7299 Wailuku; R.P. 7303 Wailuku; R.P.; 7300 Wailuku; 7302 Wailuku; 7301 Wailuku; (Lahaina award no R.P.); (Hawaii) R.P. 7523; Anaehoomalu Waimea; 1 ap.; 866 Acs; R.P. 7529; Waipio Hamakua; R.P. 7522; Kalahuipuaa Waimea S. Kohala; 1 ap.; 359 Acs; R.P. 7483; Puna; Kula & Halekamahina; 3 ap.; 2902 Acs; No R.P.; Kapalaalaea N. Kona; 1 ap; Ahupuaa; (Oahu) R.P. 7482; Hakipuu Koolaupoko; R.P. 7427; Nuuanu Street Honolulu; R.P. 7530; Aienui Honolulu; R.P. 7213; Halehala Honolulu; R.P. 7983; Kailua Koolaupoko; R.P. 5683 & 7516 & 7220 & 7255; Waikahalulu Honolulu]

No. 6409, Kupanihi, Wailuku, 29 Jan. 1848, N.R. 368v6

Greetings to the Land Commissioners: I hereby tell you of my lo`is which are situated in the `ilis of Laie Maloo and `Īao.

At Laie maloo are 14 lo`i, also some dry places, some on the east of this `ili and som
the south side. These lo`is are not situated in one place.
At `Īao are 3 lo`i as follows:
on the north is the lo`i of Aki
on the east is the watercourse of Halu
on the south is the lo`i of Pa
on the west is the lo`i of Pa.

There are some hala clumps, also, at Laie, Opilopilo II.
KUPANIHI

F.T. 426v7
Cl. 6409, Kupanihi

Kaneiaulu, sworn, I know the land of the claimant. It is one piece of kalo land of 3 m
in the ili of Laie, Wailuku, Maui. The claimant received this land from Kailihuna in t
year 1835 and has held the same without dispute ever since. There is one poalima loi
within this piece.

It is bounded:
Mauka by my land
Waihee by Government lot
Makai by Aki's land
Maalaea by my land.

N.T. 617v9
No. 6409, Kupanihi

Kaneiaulu, sworn, I know of one parcel of taro at Laie, in Wailuku. His land was fron
Kailihiwa in 1835. There is no opposition. One po`alima is in it.

It is bounded:
Mauka by my land
Waihee by the government wall
Makai by Aki
Maalaea by my land and konohiki.

[Award 6409; R.P. 4988; Laie Wailuku; 2 ap.; 1.31 Acs]

As seen through a listing of only seven LCAs occurring adjacent to the project area, land use within and adjacent to the present project area was predominantly focused upon agricultural pursuits. The LCA information lists several categories of land use within and near the project through time, from "ancient" times through at least the middle of the 19th century. These incl *lo`i* systems (pondfield cultivation of irrigated taro), *kula* lands (dry land, not wet or taro land *hala* clumps (*Pandanus odoratissimus* or screw pine; the leaves provide material for weaving baskets or mats); *po`alima* (chiefly plantations; named such as workers generally worked on a

chief's plantations specifically on Fridays). Several land divisions parcels were also claimed, from *'ili* (subdivision of *ahupua'a* lands) to *mo'o* (land subdivision of an *'ili*) and *apana* (land division of a *kuleana*). Several LCAs (407, 3255, and 3464) list house sites within their awarded claims.

Traditional land utilization within and adjacent to the 'Īao Valley project area was, on an initially small scale, replaced by sugarcane cultivation during the 1850s. This small-scale cultivation was begun by Kamehameha III and further intensified by foreign plantation managers and owners such as Peck and others (see Sterling 1998:86). Many of the awarded LCAs in the area were under sugarcane cultivation by the mid 19th century (e.g, LCA 407). By the late 1800s, much of the land within and near 'Īao Valley was planted in sugarcane. Sugarcane fields extended along the borders of 'Īao Valley, within the valley, and even occurred between the Halekii-Pihana Heiau site. Connolly (1974:5) notes that in the early 1900s, the sugarcane industry dominated commerce and land use in the 'Īao Valley area, a fair amount of water irrigation ditches, terraces, free standing walls, historic house sites, and mill structures having been constructed during this time. Agricultural terracing and a Portugese worker's camp were but several structures existing in the lower stream valley. The Portugese laborers "lived in the stream bed area, growing taro and other vegetables in the *lo'i* and working as laborers on the plantation. This population lived in a worker's camp until the flood of 1916" (Connolly 1974:5). This flood presumably ended habitation practices within lower 'Īao Valley.

In 1912, a rock crusher was installed in 'Īao Valley by Mr. Willie Crozier, an entrepreneur who was resolved to supply all of the rock needed for construction projects on Maui. This crusher, however, was also destroyed in the 1916 flood. The flood itself, generated within 'Īao Valley, demolished taro *lo'i*, the rock crusher, the Portugese Camp, and, among other things, portions of the two *heiau*. Yent (1983:7) suggests that major erosion of both Halekii and Pihana Heiau was due to the 1916 flood, the western half of Halekii being eroded down the steep valley slope and the eastern half of being eroded by 'Īao Stream. Importantly, archaeological remnants occurring in the valley (valley floor) would have also been dramatically effected by the flood as well.

Sugarcane cultivation continued in and near the valley after the flood though, with plantations rebuilding the water systems feeding the sugarcane fields (Connolly 1974:6). Cultivation of sugarcane dominated land use of the project area environs through the middle of this century. During World War II times, military training was done in *mauka* 'Īao Valley areas while ranching also occurred. Remnants of these activities (and earlier historic occupations) include iron broilers and concrete foundation walls (large ovens), concrete-lined trenches, and concrete house pads (Bordner 1983:6-9). Later use of the area included the Hawaii National Guard constructing a water tank, pipeline, and dirt road across the surface of Halekii Heiau. Presently, the 'Īao Valley project area loci is bordered by residential housing units, commercial buildings, and the Halekii-Pihana Heiau Complex.

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4.0 PREVIOUS ARCHAEOLOGICAL RESEARCH

Several archaeological projects have occurred on the flanks of ʻĪao Valley and closer to Wailuku, all of which are important in determining traditional and historic-period settlement patterns within the general area and more specifically, within the ʻĪao Valley project area (see Donham 1996). Only one study has been conducted directly within ʻĪao Valley near the current project area, an archaeological survey conducted in 1974 by Connolly for the first phase of the ʻĪao Valley Flood Control Project.

4.1 SPECIFIC PROJECTS

Initiatory research of an archaeological nature within Wailuku Ahupuaʻa was accomplished by Thrum (1909) who first identified the much investigated Halekii and Pihana Heiau. In addition to Thrum's work at the monumental structures, Stokes mapped the site in 1916. Walker also recorded the site in 1931, during his island-wide survey of Maui in which he identified many *heiau* within Wailuku Ahupuaʻa (Walker 1931). Emory was the next archaeologist working at this important site and during his 1959 campaign, reconstructed portions of Halekii and rendered another map of the Heiau. The most recent work at the site was accomplished by Yent (1983, 1984, 1995) who conducted systematic survey, mapping, and excavations as part of a restoration plan. Yent's (1995) work yielded explicit planviews of the site, detailed profiles of the *heiau,* and revealed construction techniques utilized to build the features.

Prior to the modern era, the only large-scale survey of Wailuku Ahupuaʻa and environs, albeit biased towards coastal structures, was conducted by Walker (1931). Recently, many other archaeological projects have been conducted in the area and have yielded much data regarding settlement pattern and land utilization within the *ahupuaʻa*. Kirch (1985:144) notes, however, that "more intensive study of these important regions will help to unravel the sequence of economic, social, and political change that led to the development of the powerful Maui chiefdoms witnessed by Cook and others".

Connolly (1974), as part of the initial ʻĪao Valley Flood Control Project (Phase I), conducted archaeological survey on a parcel located upvalley from the present project area. Connolly's survey augmented a preliminary reconnaissance of the study area by K. Moore of Bishop Museum in April, 1974, the latter noting the presence of stone structural remains thought to be taro or *loʻi* terraces. During survey, Connolly recorded two historic complexes composed of a substantial amount of terraces, free-standing walls, ditches, historic house foundations, and several stone mounds.

Identified by Connolly (1974) and distinguished as State Site No. 50-50-04-2978 (Wallace System Complex) and 50-50-04-2979 (North Terrace System Complex), the former site, located on the south stream bank of ʻĪao Valley, contained a site composed of twenty terraces, two irrigation ditches, one free-standing, diversionary wall, and two house foundations. The North Terrace System Complex consisted of a wet-land taro system represented by six taro terraces, two free-standing walls, and two stone mounds of unknown function. Connolly believed both

sites (and all features) to have been constructed during historic times, the sites presumably constructed by Portugese workers living in a camp within the valley. Several interesting arti were also recovered during the survey and represent traditional taro processing: one, fracture basalt *poi* pounder and one, unfinished basalt *poi* pounder. Connolly's (1974) work in the ʻĪa Valley streambed set one precedence for anticipated findings during the present study.

During May 1981, Bordner (1983) conducted archaeological reconnaissance and limited subsurface investigations at the Waiehu Housing Development, a parcel situated northwest a adjacent to the present project area. The Waiehu Housing Development abuts the Halekii an Pihana Heiau site. The reconnaissance revealed past World War II military use of the area (training grounds) and ranching activities. Empirical data representing this period included a iron broiler and concrete foundation walls (large ovens), a concrete-lined irrigation trench (sugarcane), concrete house pads, and several other mid-20th century structures. Limited subsurface testing in the parcel failed to yield any significant cultural layers, a majority of th matrix composed of consolidated sand. Bordner (1983) concluded that it was unlikely that n traditional activity (vis-a-vis agriculture) occurred on the parcel as the sandy matrix was detrimental to the cultivation of taro, particularly when compared to the alluvial soils near ʻĪa Stream. Exclusively, evidence for historic-period land use was documented.

Yent (1983, 1995), following in the footsteps of the many archaeologists previously docume Halekii and Pihana Heiau (State Site No. 50-50-04-522), conducted systematic survey, mapp and excavations at the *heiau* site during several field excursions between 1983 and 1995. Th site, recommended for inclusion in the National Register of Historic Places, lies on the north side of ʻĪao Valley Stream, or adjacent and northwest of the present project area. As stated previously in this document, the *heiau* site was especially important during traditional times ceremonial loci. The two *heiau* are located on a lithified sand dune ridge to the northwest of Stream, both structures suffering damage due to erosion caused by ʻĪao Stream and the erodi sand dune (Yent 1983:1). These two complex structures have been approximately dated to t middle-late 18th century, construction of the features occurring prior to the arrival of foreigne the Hawaiian Islands. For a more detailed description of the sites interpretive themes, archaeological results from survey, mapping, and subsurface testing, and preservation recommendations, the reader is encouraged to review the works of Yent (1983, 1984, 1995) Estioko-Griffin and Yent (1986).

The most recent archaeological work conducted near the current project area was conducted the Fredericksens (1996) on Lower Main Street and Mill Street in Wailuku. This project are approximately 500 m to the east/southeast of the current ʻĪao Valley study location. Excavat at State Site No. 50-50-04-4127 revealed two extensive, subsurface cultural deposits, both "overlain by fill from historic earthmoving activities associated with the construction of the Kahului Railroad and Lower Main Street" (Fredericksen and Fredericksen 1996). While the upper cultural deposit was disturbed by the aforementioned activities, the lower layer contair intact pre-Contact features and artifacts associated with a habitation function. Artifacts associated with fishhook manufacture, lithic tool utilization and production, and food prepar

were recovered from Layer II deposits. The deposits were dated and it appears the site was occupied during the late pre-Contact period (A.D. 1570-1780). Importantly, this habitation site is likely associated with the lower ʻĪao River flood plain in which taro was presumably produced. Thus, habitation occurred above the valley floor while taro production for households occurred on the rich but narrow alluvial flood plains of ʻĪao Valley.

Finally, Cordy (1996) and Donham (1996) provide overview studies of prior archaeological work having been conducted in the area. Cordy (1996) discussed an overview of Māhele documents on land patterns in the ʻĪao Valley area that clearly showed that lower valley region contained irrigated taro fields throughout the flood plain and houses and associated grave sites at the base of the sand dunes bordering the sides of the flood plain. Donham (1996) also summarized that house sites occur along the base of the sand dunes, with population movement occurring up valley through time.

These recent archaeological studies, although few in number, provide much insight into the nature of traditional and historical activities occurring within and near the current ʻĪao Valley project area. Through past archaeological research, oral traditions, and historical records, the chronology and settlement pattern of the valley may be brought into focus.

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5.0 CHRONOLOGY AND SETTLEMENT PATTERN: ʻĪAO VALLEY

The settlement pattern and timing of land utilization may be conveniently (and arbitrarily) divided into several general periods: traditional/pre-Contact settlement, the early historic period/early post-Contact, the recent historic, and present land use. Together, these periods create a synthesis of land use in and near the project area as well as provide a basis on which researchers explored succinct research questions during reconnaissance and sampling work.

5.1 HAWAIIAN SETTLEMENT AND LAND USE PERIOD

Wailuku Ahupuaʻa and its coastal environs are thought to have been initially settled c. A.D. 1100-1200, a concentration of incipient settlement primarily occurring near the coastline. Through time, settlement expanded to more inland locales, such as within various portions of ʻĪao Valley itself. The Wailuku area is considered to have been a chiefly and ceremonial center during pre-Contact times. Settlement, burial grounds, coastal exploitation of marine resources, and *loʻi* systems in ʻĪao Valley were supposedly common during pre-Contact times. Between A.D. 1500-1700, archaeological data indicates that habitation occurred near ʻĪao Valley, among other locales, with the valley itself utilized as taro-producing lands. The numerous ***heiau*** attest to the significance of the area (Halekii and Pihana Heiau) and war gods were invoked by Hawaiians at the temples (e.g., by Kamehameha I, for example). Many battles were fought within ʻĪao Valley, most poignantly the Battle of ʻĪao in which Kamehameha I gained complete control of the island, displacing the Maui chief before him. The unification of the Hawaiian Islands by Kamehameha I, coupled with an increasing influx of foreigners in the islands, ushered in the early historic period.

5.1.1 Early Historic Period

Besides the unification of the islands, perhaps the most significant development following Contact with westerners was the Great Māhele of 1848. Many awards were distributed in areas bordering ʻĪao Valley, most land being utilized for the irrigated cultivation of taro, acquiring leaves from *hala* trees, and for house sites resting near taro production areas. The LCAs listed for the project area and environs, some 129 awarded claims, were likely used on a continuous basis from pre-Kamehameha I times at least through the middle to late 19th century.

Another significant development was the cultivation of sugarcane which began in the ʻĪao Valley area during the 1850s. Sugarcane became the dominant crop cultivated in the area and provided occupational opportunities for both local and non-local residents. With sugarcane cultivation came irrigation and processing structures across the landscape, these being irrigation ditches, mills, and other infrastructures supporting the cash crop production. Sugarcane cultivation continued through the 20th century.

5.1.2 Recent Historic Period and Present Land Use

During the 20th century, sugarcane cultivation continued on an intensive scale. A Portugese worker camp was located within ʻĪao Valley, the camp providing residence to plantation workers. The 1916 flood erased this camp and a rock crusher installed several years previously. After the

flood, the sugarcane plantations rebuilt many of the irrigation ditches and mill stations dest during the flood. Sugarcane continued to be the dominant activity in the ʻĪao Valley area, o small taro plots still being cultivated. To the southwest and *mauka* of the current project ar land was utilized during World War II as a military training area. In addition, ranching bec viable activity in the ʻĪao Valley area, particularly in *mauka* areas below the precipitous clif the West Maui mountain range. At present, lands surrounding the project area are utilized f family housing and business buildings. The Halekii and Pihana Heiau area has been preser and restored. The project area within the lower valley, much which is overgrown with vegetation, remains relatively non-utilized at present.

Overall, the settlement pattern of the project area and environs suggests a range of site types associated with various landforms (see Cordy 1996 and Donham 1996 for settlement patter summaries). For instance, irrigated *kalo* fields would occur on the flood plains where alluvi soil and hydrological output are both present in sufficient quantities (and quality) to allow fc successful cultivation. Related to a wholly different soil type, traditional subsurface habitati deposits with associated burial loci occur at the base of sand dunes adjacent to the flood plai Sand dunes occur on both sides of the stream valley flood plain. Traditional activity areas w also utilized during historic times. For example, sugar cane cultivation occurred on an indus level in flood plain reaches from the 1850s. Even later, portions of the valley were utilized during World War II as training areas. A survey of all topographic features associated with valley has yielded variable land use patterns through time. The present survey sought to refi these patterns if evidence was indeed available.

6.0 RESEARCH DESIGN

6.1 RESEARCH QUESTIONS

The following research questions were posed prior to the introduction of field reconnaissance and limited excavation work. Fieldwork emphasis was placed in the empirical realm The questions are listed below and their answers are evaluated in further sections of the report.
The traditional and historical setting of Wailuku Ahupua`a and `Īao Valley in particular suggested that settlement and agricultural endeavors in the area occurred continuously for several hundred years, from perhaps as early as c. A.D. 1200/1300. Within the project area itself, agricultural features were thought to most fully represent traditional and historical land utilization within the parcel.

(1) If present, what is the type, timing, and extent of traditional architectural features within the `Īao Valley project area?

(2) Besides the expected potential of recovering agricultural features, what other structures or artifacts will be recovered from within the project area that allow us to infer settlement pattern and land utilization through time? This includes temporary and/or permanent habitation loci, ceremonial structures, etc.

At least 127 land claims were awarded within and near the present project area. These claims are represented by *lo`i* systems, house sites, and *kula* lands, among other land uses.

(3) Do the LCAs within the project area still contain structures or other remnants that allow for correlating the LCA with the feature and second, does the condition of the feature allow for interpreting and correlating land use and the LCA?

In 1916, a large flood swept through `Īao Valley, destroying many traditional and historic features within and bordering the valley:

(4) If present, to what extent have archaeological sites in the `Īao Valley project area been impacted by the flood? Secondarily, how have the sites been impacted by historic-period land modifications?

During the early 20th century, a Portugese camp supposedly existed within the lower valley portion of the project area:

(5) What historic remains occur within the parcel, whether structures or cultural material? Was the subject parcel continuously utilized from traditional times through modern times?

6.2 ANTICIPATED FINDINGS

Based upon previous archaeological research, LCA information, and other limited archival research of historical texts, several classes of archaeological features were thought to occur within the ʻĪao Valley project area. The lower valley parcel, encompassing ʻĪao Stream and associated narrow, alluvial floodplains, was likely utilized for the cultivation of taro from traditional times. Archaeological available data relating to this agricultural practice would include, but not be limited to, stone and earthen terraces, alignments, free-standing walls, a ʻ*auwai* or water irrigation ditches. Artifacts suggested to accompany taro production may include lithic artifacts such as basalt cores, adzes, flakes, and, as has been recovered previo *poi* pounders. Potentially, agricultural layers from traditional times through the present wo possibly be amenable to observation through the presence of oxidation and reduction layers well as charcoal layers depicting burning or clearing episodes prior to, or after, cultivation.

As has also been suggested by past research in the area, the ʻĪao Valley project parcel could contained evidence for temporary, small scale habitation from traditional through historic ti Settlement pattern research indicated permanent habitation above the valley floor through th early 20th century and worker's camps situated near the valley floor during historic times. Archaeological remains associated with these activities could include traditional lithic remai (adzes, flakes, etc.), faunal remains (subsistence), and charcoal denoting hearths (temporary campsites, etc.). Later period occupation could be reflected not only by the preceding artifa but also by structures associated with small-scale taro production (walls, etc.; see Connolly and historic artifacts such as metal, ceramic, and glass assemblages.

LCA information gleaned from a small sample of LCAs near the project area indicates that n of the project parcel was utilized for agricultural pursuits (taro). Thus, archaeological availa data reflecting this land use could include stone alignments, terraces, ʻ*auwai* or ditches, and accompanying artifact assemblage composed of lithics (basalt cores, adzes, flakes). Agricult soils, represented by charcoal layers and/or oxidation and reduction layers, could potentially noted, these depicting specific agricultural use of the area over time.

It is presumed that 20th century debris, reflecting military and ranching activities within the general project area and more recent activities, could also have been present within the proje area.

However, as will be shown below, a number of archaeological structural and artifactual class listed above were not identified within the project area during the course of the present proje Briefly, this pattern is most probably due to intensive, historic-period landscape alterations within the project area and not due to the fact that the lands were never utilized from prehisto times through the present for agricultural and/or habitation pursuits.

7.0 METHODOLOGY

As specified in the Research Design for the present project (Dega 1998), a pedestrian survey was conducted through the 4,700 ft. long, 150 ft. wide corridor of the ʻĪao Stream alternative channel alignment (see Figure 1). Two-person sweeps were conducted through the entire project area, a focus on identifying and recording all structures across the landscape. Site boundaries were identified and clearly marked with surveyor's flagging tape, as well as recorded and located on U.S.G.S. topographic maps. Additionally, the one identified site was recorded by tape and compass and vegetation clearing within and around the site was restricted to that only allowing for site identification and site boundary determinations. All stages of the archaeological investigations were fully documented in a daily log and in photographic form as specified in Section 5.3.3 of the Scope of Work (SOW). Excavations were to be conducted at recorded sites following the completion of reconnaissance survey.

7.1 RECONNAISSANCE SURVEY

Near the southwestern edge of the project area (from the concrete stream channel below the Spreckels Ditch flume, to the spillway), the open area was inspected but marking flags were not distributed across the area. Following reconnaissance of the open area, the two-person fieldcrew began surveying by implementing southwest-northeast transects, the origination point for the transects occurring on the northeast side of an unsurfaced road, the road extending northwest from Imi Kala Street to Piihana Road (see Figure 4). Flagging tape marked the extent of each northeast-southwest transect surveyed. Surveyed transects continued to the intersection with ʻĪao Stream at the northeast end of the alignment corridor, an exception being a small section that passed through currently cultivated gardens. The cultivated garden areas, a bulldozed building, a corral, and fenced animal pens and enclosures were photographed and located on an alternative channel alignment map supplied by the client (see Figures 5-9).

Overall, one site, comprised of three surface features, was identified within the project area (see Figure 3). The site (50-50-04-4755; TMK 3-4-32:1) and its three component features were photographed, mapped in plan view, and recorded on standard site and feature forms. The site and constituent features were marked with flagging tape and the site location was plotted on the channel alignment map (see Figure 3). Surface artifacts distributed within and adjacent to the site were collected through two-person sweeps within the site and a 15 m radius of the site. Surficial artifact dispersions were plotted on a distributional, plan view map of the site.

7.2 EXCAVATIONS

Limited excavations were conducted at the site. A 0.50 by 0.50 m test unit (TU) was excavated at each of the site's three constituent features. The units were excavated by 10 cm, arbitrary levels within stratigraphic layers. All layer and level findings were recorded on excavation grid forms. Excavated soil was screened through 1/4 and 1/8-inch wire mesh and all ecofactual and artifactual materials identified from the screens were recorded and preserved. Of this screened material, at least 50% of the 1/4-inch and 25% of the 1/8-inch mesh sample was retained for laboratory analysis. Any non-retained portions were visually scanned for artifacts, midden, or

other significant cultural remains. All observations were recorded on standard SCS/CRMS excavation forms and the depth of excavation from datum, plan views of cultural features, a location of *in situ* artifacts was recorded.

Recovered materials were separated into gross artifact and faunal categories and placed in st bags labeled with the project number, temporary site number, provenience of the find, and th date of recovery. All cultural materials were then listed on standard bag list forms. Speciali procedures dealing with human osteological materials were not required at the site. At the completion of each excavation, photographs were taken of the unit location and the two wall each test unit. One wall of each unit was recorded in a stratigraphic profile drawing and described in conformance with U.S. Soil Conservation Service and Munsell Color Notation references. All three units were backfilled after all recordation was completed.

7.3 LABORATORY ANALYSIS

Recovered cultural materials and soil samples were forwarded to the SCS/CRMS laboratory Honolulu, O`ahu for analysis and curation. All retrieved artifact and midden samples were thoroughly cleaned in the laboratory. A sample of artifacts was photographically recorded, sketched, and identified. All metric attributes and weight were also recorded where appropri All data were clearly recorded on standard SCS/CRMS laboratory forms which also included number and weight (as appropriate) of each constituent category.

While a maximum of two to four radiocarbon samples were budgeted for this project, no charcoal samples from the site were submitted for dating as little additional information wou have been gained from submitting the samples. The ubiquity of historic remains and the abs of traditional remains, among other indices, clearly revealed the historic age of the site.

All notes, maps, photographs, and cultural resources are temporarily being curated at SCS/CI laboratories until a suitable, permanent facility is located.

8.0 PROJECT RESULTS

As has been discussed above, expectations prior to fieldwork included the archaeological field crew potentially identifying several classes of pre-Contact and post-Contact structures and features, these primarily associated with agricultural pursuits and temporary and/or permanent habitation loci. Based on a preliminary drive through and brief inspection of portions of the project area, several landscape patterns were elucidated prior to systematic survey. Based upon the massive, overall surface modifications observed within the project area, expectations prior to fieldwork were amended. It was thus expected that only historic-period and/or modern agricultural features might be encountered during systematic survey. Project results generally conformed to those expectations.

8.1 OVERVIEW OF SITE 50-50-04-4755

One site, comprised of three constituent features, was identified in the project area during reconnaissance survey (Figure 10). The site was located along the northwestern side of the corridor near the spillway outflow path and fence (see Figure 3). The site and environs appeared to have been recently bulldozed, as evidenced by earthen berms and piled cobbles and boulders. A berm enclosed three sides of the site. The northeast and southwest berms were constructed of bare earth and scattered clumps of grass. These two berms contained waterworn cobbles, boulders, and pieces of concrete, together forming the Feature A structure or "complex". The northeast berm was covered with dry grass and scattered boulders. A large trash pile, comprised of soil, boulders, lumber, metal, automobile chassis' and engine parts, modern household items and furniture, drip-line hose lengths, and plastic pipe was located c. 23.00 m. to the southeast of the berm, between the site berm and the service road following the course of ʻĪao Stream as it proceeds downvalley. The uneven ground surface between the berm and the trash pile was littered with corrugated roofing pieces, lumber, carpet pieces, household fabrics, and large stones. The condition of the site, coupled with observable remnants, revealed an obvious historic and/or recent temporal affiliation for the site.

8.2 SITE DESCRIPTION

Site 50-50-04-4755 consists of one concrete building foundation slab, one terrace and retainments, and one short section of a stacked wall. The site boundaries occur within an enclosed area measuring c. 52.50 m. by 23.30 m and is oriented northwest-southeast (305/ 125 degrees) (see Figure 10). As stated above, a U-shaped earthen berm encloses three sides of the site. The berm varies in width from 2.75 to 8.2 m, reaches a variable height of c. 0.70 to 2.00 m above the outer surrounding soil surface, and rises 0.46 to 2.20 m above the inside surface of the enclosure. Near the southwestern berm, a basalt edge-altered flake was recovered, the flake exhibiting use-wear as a cutting tool and a retouched edge. The northwestern portion of the site is open (non-bermed) and lies c. 1.20 m above the adjacent pasture land and nearby road. Two traditional artifacts, fragments of possible grinding stones, were retrieved from the sloping surface of the berm beyond the site, near the road. A permanent site marker was placed at the southwestern flank of Feature A.

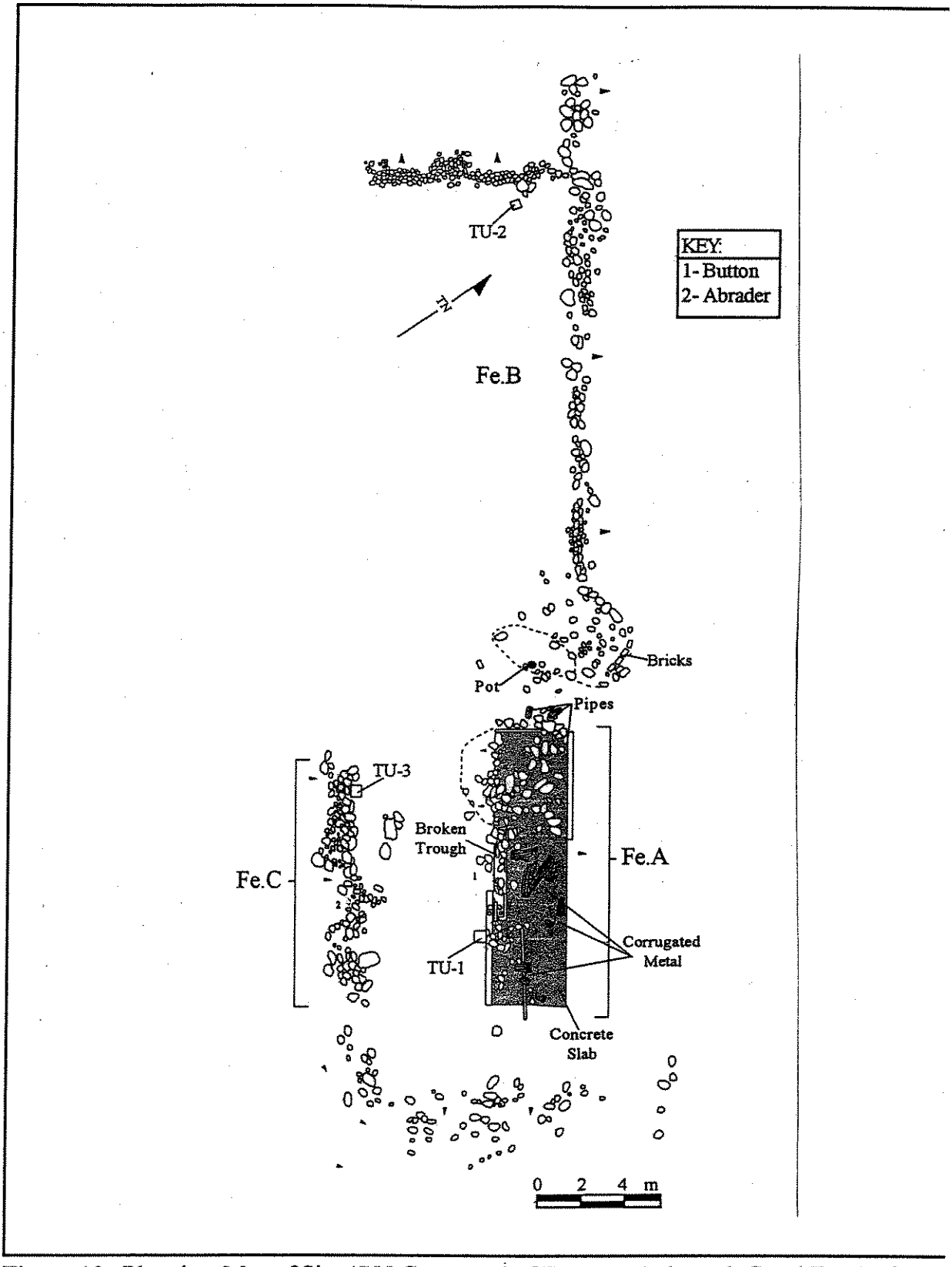

Figure 10: Planview Map of Site 4755 Composed of Features A through C and Test Units 1 through 3.

8.3 FEATURE DESCRIPTIONS

Feature A consisted of a concrete building foundation slab with remnants of two low, concrete troughs incorporated into the southwestern side of the foundation (see Figure 10; Figures 11 and 12). The troughs measure a variable 1.3-2.0 m long, are 0.40 m. wide, and have been partially filled with waterworn cobbles (Figure 13). The foundation slab itself measures 12.60 m long by 3.70 m wide. A 0.58 m high mound of soil, with waterworn stones and one piece of rusted water pipe on the surface, covers the northwestern 4.50 m of the foundation slab and extends 1.25 m beyond the southwestern edge of the platform. Rusted corrugated metal roofing, a 2.50 m length of rusted, 2 inch pipe, one child's tennis shoe, and a scattering of waterworn cobbles litter the slab surface. A feature marker was placed at the southwestern flank of the foundation slab. Test Unit-1 (TU), a 0.50 x 0.50 m unit, was placed directly against the southwestern edge of Feature A (Figure 14).

Feature B was a 19.00 m. long, soil-filled terrace confined by low retaining walls on its northeastern and northwestern sides (see Figure 10). The northeast side of the wall is constructed of three to five courses of stacked, medium to large size, waterworn cobbles (Figure 15). The wall increases in height from 0.36 m along its southeastern flank to 0.65 m near the wall's northwestern wall juncture. Along the northwestern portion of the wall, a 2.80 m long section of the feature has been disturbed and exists in a state of partial collapse. The southeastern flank of the wall articulates with a 7.00 m alignment of small boulders and concrete blocks, together, these confining a portion of a 0.25 m high, 6.00 m long dirt pile (Figure 16). A crushed aluminum pot, a metal pipe section, and a modest concentration of scattered cobbles lie on the surface of the dirt pile. The Feature B identification marker was placed between wall cobbles at the southeastern end of the linear wall.

The retaining wall across the northwestern flank of the terrace extends 9.10 m from the wall junction to within 1.00 m of the dirt berm base that defines the southwestern portion of the site. The retaining wall was constructed of four courses of medium-sized, waterworn cobbles. The cobbles were stacked to a maximum 0.52 m. high. Two, 2.00 m sections of the wall, one section occurring in the central portion of the feature, the other occurring at the northeastern end of the feature, are partially collapsed (see Figure 16). TU-2 was excavated in the northwest corner of the terrace (see Figure 10). On the surface of TU-2, one basalt abrader was recovered prior to unit excavation. The abrader fragment was square in planview and exhibited two altered edges that formed a corner at the proximal edge of the tool.

Feature C consisted of a 5.00 m long by 0.60 m high wall remnant (see Figure 10; Figure 17). The feature was evident within the northeastern, interior face of the U-shaped berm. The wall section was constructed of 2-3 courses of waterworn, basalt cobbles and boulders. Scattered cobbles and boulders are present, for a distance of 10.00 m, on both the berm face and the enclosure surface, southeast of the wall section. A permanent marker denoting Feature C was placed between wall stones, just above TU-3. TU-3 was positioned against a flat base stone at the northwest end of the wall section (Figure 18).



Figure 11: Photograph of Feature A Building Foundation and Concrete Slabs. View to Northwest.

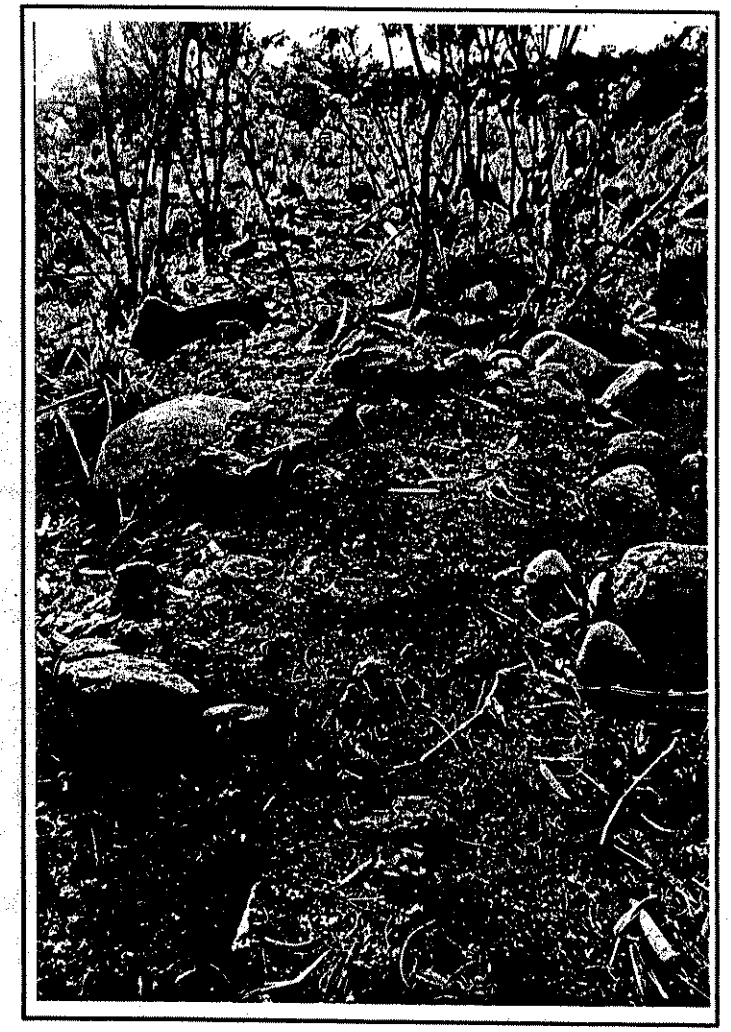

Figure 12: Photograph of Feature A Building Foundation. View to Southwest.

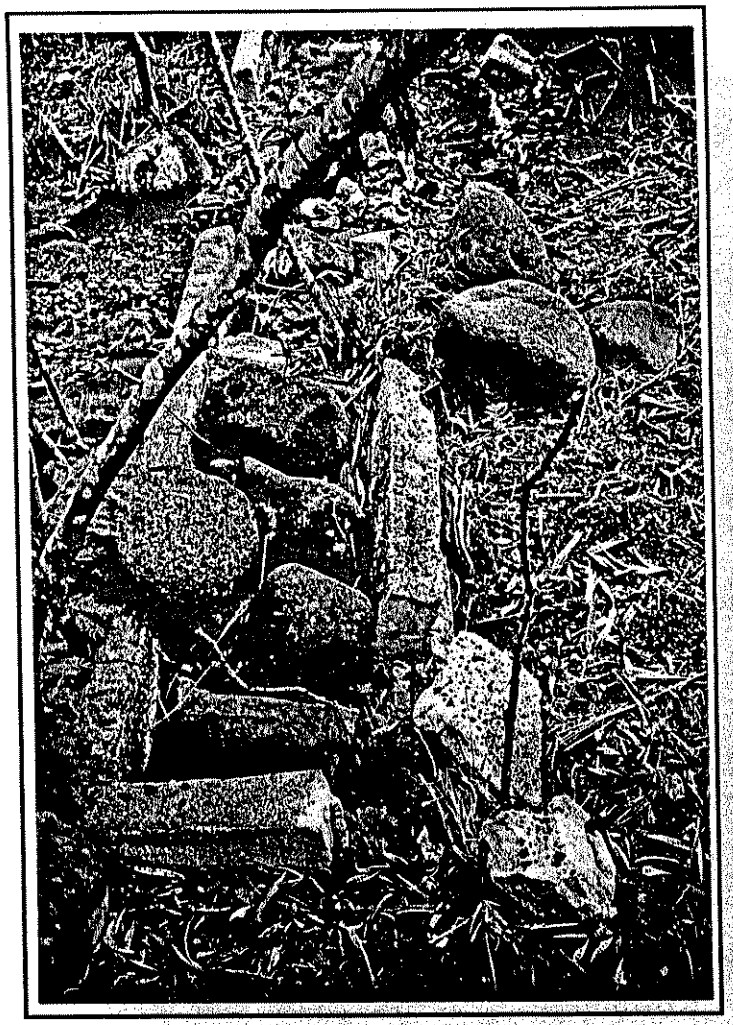

Figure 13: Photograph of Feature A Trough. Note: Cobbles inserted into Trough. View to Southeast.

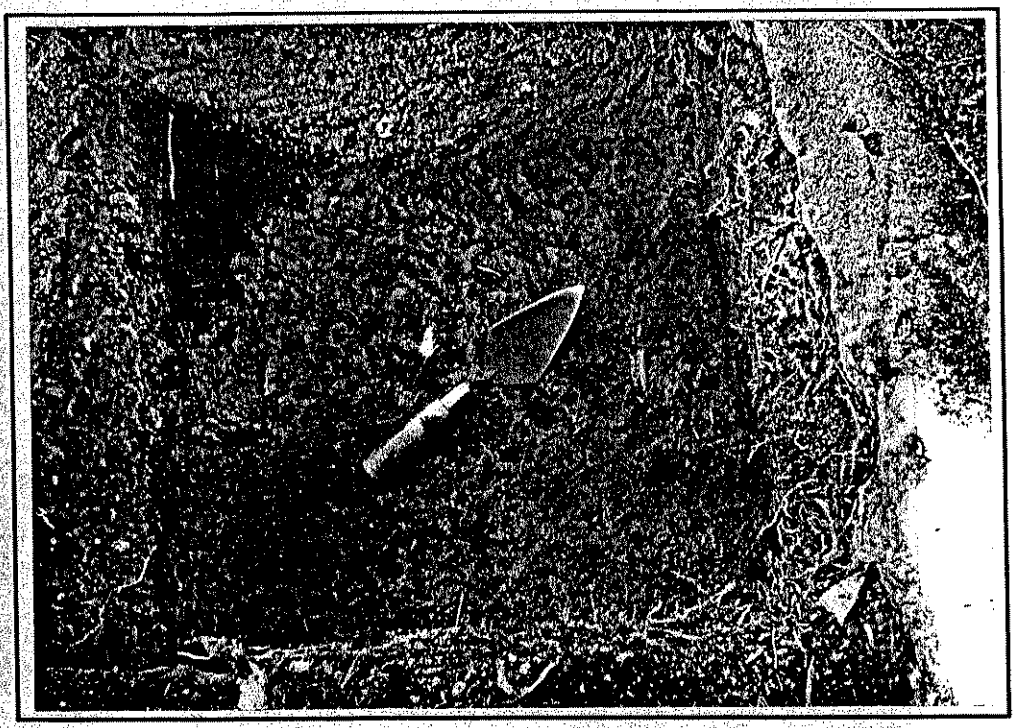

Figure 14: Photograph of TU-1, Feature A, at 60 cmbd (basal layer). Note: Concrete Foundation at Northeast Unit Portion. View to Northwest.



Figure 15: Photograph of Feature B, East-West Wall Facing. View to Southwest.



Figure 16: Photograph of Feature B, East-West Wall. View to Southeast.

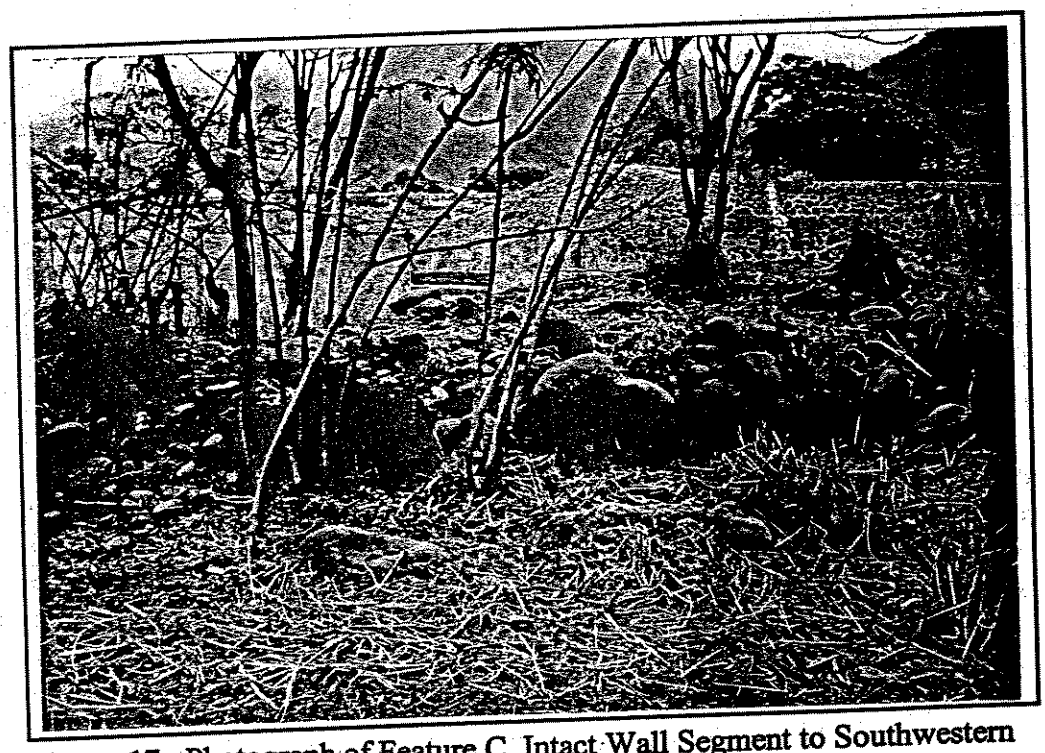

Figure 17: Photograph of Feature C, Intact Wall Segment to Southwestern Berm. View to Southwest.



Figure 18: Photograph of TU-3, Feature C, Pre-Excavation. View to West.

8.4 TEST EXCAVATIONS

Three TUs, each measuring 0.50 by 0.50 m, were excavated at Site 4755 (see Figure 10). One test unit was placed at each of the three features and was excavated from a surface datum. All three TUs were excavated by arbitrary levels within natural stratigraphic layers. All test unit excavations were terminated within sterile strata at a fairly minimal depth below surface. It is was determined in the field that the site was culturally sterile from a maximum 0.40-0.60 cmbd. Excavations provided some corollary information between surface remnants and artifacts and those occurring within subsurface contexts. A variety of artifact classes were identified during excavation, a majority unequivocally representing historic-period and more recent use of the area The artifacts have been tabulated and are presented in Appendix A. Faunal remains inventory and charcoal inventory are given in Appendices B and C.

Test Unit-1

TU-1 was excavated within Feature A to explore the relationship between the feature's recent architecture and subsurface deposits and to determine the presence/absence of subsurface cultural materials, particularly to see if a correlation existed between the historic materials on the surface and potentially prehistoric and/or historic materials below the surface (see Figure 14). The unit datum was set at 0.32 m above the surface. Excavation of the unit to basal depths revealed two layers (Figure 19):

> Layer I (0.30 - 0.52 mbd) was composed of Dark brown (10YR 3/3) hard-packed silty clay. The layer contained broken pieces of concrete and basalt pebbles. Cultural materials recovered *in situ* and during screening included 26 fragments of metal (square and round-headed nail fragments, one lead bullet casing and unidentified metallic fragments), three ceramic sherds (two porcelain and one earthenware), one brown, modern beer bottle, 6.6 g of machine cut medium to large mammal and sparse amounts of bird and vertebrate remains, 6.5 g of charcoal, and one very worn marine shell fragment (not collected). Historic artifacts clearly dominated cultural materials occurring within the layer, this being representative of historic debris littered across the site's surface.
>
> Layer II (0.52 -0.60 + mbd) consisted of Dark brown (10YR 4/3) hard-packed silty clay. The layer contained three classes of cultural material including minimal amounts of charcoal flecking (0.1 g), faunal remains (5.8 g of bird and mammal bone), and two small fragments of decomposing shell at the interface of Layers I and II (not collected). Excavation of the unit terminated at 0.60 mbd.

Test Unit-2

TU-2 was excavated within the Feature B terrace section to explore the relationship between the feature's various architectural sets (see Figures 10 and 16). Additionally, excavation of the feature was utilized to determine the presence/absence of subsurface cultural materials. As stated above, one basalt abrader fragment was recovered from the surface of TU-2. The unit datum was set at the present surface (0.00 m). Excavation of the unit to basal depths revealed one layer (Figures 20 and 21).

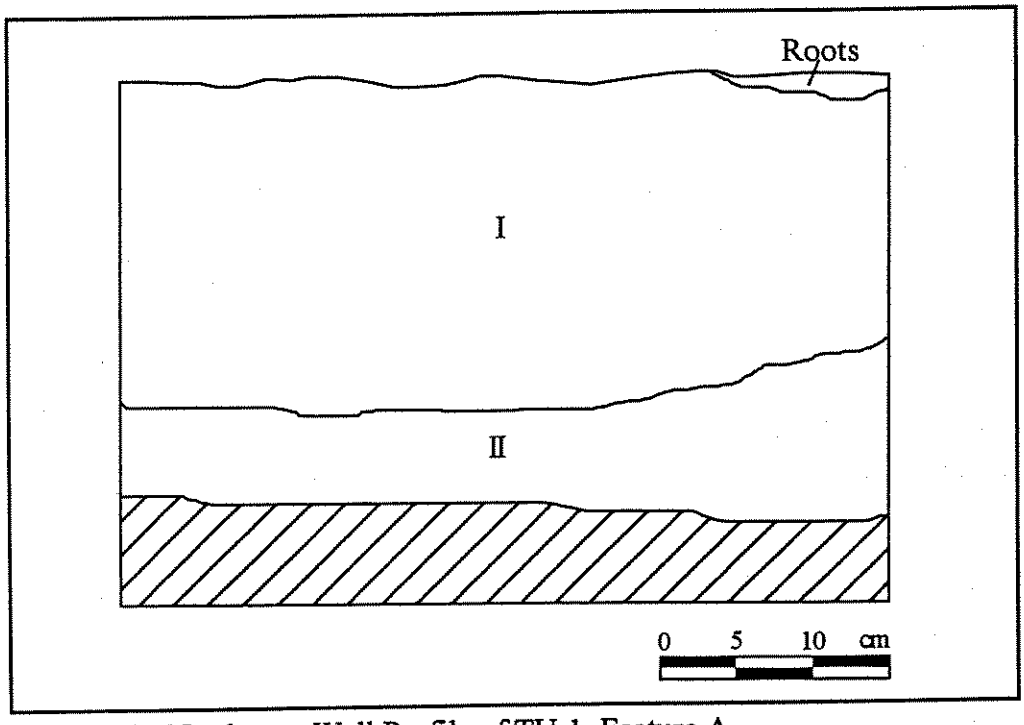

Figure 19: Northwest Wall Profile of TU-1, Feature A.



Figure 20: Photograph of Feature B, TU-2, Post-Excavation. View to West.

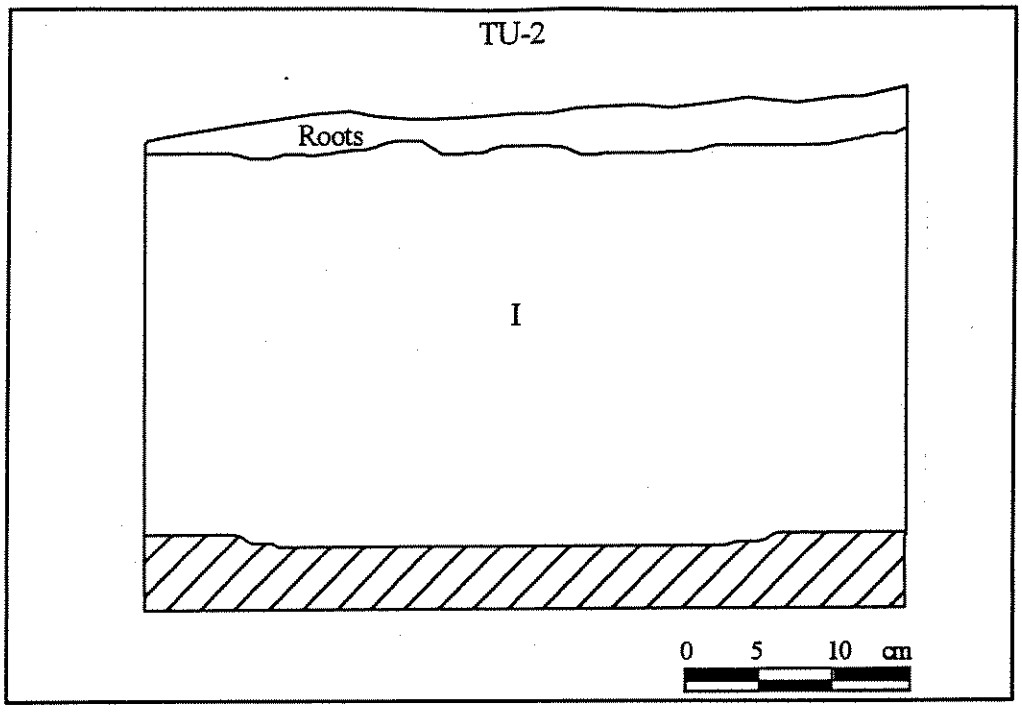

Figure 21: West Wall Profile of TU-2, Feature B.

Layer I (0.00 - 0.30 + mbd) consisted of Dark brown (10YR 4/3) hard-packed silty clay. The layer contained grass roots near the surface (a typical O-horizon characteristic) and few clastics (basalt pebbles). TU-2 was culturally sterile and excavations of the unit terminated at 0.30 mbd.

Test Unit-3

TU-3 was excavated within Feature C to explore the relationship between surface architecture (retaining wall) and possible subsurface architecture, the latter being an extension of the surface retainment wall (see Figures 10 and 18). Excavations were also done to determine the presence/absence of subsurface cultural materials, particularly to see if a correlation existed between the historic materials on the surface and potentially prehistoric and/or historic materials below the surface. The unit datum was set at 0.00 m above the surface, or on the present ground surface. Excavation of the unit to basal depths (0.040 mbd) revealed two layers and the greatest concentration of cultural materials of the three excavated units (Figure 22).

Layer I (0.00 -0.40 mbd) was composed of Dark yellowish brown (10YR 3/4) silty clay. The matrix contained a variety of mostly historic materials: 297 rusted metallic sheet fragments, 15 square and round-headed nails, 16 unidentified rusted metal fragments, one metal bottle cap, one porcelain tea cup, one porcelain sherd, 9 shards of glass, two modern bottles, and an unidentified glass top or stopper. Faunal remains recovered from the layer included 27.8 g of various mammal and bird bone, some 50% of this small assemblage composed of unidentified medium or large mammal.

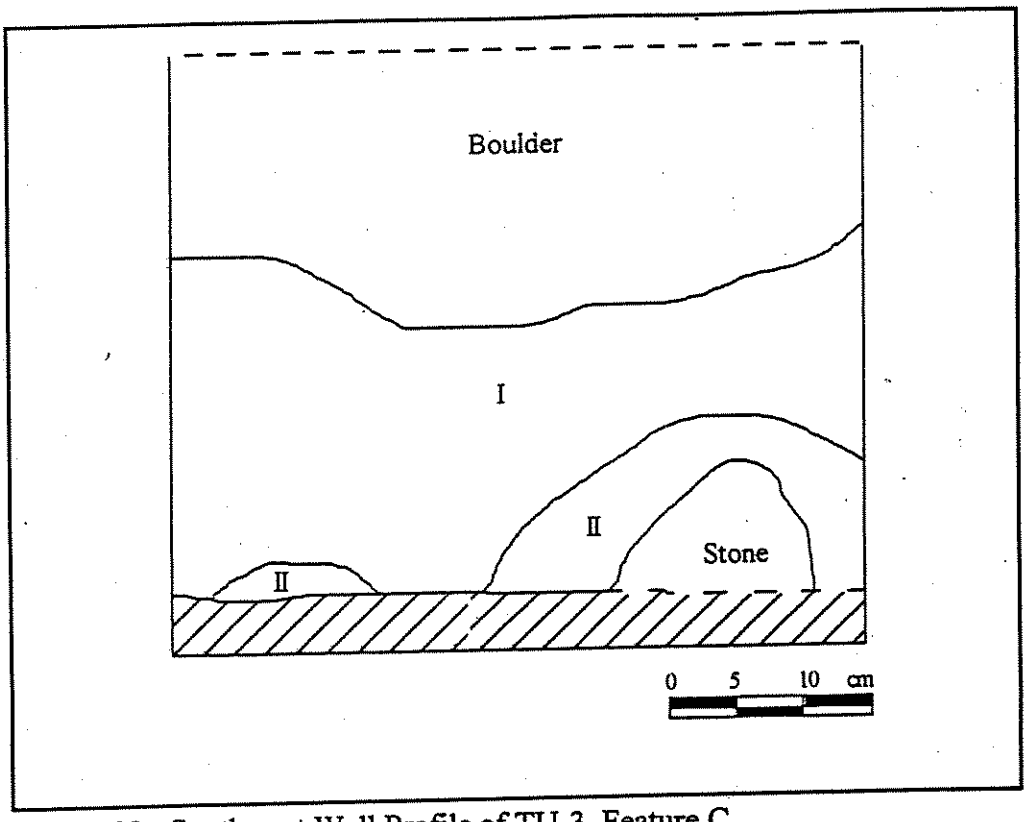

Figure 22: Southwest Wall Profile of TU-3, Feature C.

Layer II (0.27 - 0.40 mbd), a Yellowish red (10YR 4/6) silty clay with an uneven horizontal and vertical extent, was present mainly in the northwestern portion of the unit. The layer was sterile and excavation of TU-3 was terminated at 0.40 mbd.

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9.0 DISCUSSION AND CONCLUSIONS

SCS/CRMS, Inc. was contracted by the U.S. Army Corps of Engineers, Pacific Ocean Division (CEPOD) to provide archaeological reconnaissance survey and limited subsurface testing for the alternative channel alignment, 'Īao Stream Flood Control Project within 'Īao Valley, Island of Maui, Hawai'i. Research goals centered upon initial identification and mapping of any archaeological sites or features occurring within the modest portion of 'Īao Stream Valley and second, if sites were identified, to conduct subsurface testing at the sites to examine the age and extent of cultural deposits associated with a particular site. Excavations were also to be conducted to determine the temporal and spatial relationship of architectural features on intra-site and inter-site scales.

Overall, the project area was relatively void of visible architectural and/or surface remains, this being the effect of heavy landscape modifications, both cultural and natural processes, to the project area within the last 100 years. A focus on obtaining subsurface data in the floodplains related to traditional and historic cultivation was eliminated several years after this survey was completed due to the impossibility of private land owners agreeing to let archaeologists excavate their individual plots. Nonetheless, sugar cane, road construction, and other activities occurring in the recent past are quite evident across the parcel and may have caused disturbance or disruption to other archaeological sites that may have previously occurred within the project area. As has been shown previously (Yent 1983), the flood of 1916 created much disturbance to several *heiau* structures occurring *above* the stream valley floor. Extrapolating then, it appears reasonable to expect that flood damage would have been greater within the valley itself.

A 100% reconnaissance survey of the project area revealed only one site (State Site Number 50-50-04-4755; TMK 3-4-32:1). The site is composed of three features. The three features (designated as Features A, B, and C) consist of a concrete foundation with concrete troughs, a soil-filled terrace and retaining wall, and wall remnant, respectively. These features form a small, presumably historic habitation complex-activity area. A majority of these features, particularly the basalt cobble and boulder-formed walls, exist in state of poor-fair preservation condition.

The excavation of three test units at the site's three features revealed predominantly historic and recent materials, the latter likely being associated with modern debris strewn across the surface of the site. Structurally and materially, the site is most probably a post-Contact, late 19th or early 20th century, agricultural site. Local residents suggest the site was associated with a small piggery that was formerly in operation several decades ago.

Residential usage may be indicated by several classes of household materials retrieved from slightly below the surface at TU-3: metallic fragments (including nails), a teacup fragment, a cosmetic bottle top, and clear glass and colored glass fragments. The trash pile and scattered, recent household items occurring across the surface of the site and its environs appears to be associated with the site. However, it is possible, and perhaps likely, that most of the surface debris could have been pushed by a bulldozer from a presently-cleared area just northeast of the dirt road that extends along the northeast side of the site.

The earthen berms bordering the southwest and southeast sides of the site appear to be have been created at a later time than the berm along the northeast side. The northeast berm is covered with tall grass, but only sparse grass clumps were present on the loose soil of the other two berms. Additionally, the southwest berm, composing a portion of the site, proceeds to the road adjacent tc the site and above the stream for c. 23 m to the southwest. Two traditional artifacts, fragments of possible grinding stones, were retrieved from the sloping surface of the berm, beyond the site (Figure 23). One additional artifact, a fragment of fine grain basalt displaying one ground surface, was recovered from the outer slope of the southeast berm. The three artifacts found on the berms and the basalt abrader recovered on the site surface are the only indication of possible traditional or prehistoric presence in the project area and appear to have been recovered in a secondary context, their primary context disturbed by modern bulldozing activities in the area.



Figure 23: Photograph of Bulldozer-Pushed Berm to the Southwest of Site 4755. View to Southwest.

The project area location, overall, proceeds across a fairly level flood plain adjacent to the perennial ʻĪao Valley stream. These factors indicate the suitability of the area for *taro* cultivation. That taro cultivation in the area continued from prehistoric times into the historic period has been documented on maps and in examinations of Land Commission Awards. However, the stream is, at present, considerably lower than the level of the flood plain and no evidence of taro fields or *ʻauwai* was encountered.

The lack of surface evidence for either *loʻi* or *ʻauwai* throughout the project area is likely explained by the long history of sugar cane cultivation in the area. While individual taro fields on the southeast side of ʻĪao Stream in lower Wailuku Town continued to be tended into the early

1900s, by the latter half of the 19th century, much of the flood plain area on the northwest side of the stream had been taken over by sugar plantations. Evidence of the former cane fields is still immanently present in the form of drip line irrigation hoses that can be seen protruding above the soil surface in all visible areas of the project area not masked by dense vegetation. Large boulder piles, generally resulting from surface leveling, and deep plow zones typically associated with sugar cane field preparation, were not present in the project area however. Many cobbles and boulders were recorded as occurring near the southwest end of cultivated gardens and in the pushed, earthen berm above the stream at the northeast end of the alignment corridor. The entire corridor and former sugar cane fields appear to have been leveled and cleared in the recent past. However, this evidence does not preclude the fact that former cultivation soils (i.e., for *loʻi*) may indeed remain in the flood plain. Archival studies, such as were completed by Cordy (1996), have proven that irrigated taro production was conducted on a large scale within the valley during traditional times. If, in the future, access is granted to several privately-owned flood plain parcels, then analysis of such soils and associated botanical material may be undertaken.

A meeting between the US Army Corps of Engineers, Honolulu District, and the County of Maui Department of Public Works and Waste Management was held on May 9th, 2003 to present to the county ʻĪao Stream Flood Control alternatives. These alternatives are presented in Appendix D.

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10.0 SIGNIFICANCE ASSESSMENTS

The identified site, 50-50-04-4755, is significant under Criterion D which includes sites that have yielded, or are likely to yield, information important to research on history or prehistory. The site has provided a modest amount of information pertaining to post-Contact agricultural use and limited habitation the ʻĪao Valley project area parcel.

While proven primarily through archival work that the ʻĪao Valley landscape was subject to intensive taro production during traditional and early historic times, there is the possibility that signatures for such activities remain on the flood plain. The fact that sugar cane cultivation destroyed these signatures can only be proven through subsurface testing. As such, if future testing does lead to the identification of significant subsurface deposits associated with the famous agricultural fields of the ʻĪao Valley, significance assessments for the valley must be amended.

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11.0 RECOMMENDATIONS

Although the one site was initially assessed as significant under Criterion D, this based upon archaeological work conducted at the site, sufficient information has now been obtained from recording and excavations at the site so the latter may be considered no longer significant. No further work is considered necessary or is recommended for the site. If, in the future, permission is granted by private landowners to excavate portions of the flood plain, such permission should be readily accepted to assess the presence/absence of archaeological signatures within such domains. There is a very good chance that agricultural soils and/or botanical materials such as pollen or phytoliths could have survived intensive sugar cane cultivation. If so, an empirical record supporting presently suggested settlement patterns may be tenable.

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APPENDIX A

Site 4755 Artifact Inventory List

Unit #	Feature	Level	Lot #	#	Material	Function	Bag #	Length cm	Width cm	Thickness cm	Weight gm	Lot Count	Comments
TU-1	A	I/1	27		Ceramic	Unknown	2				0.4	1	White glazed ceramic
TU-1	A	I/1	28		Metal	Unknown	2				0.2	4	Ferrous metal fragments
TU-1	A	I/1		3	Bone	Unknown	2				5.8		2 rib and 4 undetermined bone frags. Of med. Or large mammal, all worked
TU-1	A	I/1	1		Metal	Miscellaneous	3				7.7	16	15 unidentified metal frags., 1 bent
TU-1	A	I/1	2		Glass	Bottle	3				0.4	1	Brown bottle glass
TU-1	A	I/1	3		Ceramic	Unknown	3				2.1	1	Brown ceramic with gloss
TU-1	A	I/1	4		Metal	Miscellaneous	6				1.7	7	5 unidentified metal frags., 2 nail
TU-1	A	I/1	5		Ceramic	Unknown	6				0.4	1	Brown, no gloss
TU-1	A	I/2	6		Metal	Unknown	10				0.9	1	Unidentified metal fragment
TU-1	A	I/2	7		Metal	Miscellaneous	11				22.5	7	4 nail frags. (1 bent), 2 bottlecap frags, 1 rifle bullet projectile
TU-1		I/2		4	Bone	Unknown	12				19.6		1 limb, 1 rib and 23 undetermined bone frags. of med./large Vertebrate all worked with undetermined implement
TU-1	A	I/2	8		Metal	Unknown	13				0.7	1	Nail fragment
TU-1	A	I/2	9		Glass	Bottle	13				0.3	1	Clear bottle glass
TU-1	A	I/2	10		Ceramic	Unknown	13				0.1	1	White glossy ceramic
TU-1	A	I/2	11		Metal	Miscellaneous	15				0.8	2	1 unidentified metal frag., 1 nail frag. (bent)
TU-1	A	I/2	12		Glass	Bottle	15				0.2	1	Clear bottle glass
TU-1	A	I/2	13		Plastic	Button	18				1.1	1	Cream colored, 4 holes
TU-2	C	Surface		1	Basalt	Abrader	19	5.24	5.16	1.68	69.7		Basalt frag, square planview; 2 altered edges form corner; 1 worked
TU-3	C	I/1	14		Metal	Unknown	20				50.1	107	106 unidentified metal fragments, 1 nail frag.
TU-3	C	I/2	15		Metal	Miscellaneous	21				177.9	184	175 unidentified metal frags., 7 nail frags., 2 small, j-shaped objects
TU-3	C	I/2	16		Glass	Candlestick(?) & Bottle	22				15.2	8	7 clear pcs., 2 brown (1 with writing: LAW... -USE OF)
TU-3	C	I/2		5	Metal	Nail	23				0.4		Fragment of ferrous metal square nail
TU-3	C	I/2		6	Bone	Unknown	23				5.4		1 rib and 5 undetermined fragments of med./large mammal, worked bone
TU-3	C	I/2	29		Metal	Unknown	23				1.1		Ferrous metal fragments
TU-3	C	I/2	17		Ceramic	Tea cup	24				19.7	1	Glossy white ceramic shard with green, red, & gold paint
TU-3	C	I/3	18		Glass	Bottle	25				10.1	9	Clear bottle glass
TU-3	C	I/3	19		Ceramic	Unknown	25				3.8	5	5 white glossy shards, 2 with green

TU-3	C	I/3	20		Glass	Bottle cork	26				14.3	1	Light green, complete
TU-3	C	I/3		7	Bone	Unknown	27				31.5		3 limb and 7 undetermined frags. of med./large mammal, worked bone
TU-3	C	I/3	21		Metal	Miscellaneous	28				33.4	22	2 nails, 3 nail frags., 1 nut, 16 unidentified metal frags.
TU-3	C	I/4	22		Metal	Miscellaneous	29				15.9	8	5 unidentified metal frags., 1 nail, 1 nail frag., 1 bottle cap
TU-3	C	I/4		8	Bone	Unknown	30				11.6		5 undetermined bone fragments of med./large mammal, all worked
TU-3	C	I/4	23		Glass	Bottle	31				14.9	3	Clear bottle glass
TU-3	C	I/4	24		Ceramic	Cup(?)	31				7.0	1	Glossy white ceramic shard
TU-3	C	I/1	25		Metal	Unknown	33				0.5	3	3 unidentified metal frags.
TU-3	C	I/1	26		Metal	Unknown	34				0.5	3	3 unidentified metal frags.
SW Berm		Surface		2	Basalt	EAF	37	4.70	2.93	1.65	34.4		1 use-wear retouched edge, straight, bifacial; used as cutting tool

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APPENDIX B

Site 4755 Faunal Remains Inventory List

SITE	BS-1	BS-1	BS-1	BS-1	BS-1	TOTAL
UNIT	TU-1	TU-1	TU-3	TU-3	TU-3	
FEATURE	A	A	C	C	C	
LAYER/LEVEL	I/1	I/2	I/2	I/3	I/4	
AVES						
Medium or Large Bird	0.5	2.5	0.5			3.5
MAMMALIA						
Medium or Large Mammal	6.6	2.4	5.8	14.0	1.5	30.3
Rattus exulans			0.3			0.3
Sus scrofa	0.7					0.7
Carangid	0.01	0.2				0.21
Tetraodontid	0.3					0.3
Scombrid				0.8		0.8
VERTEBRATE						
Medium or Small Vertebrate	0.5	0.7	4.9			6.1
TOTAL	8.61	5.8	11.5	14.8	1.5	42.21

APPENDIX C

Site 4755 Charcoal Inventory List

Bag #	Site	Feature	Unit	Layer/ Level	Sample	Weight (gms)
7	BS-1	A	TU-1	I/1	Charcoal	6.5
16	BS-1	A	TU-1	I/2	Charcoal	0.1
32	BS-1	C	TU-3	I/1-2-3-4	Charcoal	9.7

Bag #	Site	Feature	Unit	Layer/ Level	Sample	Weight (gms)
7	BS-1	A	TU-1	I/1	Charcoal	6.5
16	BS-1	A	TU-1	I/2	Charcoal	0.1
32	BS-1	C	TU-3	I/1-2-3-4	Charcoal	9.7

US Army Corps
of Engineers
Honolulu District

IAO STREAM FLOOD CONTROL PROJECT

PRESENTATION OF ALTERNATIVES
TO
COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS and
WASTE MANAGEMENT

MAY 9, 2003

IAO STREAM FLOOD CONTROL PROJECT
MEETING WITH PROJECT SPONSOR, MAUI DPW & WM
WAILUKU, MAUI
MAY 9, 2003
9:00 - 10:30 AM

AGENDA

1. Introductions ..... All

2. Purpose of Meeting ..... Warren
   - Presentation of Alternatives and Cost
   - Feedback on Preferred Plan

3. Brief History and Background ..... Sharon

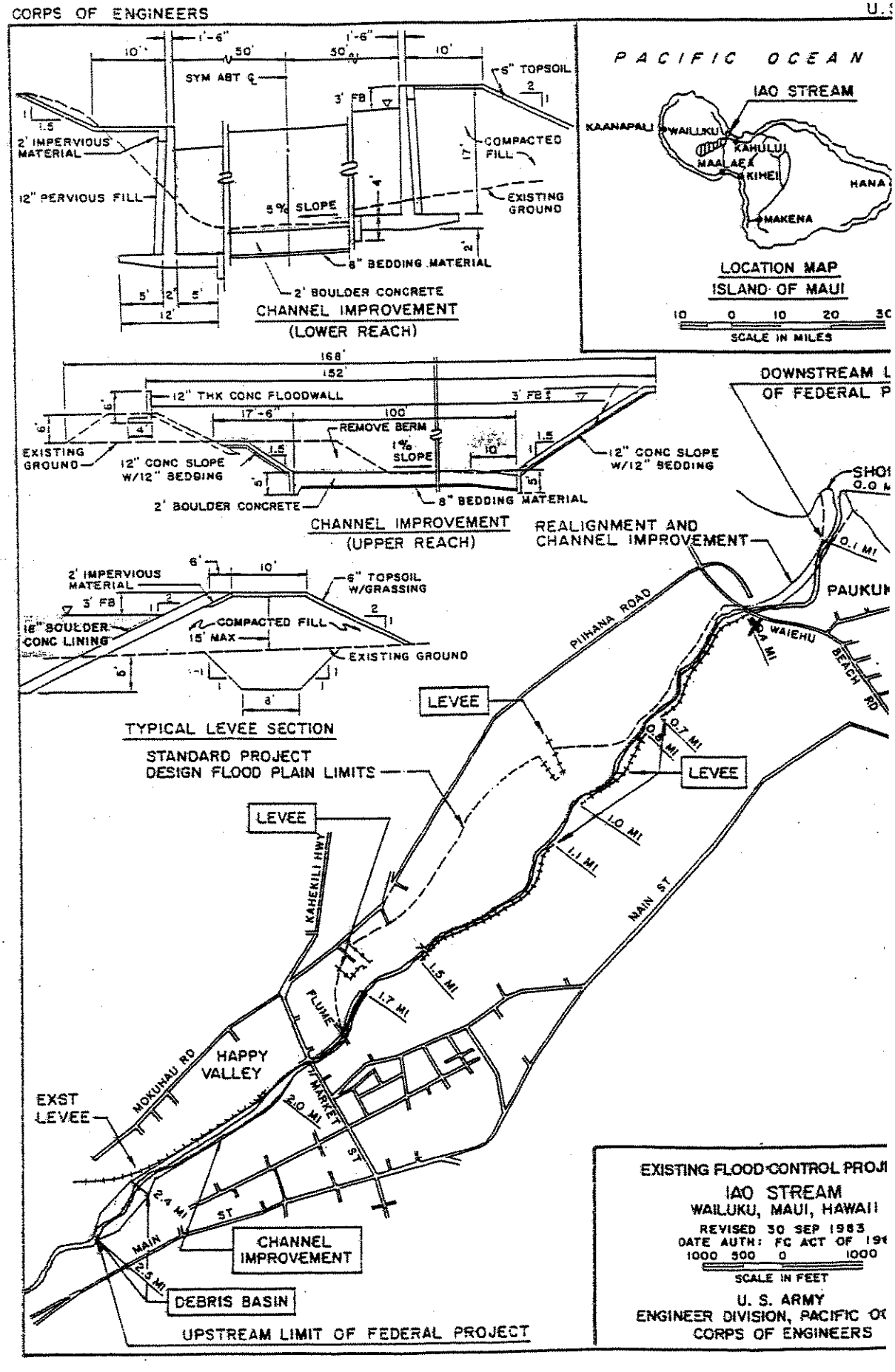
4. Current Status
   - Existing Condition & Flood Plain ..... Jim
   - Alternatives Developed (1, 2, 3 & 4) ..... Jim
   - Structures ..... Jim
     - Baffle Blocks
     - Drop Structure
     - Bridge/ Waterline (1, 2 & 3)
   - Viable Alternatives (1 & 3) ..... Jim/Warren
   - Estimated Costs ..... Warren
   - Cost Share ..... Warren

5. Schedule
   - Scoping ..... Environet
   - DDR (Selected Plan) ..... Warren/Jim
   - EA ..... Warren/Environet

6. Sponsor Input/ Recommendations ..... Joe/ DPW
   - Drop Structure
   - Bridge Replacement
   - Preferred Plan

7. Close ..... Target 10:30 AM

EXISTING FLOOD CONTROL PROJECT



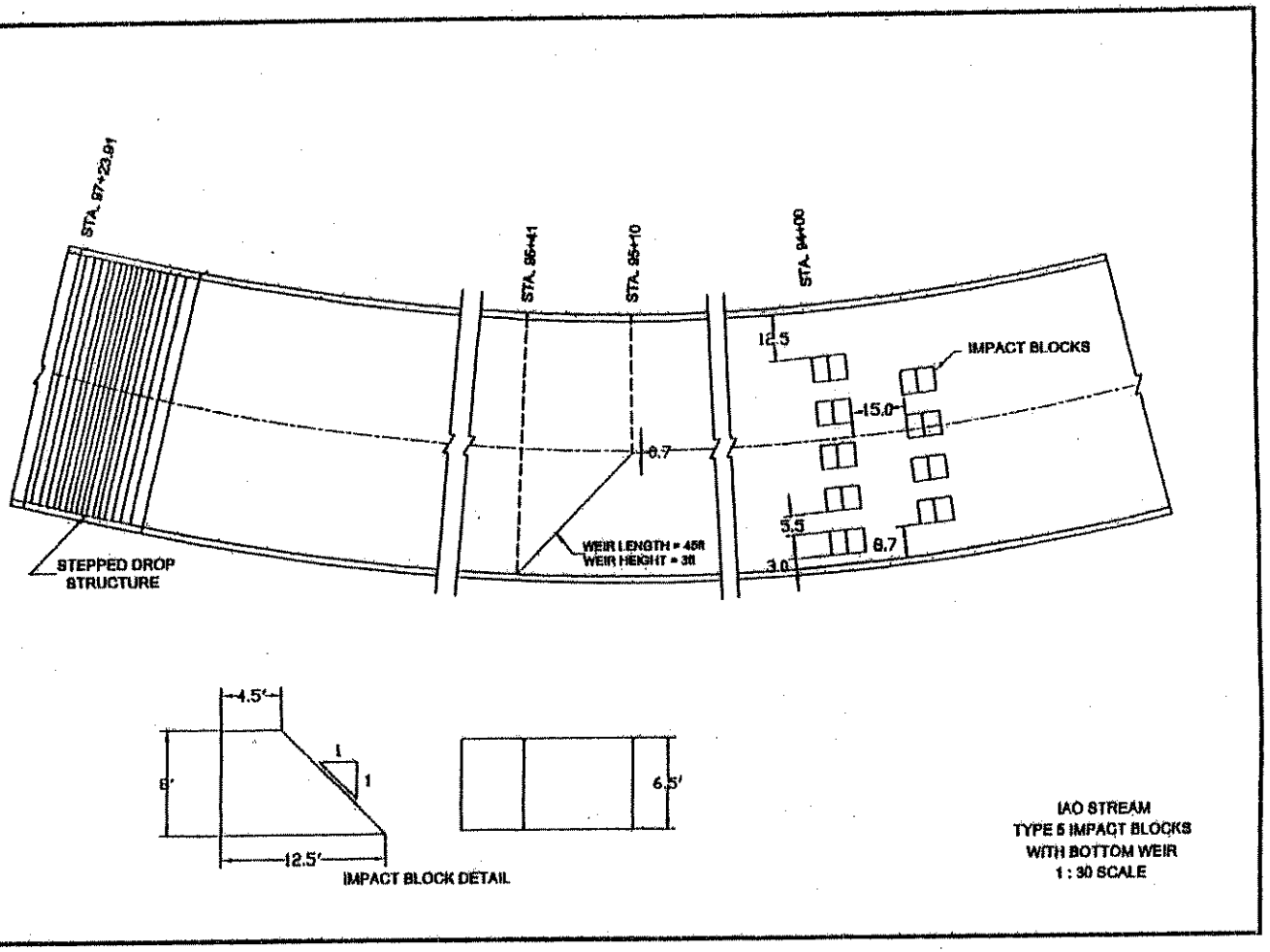
HYDRAULIC STRUCTURES

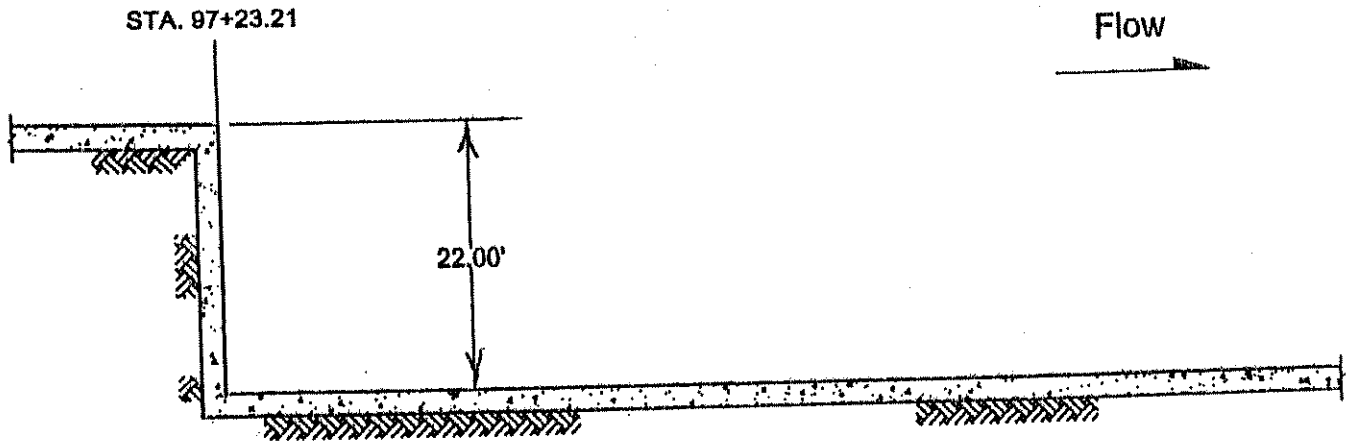
BAFFLE BLOCKS (STATION 94+00)

This structure consists of nine concrete blocks that would be constructed at the downstream end of the existing rectangular concrete channel. These baffle blocks are required to slow down the high velocity flows before they enter the middle reach of the project with the levee system. These blocks are required for each of the alternatives. The estimated construction cost of the blocks is $30,000.

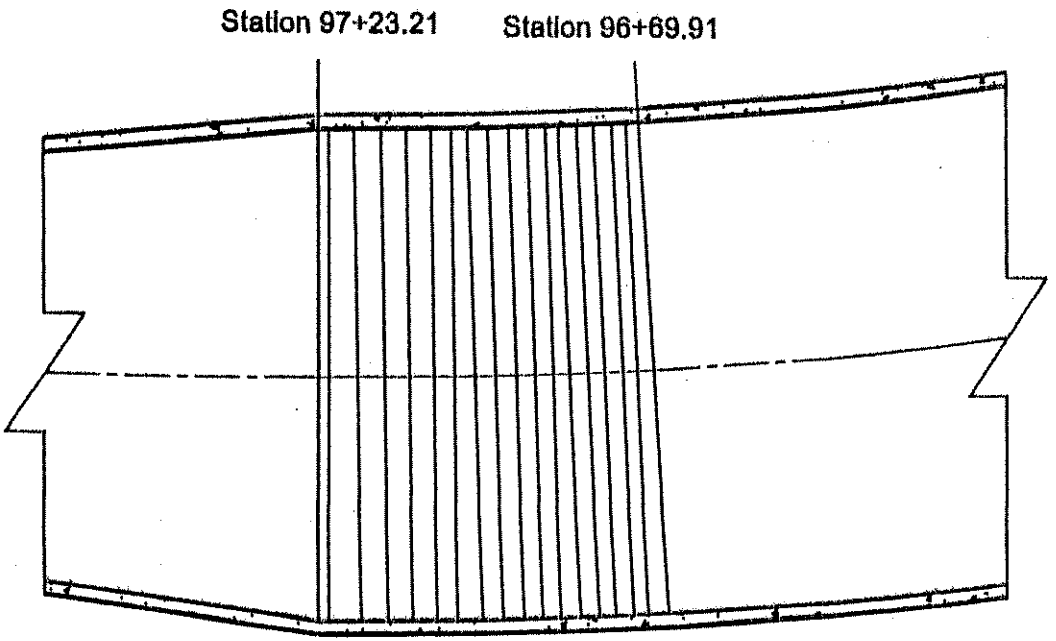
DROP STRUCTURE (STATION 97+23)

This structure would eliminate the 22-ft vertical drop that exists at the end of the rectangular channel. This structure is not required for hydraulic reasons, but may be desirable for safety or fish passage reasons. The decision on this structure will likely be driven by the sponsor's desires and the public interest review comments. The estimated construction cost of the drop structure is $154,000.


STA. 87+23.91
STA. 86+41
STA. 85+10
STA. 84+00
12.5
IMPACT BLOCKS
15.0
6.7
5.5
6.7
3.0
STEPPED DROP STRUCTURE
WEIR LENGTH = 45ft
WEIR HEIGHT = 3ft
4.5'
1
1
6'
12.5'
6.5'
IMPACT BLOCK DETAIL
IAO STREAM
TYPE 5 IMPACT BLOCKS
WITH BOTTOM WEIR
1 : 30 SCALE



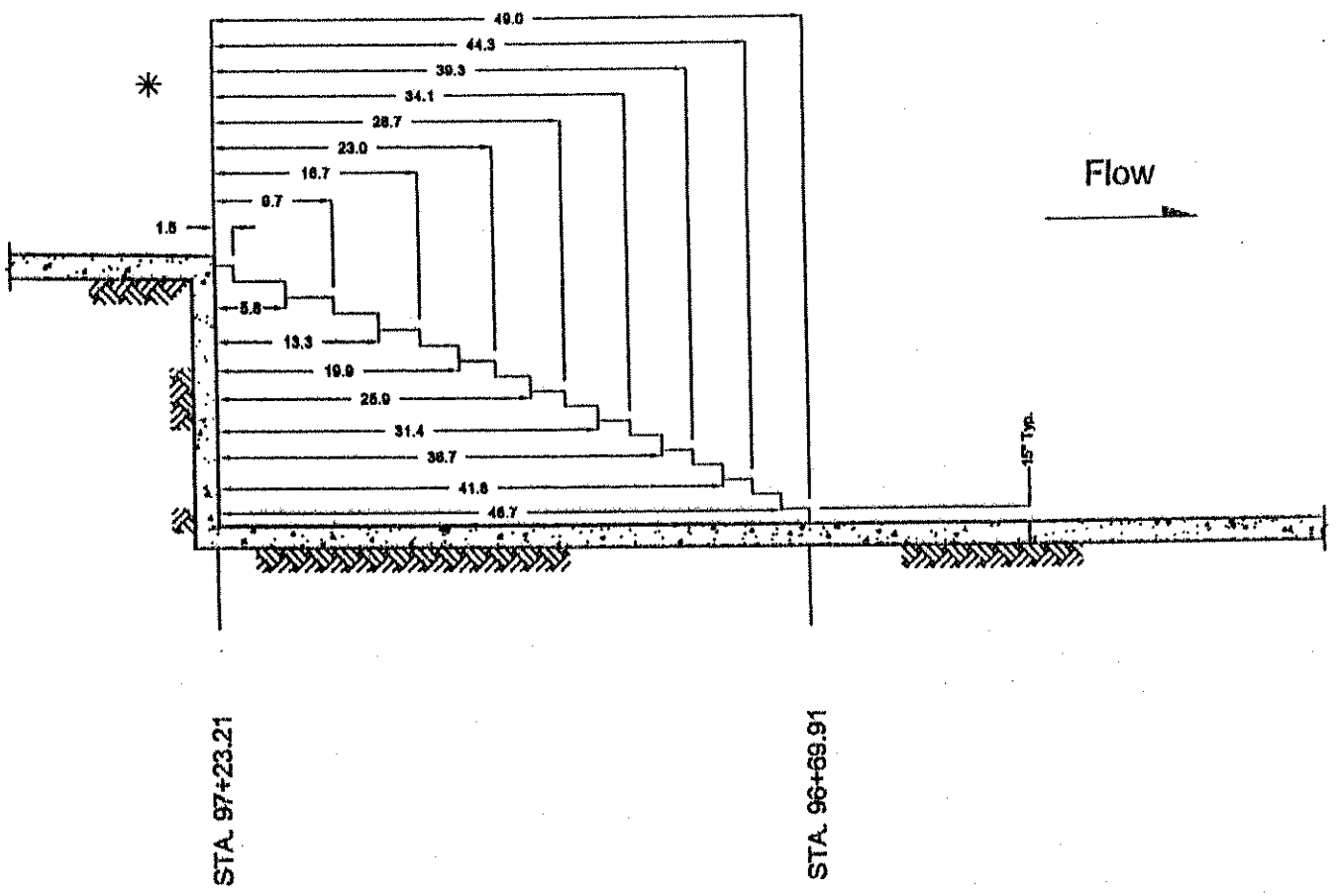
Iao Stream
Vertical Drop
Section View



Iao Stream

Stepped Drop Structure

Plan View



Iao Stream

Revised Step Drop Structure

Section View

* Dimensions are in prototype feet

ALTERNATIVE 1

Trapezoidal Concrete Channel Following Existing Alignment

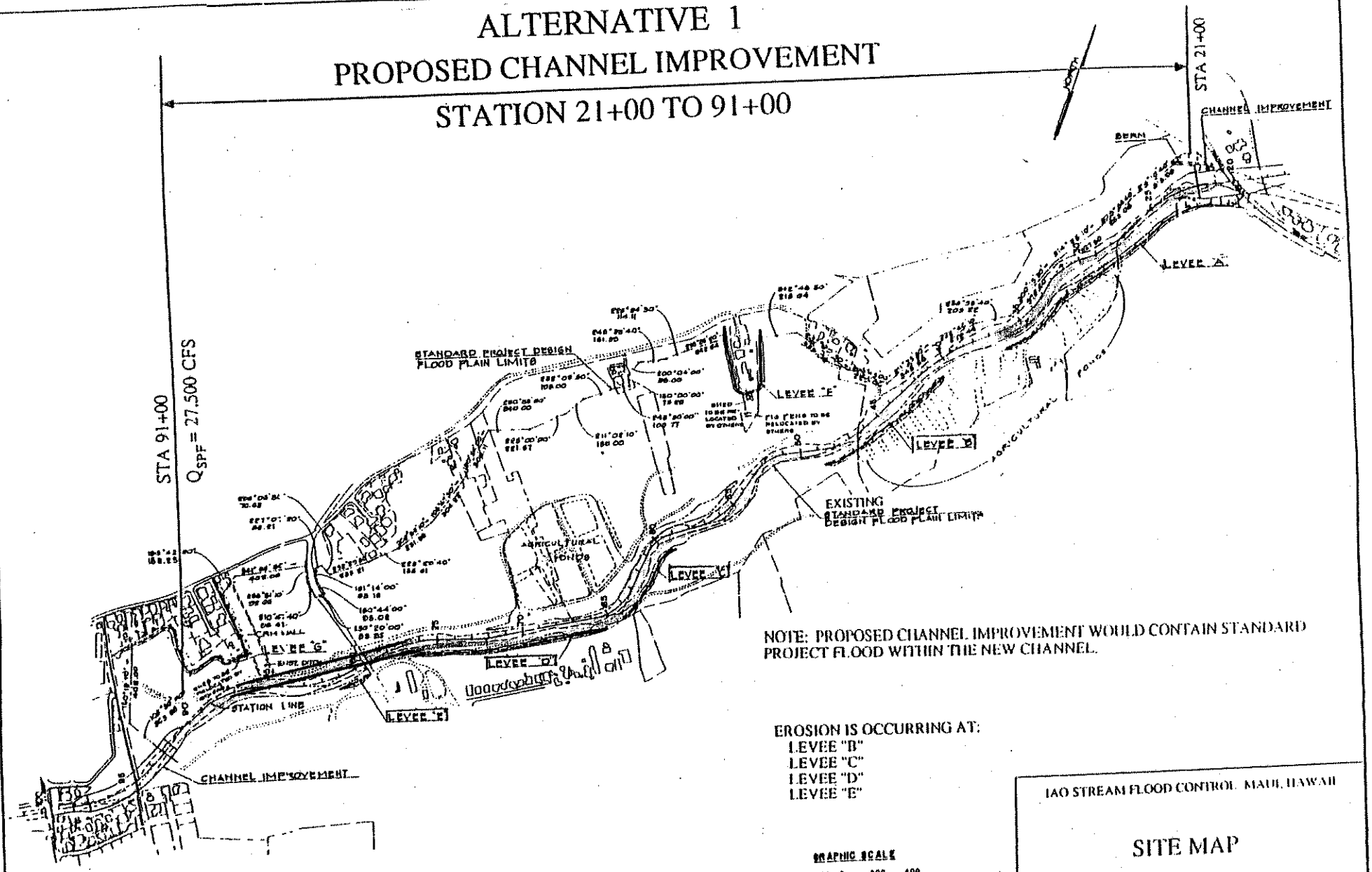
Description. This alternative consists of a trapezoidal, concrete-lined channel with a 40-foot bottom width. The channel would mostly follow the existing stream alignment from station 21+00 to station 91+00 for a distance of about 7,000 feet. From station 76+40 to 86+60, however, the channel would be realigned to the north to avoid affecting structures that have been constructed on the right bank. The channel will have a top width of the approximately 90 feet and will include interior splitter walls at all channel curves. All design flows would be contained within the channel, eliminating the floodplain on the left bank of the project. All the levees could possibly be de-authorized through separate action. Estimated construction cost is $21.1 million.

Advantages. This alternative would meet the project purpose and is viable from an engineering and cost perspective. This channel would also be easier to maintain than Alternatives 3 or 4.

Disadvantages. The resource agencies may object to the conversion of a natural stream bottom to a concrete invert.

- This alternative will be considered for more detailed evaluation in the Design Documentation Report.

ALTERNATIVE 1
PROPOSED CHANNEL IMPROVEMENT
STATION 21+00 TO 91+00



NOTE: PROPOSED CHANNEL IMPROVEMENT WOULD CONTAIN STANDARD PROJECT FLOOD WITHIN THE NEW CHANNEL.

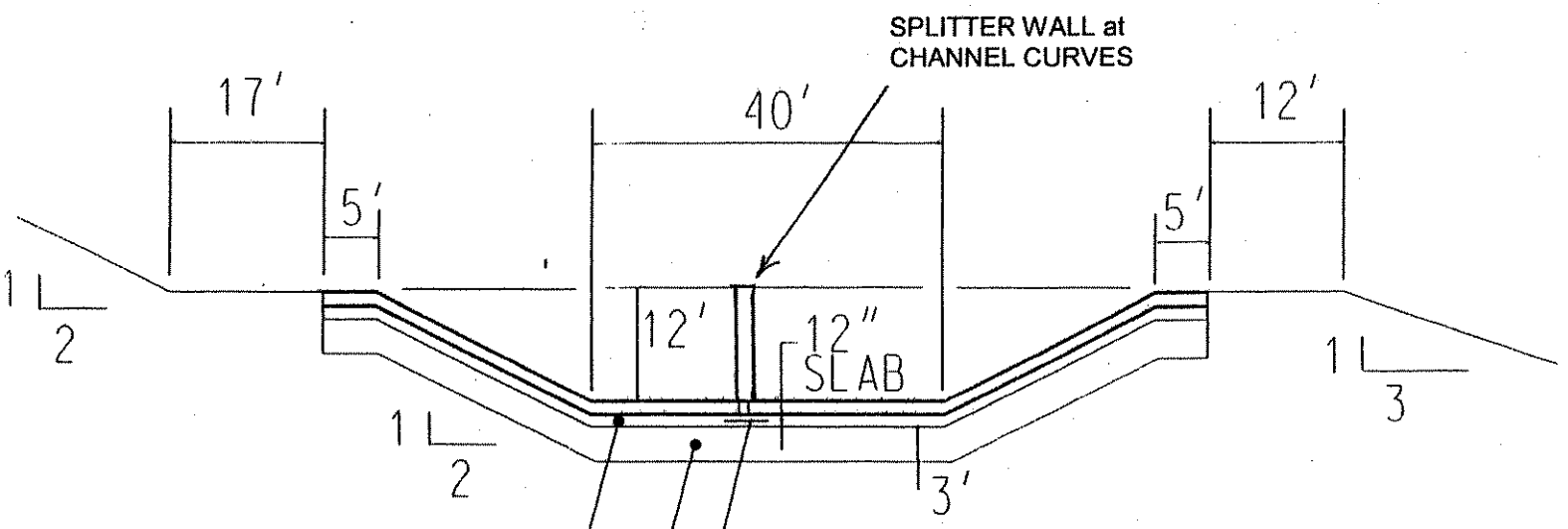
EROSION IS OCCURRING AT:
- LEVEE "B"
- LEVEE "C"
- LEVEE "D"
- LEVEE "E"

GRAPHIC SCALE

IAO STREAM FLOOD CONTROL MAUI, HAWAII

SITE MAP

US ARMY ENGINEER DISTRICT HONOLULU



BEDDING MATERIAL
12″ THICK

3′ THICK MAT OF
COMPACTED CRUSHER
WASTE MATERIAL

WEEPHOLES 4″ DIAMETER
SPACED 8′ OC ON CHANNEL FLOOR
SPACED 10′ OC ON CHANNEL SLOPES.
GEOTEXTILE (FILTER FABRIC)
AND GALVANIZED WIRE MESH COVER
BOTTOM OF WEEPHOLE OPENING

TYPICAL CHANNEL SECTION - ALTERNATIVE 1

16 12 8 4 0 16 32FT

SCALE: 1/16" = 1'-0"

US Army Corps of Engineers

U.S. ARMY ENGINEER DIVISION, PACIFIC OCEAN
HONOLULU DISTRICT
HONOLULU, HAWAII

KAO STREAM PROJECT DESIGN MEMORANDUM

PHASE II

ALTERNATIVE 2

Rectangular and Compound Channel Along Straight Alignment

Description. This alternative consists of a rectangular and compound, concrete-lined channel with a 20-foot bottom width from station 21+50 to station 89+92. It would include a straightened alignment and a shallower 55-foot wide grass-lined channel adjacent to it to handle larger storms. Total top width of this channel is approximately 145 feet. Design flows would be contained within this channel, eliminating the flood plain on the left bank of the project. All the levees could possibly be de-authorized through separate action. This alternative has an estimated construction cost of $29.5 million.

Advantages. This alternative would meet the project purpose and would be the easiest to maintain.

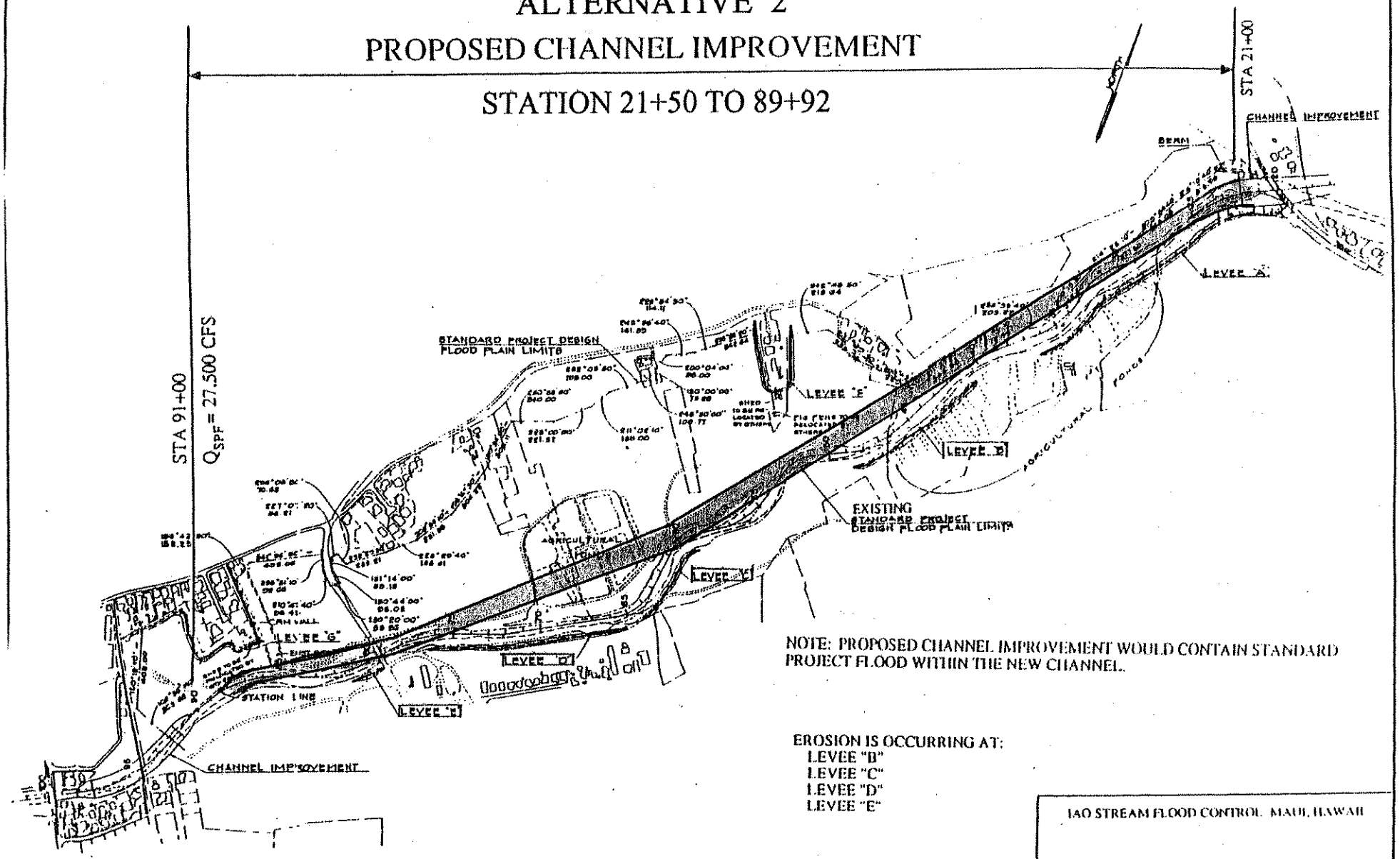
Disadvantages. This alternative would cost the most and would likely elicit strenuous objections from the resource agencies.

- This alternative will not be carried forward for detailed evaluation.

ALTERNATIVE 2

PROPOSED CHANNEL IMPROVEMENT

STATION 21+50 TO 89+92



NOTE: PROPOSED CHANNEL IMPROVEMENT WOULD CONTAIN STANDARD PROJECT FLOOD WITHIN THE NEW CHANNEL.

EROSION IS OCCURRING AT:
- LEVEE "B"
- LEVEE "C"
- LEVEE "D"
- LEVEE "E"

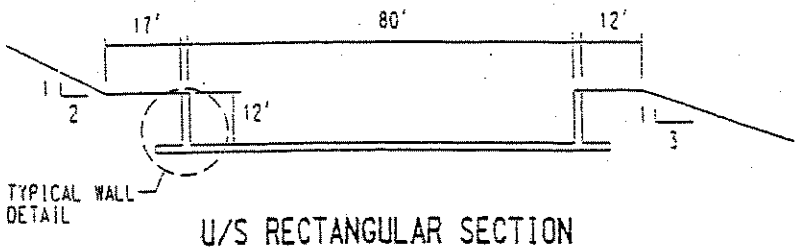
GRAPHIC SCALE

200 100 0 200 400

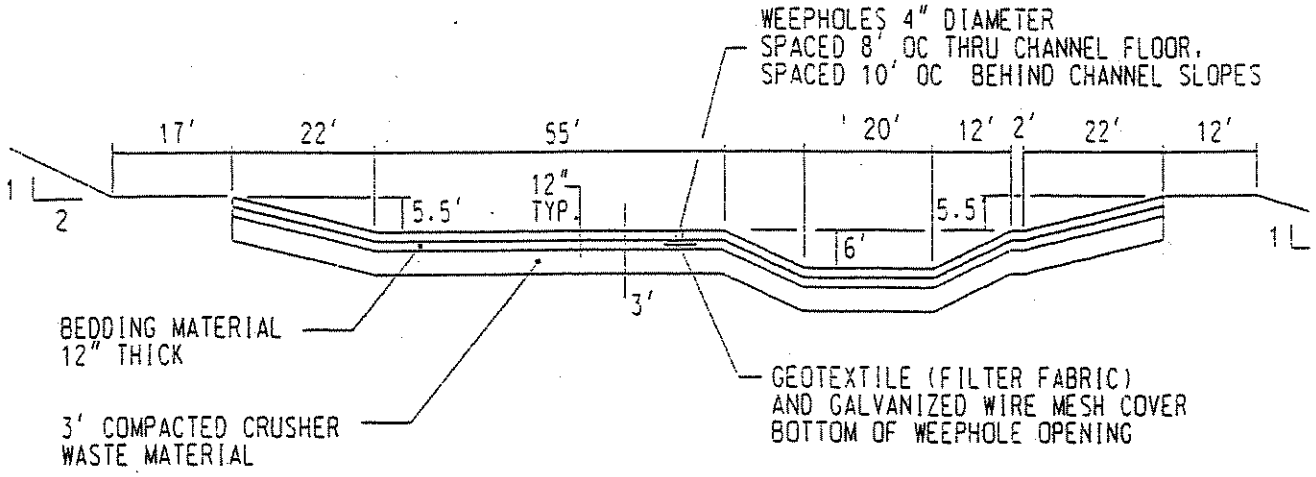
IAO STREAM FLOOD CONTROL MAUI, HAWAII

SITE MAP

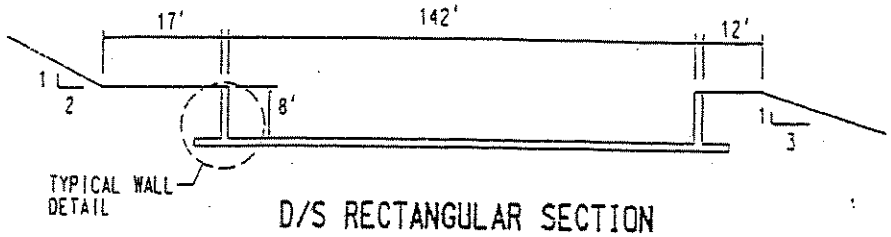
ALTERNATIVE 2



U/S RECTANGULAR SECTION

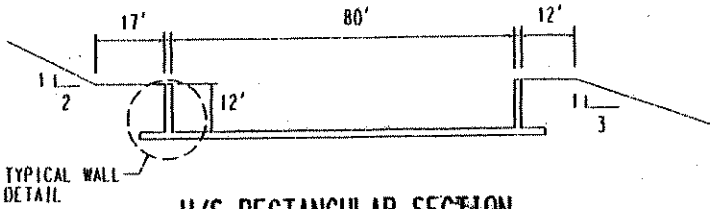


NEW TRAPEZOIDAL SECTION



D/S RECTANGULAR SECTION

Channel Cross-Section	Reach
U/S Rectangular Channel	72+18 - 89+92
Transition to Compound Chan	60+37 - 72+18
Compound Channel	37+62 - 60+37
Transition to Rectangular Chan	28+45 - 37+62
D/S Rectangular Channel	21+50 - 28+45
Total Channel Length	6,842 feet

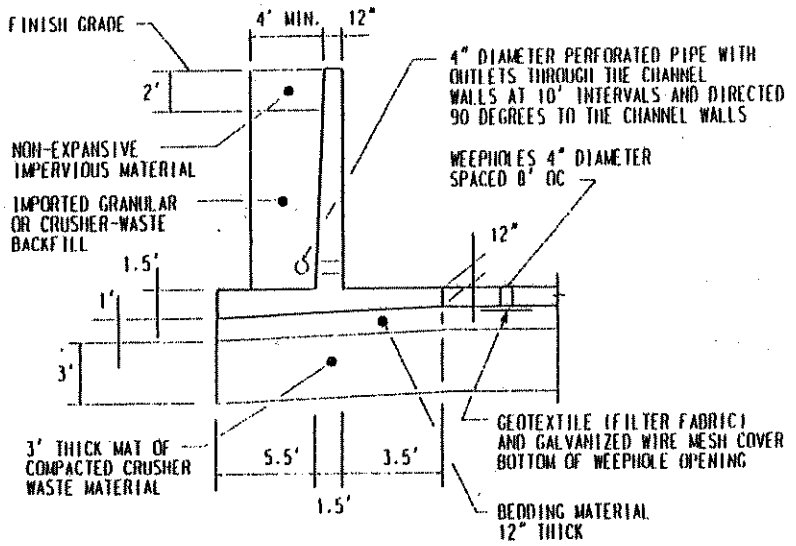


U/S RECTANGULAR SECTION

ALTERNATIVE 2

16 12 8 4 0 16 32FT

SCALE: 1/16"=1'-0"



TYPICAL WALL DETAIL

4 3 2 1 0 4 8FT

SCALE: 3/4"=1'-0"

US Army Corps of Engineers

ALTERNATIVE 3

Grouted Boulder Invert Channel Following Existing Alignment

Description. This alternative would mostly follow the alignment of the existing stream from station 21+00 to station 91+00 and would contain up to the 10-year flood event within the structural improvements. From station 76+40 to 86+60, however, the channel would be realigned to the north to avoid affecting structures that have been constructed on the right bank. The plan would use the existing levees as part of the project and would retain the floodplain on the left bank. The median base width range would be 20- to 50 feet. For the proposed condition, the typical stream stabilization improvements would consist of large stones in the main channel low flow section with roller compacted concrete stream bank protection on a 1.5:1 (H;V) to 5:1 bank slope. Channel lining, retaining walls, and raising the levee walls would be necessary due to the excessive flow velocities and higher flood levels. This channel design is considered the "environmental alternative" and would have an estimated construction cost of $19.0 million.

Advantages. This alternative would meet the project purpose and is viable from an engineering and cost perspective. This alternative might be more acceptable than a concrete channel to the resource agencies;

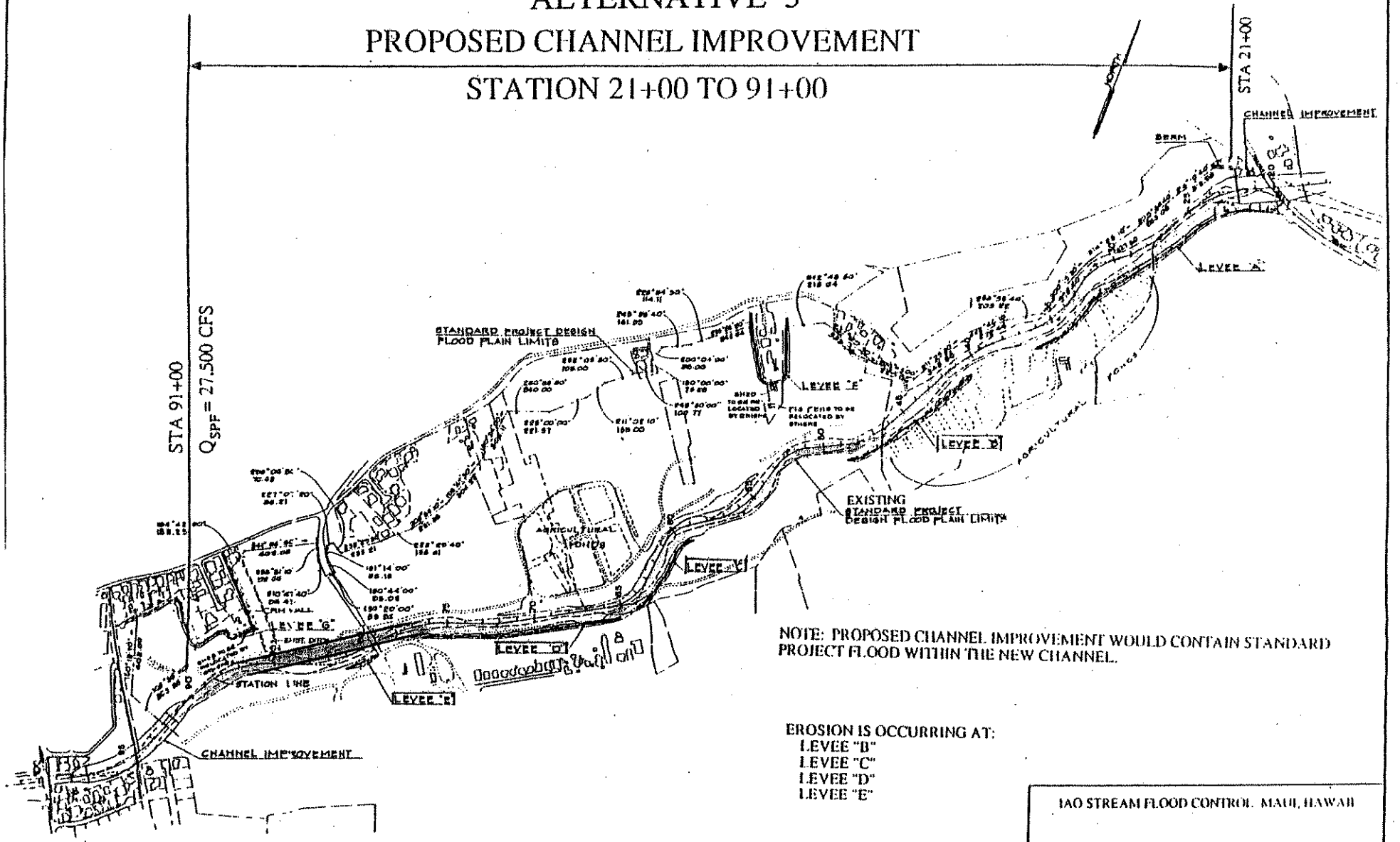
Disadvantages. This alternative would be more difficult to maintain than one with a concrete invert.

- This alternative will be considered for more detailed evaluation in the Design Documentation Report.

ALTERNATIVE 3

PROPOSED CHANNEL IMPROVEMENT

STATION 21+00 TO 91+00



NOTE: PROPOSED CHANNEL IMPROVEMENT WOULD CONTAIN STANDARD PROJECT FLOOD WITHIN THE NEW CHANNEL.

EROSION IS OCCURRING AT:
- LEVEE "B"
- LEVEE "C"
- LEVEE "D"
- LEVEE "E"

GRAPHIC SCALE
200 100 0 200 400

IAO STREAM FLOOD CONTROL, MAUI, HAWAII

SITE MAP

ALTERNATIVE 3

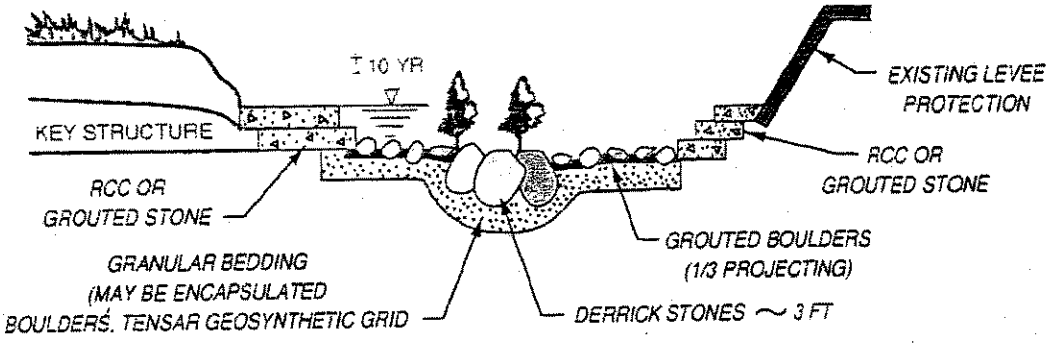


Figure 1 Cross section of armored channel adjacent to existing levee

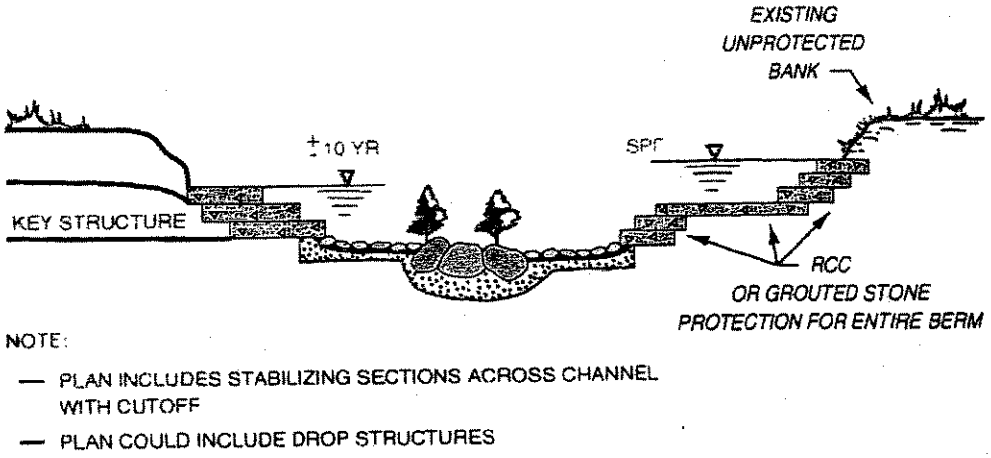


Figure 2 Cross section of armored channel adjacent to unprotected bank

ALTERNATIVE 4

Levee Toe Repairs

Description. This alternative (originally designed in April 1992) consists of widening the basal stream area, flattening the slope of the left bank, and reconstructing the levee toe with concrete riprap filling the void under the levee toe. A CRM cutoff wall would be constructed fronting the existing levees. This plan would retain the floodplain on the left bank. The estimated project cost in October 1991 price levels is $6.6 million.

Advantages. This alternative has the lowest estimated construction cost.

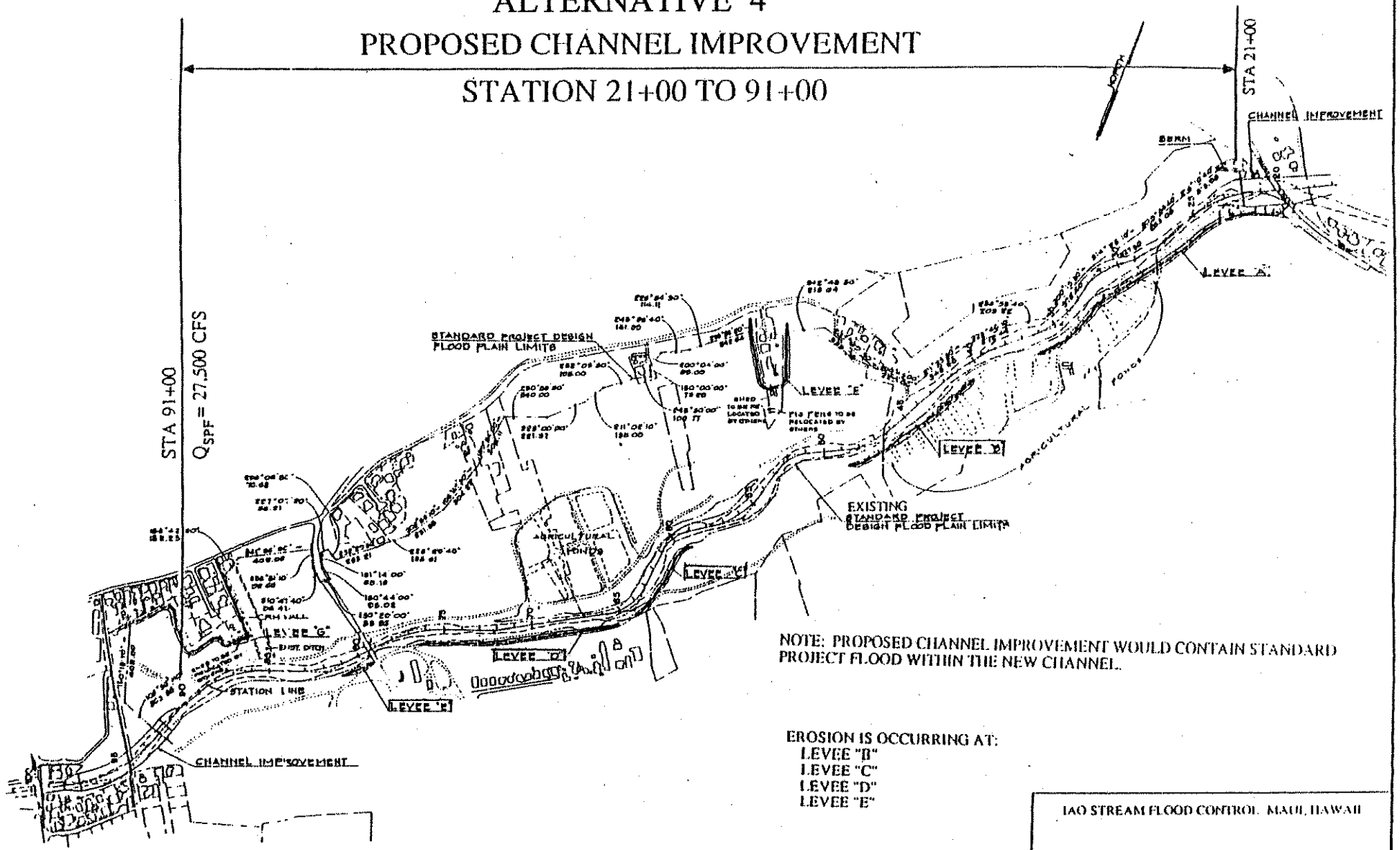
Disadvantages. This alternative would not meet the project purpose because erosion of the levees' foundations would continue to occur and the risk of any levee failing would remain. This alternative requires the highest maintenance cost that would be necessary for the life of the project.

- This alternative will not be carried forward into detailed evaluation.

ALTERNATIVE 4

PROPOSED CHANNEL IMPROVEMENT

STATION 21+00 TO 91+00



NOTE: PROPOSED CHANNEL IMPROVEMENT WOULD CONTAIN STANDARD PROJECT FLOOD WITHIN THE NEW CHANNEL.

EROSION IS OCCURRING AT:
LEVEE "B"
LEVEE "C"
LEVEE "D"
LEVEE "E"

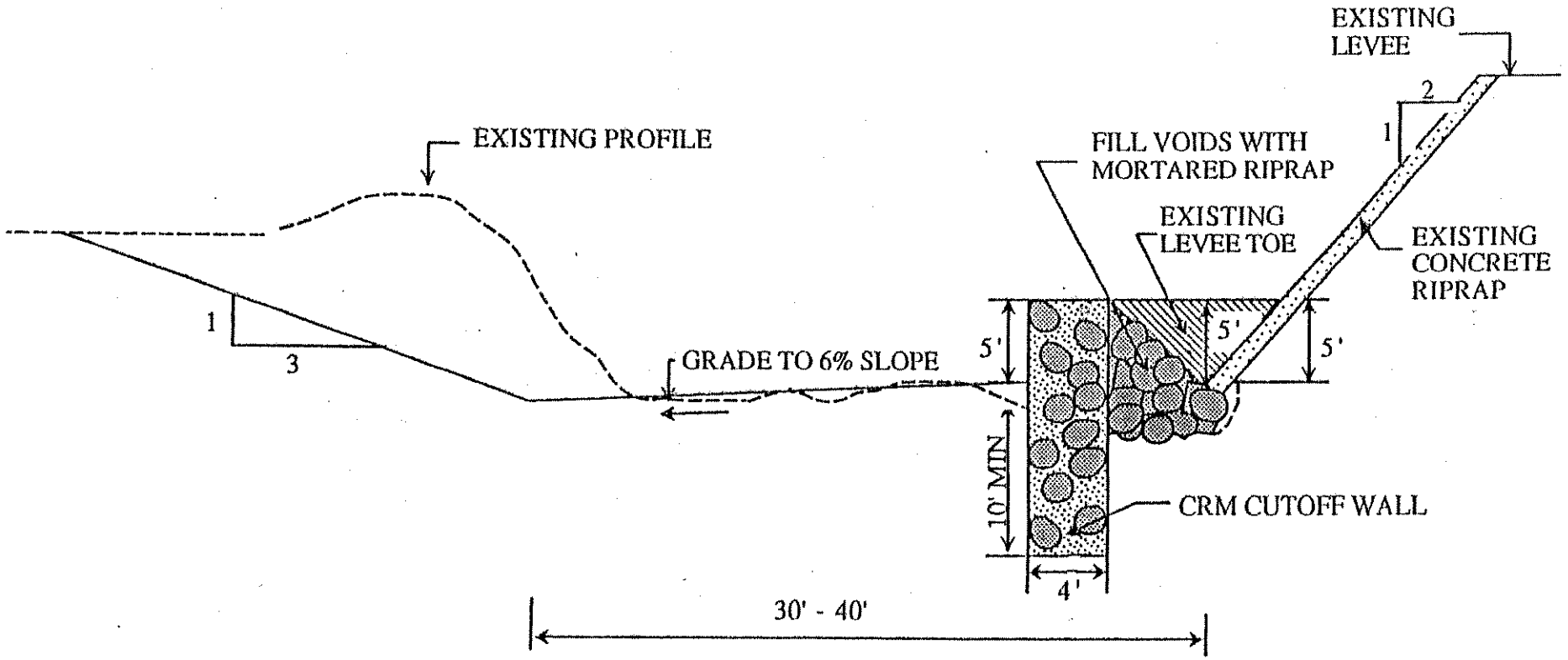
GRAPHIC SCALE

IAO STREAM FLOOD CONTROL, MAUI, HAWAII

SITE MAP

US ARMY ENGINEER DISTRICT, HONOLULU

ALTERNATIVE 4



IAO STREAM FLOOD CONTROL PROJECT
MAUI, HAWAII

SCALE 1" = 10'

TYPICAL MODIFIED SECTION

SUMMARY COMPARISON OF ALTERNATIVES IN MEETING PLANNING OBJECTIVES

		Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	**Level of Flood Protection**	SPF Protection	SPF Protection	SPF Protection	SPF Protection, but risk of structural failure
2	**Utilization of Flood Plain**	Flood plain may be utilized for other purposes	Flood plain may be utilized for other purposes.	Left bank remains a restricted flood plain	Left bank remains a restricted flood plain
3	**Visual Aesthetics**	Concrete channel replaces natural stream	Concrete channel replaces natural stream	Most similar in appearance and function as natural stream	Retains natural stream bottom
4	**Ease of Maintenance**	Easiest to maintain	Somewhat easy to maintain	Difficult to maintain	Difficult to maintain, and require continual repairs of levees
5	**Environmental Acceptability**	May not be acceptable	Not likely to be accepted	Most favorable	May be acceptable
6	**Technical Adequacy**	Meets project purpose	Meets project purpose	Meets project purpose	Does not meet project purpose; risk of failure remains
7	**Cost**	2nd highest cost	Most expensive	3rd highest cost	Least expensive

Appendix C:

Cultural Impact Assessment

Draft Report

Oral History Studies for the Determination of Traditional Cultural Properties and Cultural Impact Assessment for the `Iao Flood Control Project, Maui Island, Hawaii

Contract No. DACA83-02-D-0005
Task Order 0004

Prepared for
E&C, Environmental Tech Branch
United States Army Engineer District, Honolulu, Bldg. 230
Fort Shafter, Hawaii 96858-5440

Prepared by

Social Research Pacific, Inc.
667 Old Mokapu Road
Kailua, HI 96734

December 5, 2003

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1.0 Introduction

At the request of the U.S. Army Corps of Engineers, Honolulu Engineer District, under Contract No. DACA83-02-D-0005 (Task Order 0004), Social Research Pacific, Inc., completed "Oral History Studies for the Determination of Traditional Cultural Properties and Cultural Impact Assessment for the ʻÏ`ao Flood Control Project, Maui Island, Hawaii." The study was done between August 12 and November 15, 2003. This draft report presents the findings of this study.

The U.S. Army Corps of Engineers is conducting a Feasibility Study and Environmental Assessment (EA) for flood control measures in the ʻÏ`ao Stream Drainage on the southern end of Maui Island. The determination of Traditional Cultural Properties (TCPs) and Cultural Impact Assessment (CIA) partially fulfill the requirements for an EA as specified by Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and Chapter 343 of the State Constitution of Hawai`i (HRS and Act 50).

The major tasks involved in completion of this TCP/CIA included: 1) preparation of a Work Plan (WP); 2) archival and record searches; 3) field study (collection of oral histories from native Hawaiians knowledgeable about traditional uses of the area, survey of area residents to identify potential cultural impacts, and attendance at scoping and public meetings); 4) description and assessment of Traditional Cultural Properties (TCPs) identified during field studies; and 5) preparation of this report.

1.1 Goal and Purpose of Study

The goal of this project was twofold: 1) to identify potential TCPs through archival searches and oral histories; and 2) to complete a CIA that addresses the potential impacts of the proposed project. The completed TCP/CIA study also meets both federal and State of Hawaii NEPA requirements for the ʻÏ`ao Flood Control Project in the documentation of an Environmental Assessment.

Archaeological work completed for an earlier phase of this project by Scientific Consultant Services, Inc. (SCS 1999), indicated that potentially significant Native Hawaiian cultural remnants, eligible for the National Register of Historic Places, were likely to be present in the project area. More recent archaeological investigations upstream of the current project area (Haun and Associates 2002), found traditional Hawaiian residential and agricultural sites. Along with known historical uses and

archaeological sites in the vicinity of the project area, portions of the flood plains within the streambed are presently used as for small-scale agricultural and subsistence purposes. There also remain a handful of land owners on parcels originally given during the Land Commission Awards [LCA); most of these are located north (*mauka*) of the project area. Knowledge about traditional and historic land uses along ʻĪʻao Stream made it likely that TCPs would be found in the vicinity of the project area.

Land use along ʻĪʻao Stream is primarily residential. This is particularly true for the upper and lower portions of the stream. Within the immediate vicinity of the project area, particularly along the southern flanks of the stream, there are a large number of commercial interests. Based on observations of current impacts, the residents and businesses along the southern flanks will be most directly impacted by any future flood control measures. This area also forms the primary user group identified by this study. The potential impacts and cultural concerns that area residents (and other user groups) relate directly to the proposed project forms the basis for the cultural impact assessment.

1.2 Project Location

ʻĪʻao Valley lies within Wailuku a*hupuaʻa*, in the northeastern portion of Maui Island (Figure 1). The project area includes only that portion of ʻĪʻao Stream which has not previously been upgraded; it extends approximately 7,200 lineal feet between Market Street and Waiehu Beach Road, in Wailuku town. The remainder of the stream, immediately above and downstream of the project area, is already lined in concrete (previous improvements). Among the options being considered in the present EA, is concrete lining of the portion of the stream that forms the project area.

While the stream proper runs as a fairly narrow channel, the width of the streambed (floor) varies significantly. In the north-central portion of the project area (between Pihana Street and the active stream flow channel) lays a flood plain that is currently used as both pastureland and for growing vegetables (Burgett and Dega 1999:5). Along with a very large banana patch, newly planted cultivars such as taro can also be seen in the flood plain area. Along the upper, westernmost portion of Pihana Street are residential units; a few small businesses can be found along Market Street, on either side of the bridge. A Hawaiian Homes Lands subdivision lies along the eastern, lower portion, of Pihana Street, ending at Waiehu Beach Road.

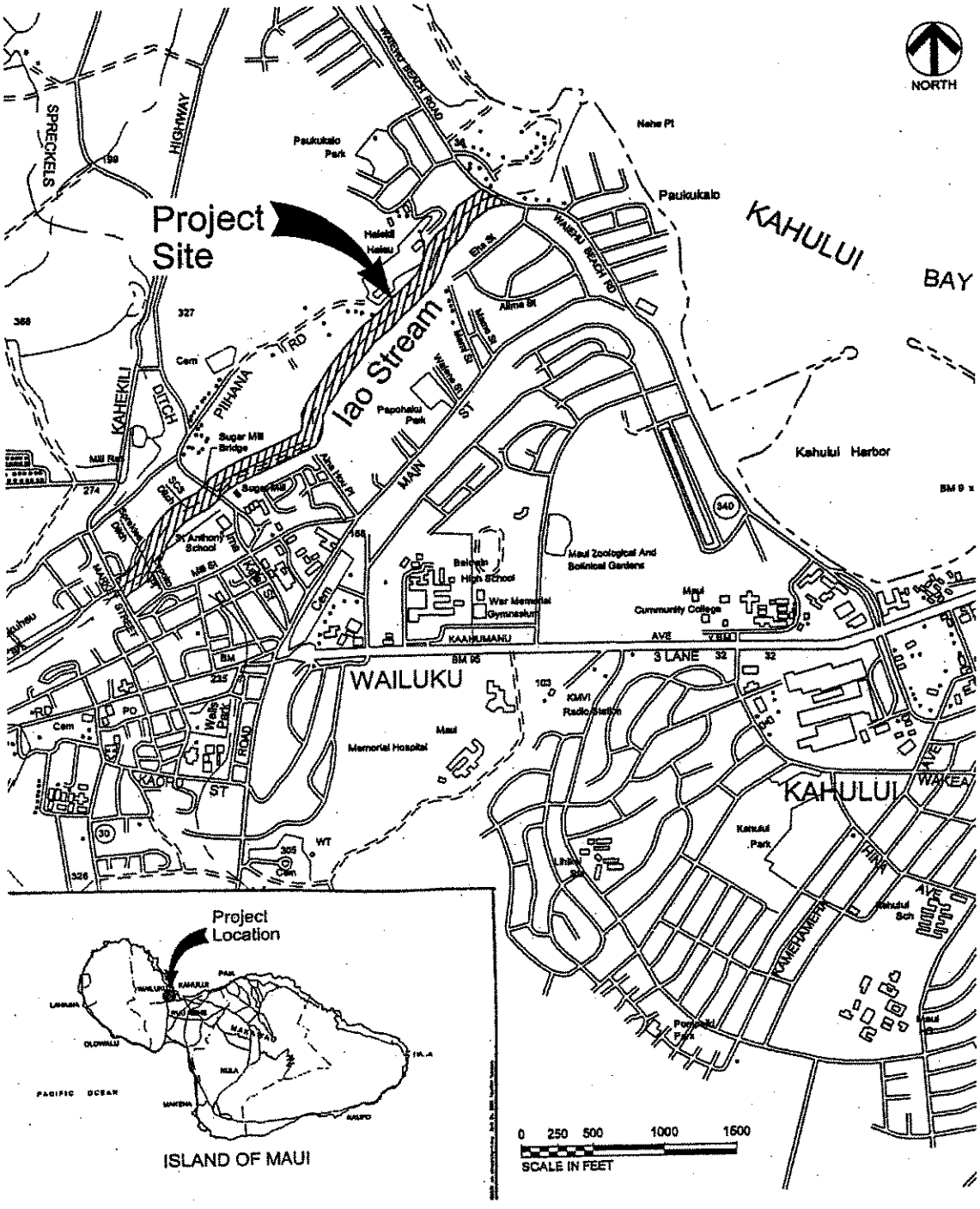

Figure 1. Map of Project Area showing the Iao Stream Hydraulic Design (M&E Pacific, Inc. 2000).

The area along the southern flanks of ʻĪʻao Stream is a mixture of residences and business/commercial interests. Part of this area makes up the Wailuku Industrial Park and the Millyard (formerly Mill Camp) business complex (Figure 2). Residential units are found nestled

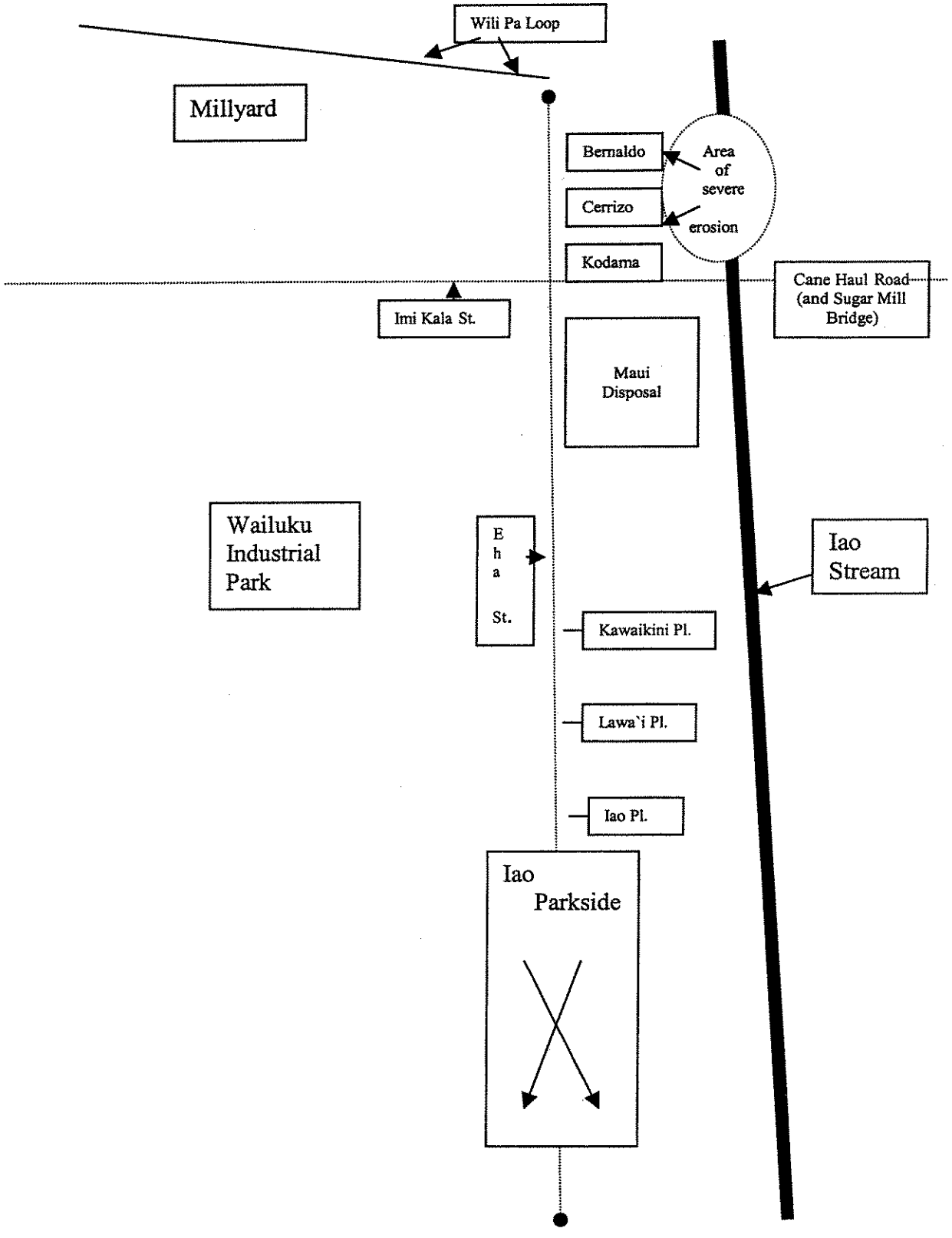

Figure 2. Location of Selected Sites in the Project Area

between commercial buildings and ʻĪʻao Parkside; the latter is an extensive condominium development that borders on the southeastern flanks of the project area.

1.3 Federal Guidelines for Identifying TCPs

Federal guidelines define (identify) what properties constitute a TCP. In the *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (National Register Bulletin No.38) a TCP is defined as:

> "...[a traditional cultural property is generally] one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identify of the community" (Parker and King 1995:2).

The process of identifying a Traditional Cultural Property calls for a "systematic study, just as most other kinds of historic properties" (Parker and King 1995:5). The ultimate goal of identifying a TCP is to evaluate its eligibility to the National Register of Historic Places... "its significance (former and present) must be at the very least, mentioned in planning federal, federally assisted, and federally licensed undertakings" (ibid 1995:4). An interview with knowledgeable sources is among the primary method for identifying TCPs. Among the individuals contacted were *kūpuna* (Hawaiian elders) from Maui Island who can identify properties of cultural/historical significance in ʻĪʻao Valley. Along with interviews, information about TCPs was gathered from written and archival (mostly photographic) sources. These data helped identify areas/properties in ʻĪʻao Valley that have cultural/historical significance and satisfy the criteria established for TCPs, and areas/properties of local cultural importance that do not meet the criteria. Both categories are discussed in later sections of this report.

1.4 State of Hawai'i Guidelines for Cultural Impact Assessments

Articles IX and XII of the State Constitution of Hawai'i (Chapter 343, HRS), require government agencies to promote and preserve cultural beliefs, practices, and resources of native Hawaiians and other ethnic groups. As such, preparers of environmental impact assessments and statements need to study the impacts of a proposed action on cultural practices and features associated with a project area. The "Guidelines for Assessing Cultural Impacts", (Appendix A) adopted by the Environmental Council of the State of Hawai'i, on November 19, 1997, identifies the protocol for conducting

cultural assessments. The impacts addressed by this study look at the potential cultural impacts of the proposed flood control project on the resident community. The evaluation of potential cultural impact(s) of the flood control project is based primarily on the results of a questionnaire-based survey done among residents and organizations in the Wailuku area. Some of these individuals participated in the EA Scoping Meeting, held in Wailuku on August 12, 2003. The results of this survey are presented in Section 4.0 of this report.

2.0 The Study Approach

Since the purpose of this study was twofold - identification of TCPs and completion of a CIA – the data needed to complete the project involved gathering information from both historical and present sources. Hence, the study approach taken was both ethnohistorical and ethnographic in nature. The categories of data gathered included: 1) historical information from written/archival sources; 2) oral information (on TCPs and traditional land uses) from Hawaiian *kūpuna* familiar with the project area; and 3) a questionnaire-based survey of individuals and groups who are current "users" of the project area.

The primary objective of the TCP study was to:

- identify potential areas, features and/or sites of traditional (Native Hawaiian) significance within the vicinity of the project area.

The primary objectives of this CIA was to:

- identify current cultural uses of the ʻĪʻao Flood Control Project area;
- identify user groups at that would be affected (culturally impacted) by the proposed project;
- conduct interviews with individuals and groups to identify these potential affects; and
- assess the level of impact(s) from these potential affects on cultural practices in the area.

2.1 Tasks Completed

Data gathered for this study combined available background information on the cultural and historical make-up of the project area, with results of the oral interviews and the questionnaire-based survey. Specifically, the following tasks were completed:

1. gathering of background data (written traditional/cultural and historical data on the project area)
2. designing a survey questionnaire
3. field research
   - identification of primary user/interest groups and stakeholders, particularly residents and businesses that were most likely to be directly impacted by the proposed project
   - administration of survey questionnaire
   - oral interviews (individual and group meetings)
   - general community observations
   - field visits to the project area.
4. quantitative and qualitative analyses of data gathered from field research and general background information
5. development of recommendations based on the findings
6. preparation of this draft report

2.1.1 Background Data

Background data was gathered from the initial stages of the project up to the present. Interviews were completed on the island of Maui between the months of September and November 2003 (see Appendix B for transcripts of the interviews). The survey of residents, households, businesses and other potentially affected 'user groups' for the CIA survey was completed alongside the field site visits and oral interviews. All but two oral interviews were held in person; the remaining two were completed via telephone.

2.1.2 Survey Questionnaire

A one-page survey questionnaire (Appendix C) was developed to gather information for the CIA component of this study. Its primary purpose was to gather responses about the possible cultural impacts any individual and/or business may experience as a result of the proposed flood control project; secondarily, it served as a tool for obtaining information about TCPs in the project area. The questionnaire was administered in person, as well as via telephone (a few individuals were unable to

meet in person). Individuals attending the ʻĪʻao Flood Control Project Scoping Meeting, held in Wailuku on August 12, 2003, were also contacted.

2.1.3 Field Research

One of the initial tasks of this study was to identify (a) *küpuna* and knowledgeable others about TCPs in the area, and (b) individuals and groups likely to be impacted by the proposed project. Most of the contacts for identifying TCPs did not live in the immediate vicinity of the project area, while nearly all of the individuals to whom the questionnaire was administered, lived and/or worked immediately adjacent to the project area. The latter included residents and businesses along ʻĪʻao Stream. Interviews were held at individual residences, at places of business as well as at other convenient meeting places. In some cases, meetings were completed in group settings. Throughout the field research phase, general observations were made within and around the project area (several individuals were approached after being observed in the immediate vicinity of the project area).

2.1.3.1 Oral Interviews

All individuals who provided oral interviews about TCPs in the project area have consented to the sharing of their information (the CIA did not entail formal interviews). Two of these interviews were recorded on audiocassette (see Appendix B); the remainder was recorded in written form. The identification of Hawaiian *küpuna* for the island of Maui came from previous oral history research on the island, the Office of Hawaiian Affairs (OHA), the State Historic Preservation Office (SHPO) on Maui, and the Maui Historical Society (Appendix D). Additionally, there were residents who have taken an interest in the TCPs of ʻĪʻao Valley that provided useful information.

3.0 Traditional and Current Land Uses of ʻĪʻao Flood Control Project Area and Surrounding Vicinities

ʻĪʻao Valley, as with the remainder of Wailuku *ahupuaʻa* is known to have numerous traditional and historic sites of significance. Many of these are not located within the project area however, they may have had significant association with features in the project area. The next two sections review the significance of Wailuku *ahupuaʻa* and ʻĪʻao Valley, first in its historical context, and second in its present day.

3.1 Traditional Hawaiian Uses of ʻÏ`ao Valley and Wailuku *ahupua`a*: Written and Oral Accounts

In a recent historical literature review of the traditional land uses of Kahului Harbor, Tomonari-Tuggle and Welch (in Prasad and Tomonari-Tuggle 1999) discuss the importance of the Wailuku area. The project area falls within the traditional *ahupua'a* of Wailuku in the district of Wailuku. The district encompasses the eastern flank of the West Maui Mountains and all of the isthmus between east and west Maui, including the coastal stretches of both Kahului Bay on the north and Mäʻalaea Bay on the south. The *ahupua'a* of Wailuku covers the coastal area of Kahului Bay, all of ʻÏ`ao Valley, and the north half of the isthmus.

Handy and Handy (1972:272) call Wailuku district *Na Wai 'Eha*, "The Four Waters," after the four major streams and taro-growing areas of windward West Maui: Waikapü, Wailuku, Waiehu, and Waiheʻe. Based on the account of a native Hawaiian of "considerable age," a writer at the turn-of-the-century described the district (Paradise of the Pacific, September 1900, in Silva n.d.,10):

> The district was called Nawaieha (the four streams) and was famous throughout the group, not only for the magnificence of Kahekili's court but for the vastness of its products. The shores of Kahului harbor, from Waihee Point to Haiku, were surrounded with the grass huts of the fishermen and of those connected with the innumerable war canoes of the king. Myriads of cocoanut [sic] trees lined the beach from Kahakuloa to Wailuku, the trunks of many of which are found in the marshes at Wailuku at this day, the trees having been destroyed by a conquering army from Hawaii.

In the late prehistoric period, a time of frequent warfare among the chiefs of Maui, Oʻahu, and Hawaiʻi, Wailuku was a chiefly center and a site of decisive battles. In 1736, the fatally ill Maui chief Kekaulike heard that the Hawaiʻi chief Alapaʻi was planning to invade his island. He and his retinue retreated from Kaupo to Kula and then to Wailuku where the Maui chief died at Halekiʻi Heiau. There, his body was burned and his ashes thrown into ʻÏ`ao Stream (Speakman 1978:13, in Kennedy et al. 1993).

Between 1765 and 1793, Kahekili was chief of the island (as well as Oʻahu, Molokaʻi, and Länaʻi). Late in his rule, war broke out between Kahekili and the chief of Hawaiʻi, who led a force of special warriors in an invasion of Maui. Kahekili awaited the outcome of the battle at his residence in Wailuku. Kamehameha fought one of his first battles with European weapons on the plains of

Wailuku. "The bay from Kahului to Hopukoa was filled with war canoes. For two days there was constant fighting in which many of the most skillful warriors of Maui took part, but Kamehameha brought up the cannon, Lopaka, with men to haul it and the white men, John Young and Isaac Davis, to handle it; and there was great slaughter (Kamakau 1961:148). But Wailuku was also a place where chiefs passed their quiet times. In the 1760s, "the chiefs of Wailuku passed their time in the surf of Kehu and Ka'akau" (Kamakau (1961:83). 'Ī`ī (1959:135) identifies "the surfs of Kaleholeho, Kaakau-pohaku, and Paukukalo" in Wailuku as some of the attractive locations for this sport.

Written and oral traditions associated with 'Ī`ao Valley clearly point out the area's unique significance to Native Hawaiian culture. 'Ī`ao was the name of Maui and Hina's daughter, whose lover was turned into a pillar of salt ('Ī`ao Needle) by Maui. Numerous chiefs are said to be buried at Oloeio, a cave located in 'Ī`ao Valley (Fornander 1996) that served as a royal burial grounds (*kapela*). Some of the biggest battles in Hawaiian history (Battle of'Ī`ao, Battle of Kepaniwai, Kamehameha I's victory in 'Ī`ao) were fought within and around 'Ī`ao Valley. Wailuku *ahupua`a*, which translates to "water [of] destruction" (Pukui et al. 1976:225), and Wailuku District were ceremonial and political centers for Hawaiian chiefs (Kirch 1985). Wailuku was considered a "chiefly center" (Sterling 1998:90), with many of the chiefs and area's population residing near or within portions of 'Ī`ao Valley.

Traditional land use of 'Ī`ao included intense cultivation of taro; many *lo`i* systems line the stream banks of 'Ī`ao Valley. A total of sixty-six LCAs, primarily taro patch *kuleana*, and thirty-nine *po`alima* are located between the old Wailuku Mill site and Paukūkalo, on the southern side of 'Ī`ao Stream (Fredericksen 2001:4). Two *`auwai* (prehistoric ditches), were "constructed for the purpose of irrigating *kalo* on the plains which stretch away to the northward and southward of the ['Ī`ao] river" (Sterling 1998:86). Much of the historical literature supports extensive taro cultivation in greater Wailuku Valley. Habitation sites along Lower Main Street in Wailuku "are associated with the rich taro producing lands in the Lower 'Iao River flood plain, and the extensive cultivation systems present in `Iao Valley" (Burgett and Dega 1999:14). Taro from Wailuku *ahupua`a* also supplied other areas of the island. For instance, areas such as Kahikinui were not suitable for taro cultivation, therefore its people would trade ocean food sources for taro with their distant neighbors in Wailuku. It is highly likely that similar trade arrangements existed with other parts of the island that were unsuitable for cultivating taro.

A maps prepared by Monsarrat in the 1880s offer 'snapshots' of late 19th century history of Wailuku *ahupua`a* and 'Ï`ao Valley. Figure 3 is a portion of Monsarrat's 1888 map that shows 'Ï`ao Stream



Figure 3. Portion of Monsarrat's 1888 map showing 'Ï`ao Stream and Paukükalo.

curving around *kuleana* lots in the Paukükalo area, and emptying into Kahului Bay. An earlier map (1882) shows all the traditional Hawaiian land divisions are shown on this map – district, *kalana, ahupua`a, ili, mo`o (mo`o `āina)* and *paukū (kuleana*). There are also a large number of subdivisions (areas with names that are no longer known or used) along either side of 'Ï`ao Stream. According to Bob Hobdy (pers. comm.) who has done extensive research relocating sites identified on early historic maps, these were likely to be *mo`o*. Altogether, he identified a total of twenty-six *mo`o* along 'Ï`ao Stream. The *mo`o* are attached to wetland taro cultivation; each one is serviced by its

own *`auwai*, and includes several *kuleana* (ibid). In a similar map of Honokohau from the 1930s, Hobdy saw complete descriptions of *kuleana, mo`o* and the *`auwai*. Each *`auwai* coming off Honokohau Stream showed a cluster of *lo`i* and multiple *kuleana* within the *mo`o*.

In addition to *lo`i*, there are two *heiau* in the immediate vicinity of the project area. The Haleki`i-Pihana Heiau State Monument can be easily seen on the northwest flank of 'Ï`ao Stream, along the lower portion of the project area. This is the third largest structure on Maui, after Pi`ilanihale *Heiau* in Hana, and Loaloa *Heiau* in Kaupo (Kolb and Keau 1990:5). Other heiau are known to have existed in the area, however, as noted by Winslow Walker, all but two (Haleki`i and Pihana) of the known *heiau* were still standing during his initial archaeological survey of Wailuku. Keahuku, Olokua, Olopio, Malena, Pohakuokahi, Lelemako, Kawelowelo, Kaulupala, Palamaihiki, and Oloolokalani could not be found (Walker 1931:146-148, in Fredericksen 2001:11-12). Halekii-Pihana *heiau* sits at the edge of lithified sand dunes, which itself is a significant prehistoric burial site that runs semi-parallel to 'Ï`ao Stream and mid-way up Wailuku *ahupua`a*. Early historic burials are also known from Mahalani Cemetery, located between the *Pu`u One Dunes* and the flood plains along the project area portion of 'Ï`ao Stream. According to its President, King Kekaulike's wife is buried at the cemetery along with burials are from the later historic, plantation period (W. Cockett, pers. comm.).

Traditional uses of the land area can also be seen in the travel routes taken by people. At least one prehistoric-historic trail, crossing the saddle to the western side of the island, is known to exist in the back of Wailuku Valley. The trail is believed to have been used by a fighting chief who escaped by taking it to cross the saddle to Olowalu. Na Ala Hele, the group tasked with locating/identifying ancient trails throughout the islands, has found many similar trails in and out of the gulches of Maui. As a member of Na Ala Hele, Bob Hobdy (pers. comm.) says that trails along the gulches are most visible due to the terrain on which they sit; those in flat areas or bottom lands are less known since they were most likely to have been converted into roadways for buggies and cars.

Many of the elders, including long-term area residents, discuss what was likely found in the Wailuku before changes were introduced by the sugar plantations. These are sites and features that no longer exist or have been greatly disturbed. *Küpuna* Charlie Keau knows of many previous traditional sites throughout the Wailuku area, including *heiau*, fishing shrines (*ko`a*), trails, and *lo`i*. Charlie grew up in Paukükalo, which was good for fishing and picking *limu*. He recalls that the old folks really liked Paukükalo and how dramatically the area has changed since construction of the Maui Community

Center. Charlie remembers that old timers used to put their canoes out from "Kalo Grounds," the present day location of Maui Beach Hotel in Kahului. Some of these people also lived underneath the nearby trees. Members of the Duarte family, with multiple generations living in ʻĪʻao Valley, recall some prehistoric and historic features used by Hawaiian families; these, too however, no longer exist. Kaahumanu Church, the oldest church in Wailuku, was deliberately built on the foundation of Kahekili's *heiau*. (Ashdown 1970:34). More recently, Bob Hobdy has seen areas that contained extensive rock walls, delineating small units of land, bulldozed in Waikapuʻu. Likewise, the old *ʻauwai* system was most likely destroyed when irrigation ditches were placed for sugar plantations.

Recent studies within the immediate vicinity of the project area indicate that traditional, prehistoric features and sites are not likely to be found. During the Phase I archaeological survey of the Flood-Control Project Area, Connolly (1974) noted that "no positive structural evidence of a prehistoric occupation was observed...all of these structural remains–considered with the surface-artifact and midden remains, and the known ethno-historical materials appeared to be principally historic (post-European contact) in age" (1974:Abstract). The boundaries of Phase I border on the eastern-most boundary of the current project area.

3.1.1 Land-Use Changes resulting from Changes in Land Ownership

The first commercial activity in the Wailuku area appears to have been cattle ranching. As early as 1845, large herds of cattle were roaming the Kahului Isthmus (Barrere 1975:52). The cattle, under royal *kapu* which kept the herd from being harmed, were very destructive to the environment (ibid). In the 1830s, there was also an attempt to grow cotton. Although the environment was additionally impacted by the attempt, cotton growing also met with little success (Fredericksen 2001:4).

During the mid-19th century Mahele or division of lands, Wailuku was designated as Crown Lands claimed by the Kamehameha III. Numerous Land Commission awards to commoners were given out in the area around Wailuku and ʻIao Valley. In 1878, through his friendship with King Kalākaua, Claus Speckles secured a lease of 40,000 acres of land, among which was a portion of Wailuku *ahupuaʻa*. In 1882, he acquired fee simple title to all of the *ahupuaʻa* through Grant 3343 (Kennedy et al. 1992:12). That same year, Speckles built the Waiheʻe ditch and founded the Hawaiian Commercial and Sugar Company (HC&S), which quickly became the largest and best-equipped

sugar plantation in the islands (Kuykendall 1967:60). Figure 4 shows that by 1937, the majority of Wailuku was designated as "ranch land", being used primarily for sugar.

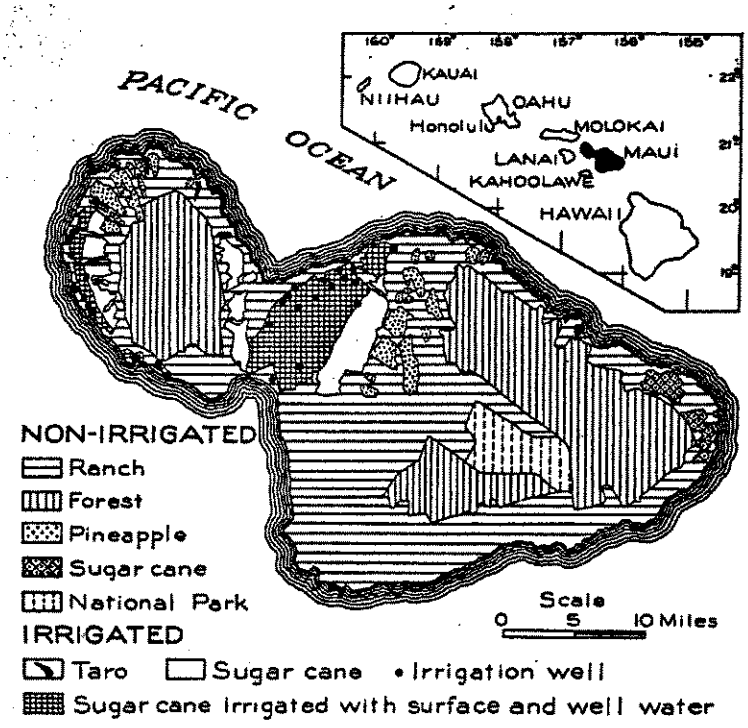

Figure 4. Land Utilization on Maui in 1937 (Source: Territorial Planning Board 1939, in Stearns and MacDonald 1942).

On a smaller-scale, change to land use has also been brought about by the U.S. military's use of the Wailuku area. As with many areas on Maui (e.g. Pu`unene Air Station, Naval Air Station Kahului [NASKA], the U.S. Marine Camp in Hailemaile), military use of the island intensified during World War II. Like the commercial farming ventures before them, the military has brought about fairly permanent changes to land use. Gordon and W. Cockett recall the Army Camp that was set up in Paukūkalo, bordering Pihana and near the Haleki`i-Pihana heiau, shortly after World War II. The area is now mostly Hawaiian homesteads. A portion of this earlier camp may also be the present day location of the Hawaii National Guard Camp Site and Rifle Range (c.f. Yent 1995:2-3). An undated photo below (Figure 5) shows another camp set up along Kahului Harbor, before reaching Waiehu and Paukūkalo. Kahului Harbor served as the main port of entry for military ships during WWII.

Written and oral histories tell of the traditional significance of Wailuku. Once an area of great traditional significance to Native Hawaiians, Wailuku went on to become a major sugar



Figure 5. Village at Paukükalo c.1946, showing military barracks at upper left, fronting the Pu`u One Dunes (Courtesy of Bailey House Museum).

cultivation/production area, to its present day residential and business use. Sugar plantations dominated the Wailuku landscape, especially along ʻĪʻao Stream, for much of the very late 19th and early 20th centuries. These changes in land use have significantly compromised the existence of prehistoric, traditional archaeological features. According to Haun and Henry (2002), the density per acre value of archaeological sites and features are relatively low due to the extensive impact of plantation agriculture and urbanization (Hahn and Henry 2002:17). The following section briefly discusses current land use within the immediate vicinity of the project area.

3.2 Current Uses of the Project Area

Current uses of the project area differ dramatically from its traditional uses. The change has come about in several stages. If for instance, the maps prepared by Monsarrat in the late 19th century depict a true picture of land use in that day, than along with the prehistoric uses, the intermediate phase of land use is also long gone. Sugar has left its imprint primarily in the form of water diversions (dikes, ditches), and other structural remnants such as bridges and a few old buildings. But these are becoming less obvious with the rather rapid level of urban development in the Wailuku area. Present day land uses identified during this study fall into three categories:

Residential

Commercial

Recreational

Farming

Residential development along ʻĪʻao Stream extends from Kahului Bay to the far western (*mauka*) sections of the valley. The most dense residential settlement is along the lower (*makai*) portions of the stream, in the areas of Waiehu, ʻIao Parkside, Happy Valley, Pihana, Millyard and the Hawaiian Homestead bordering on the Halekiʻi-Pihana Heiau. Along the northern corridor of the project area, which extends from Millyard to Waiehu Beach Road (see Fig. 2), there is continuous housing except for within the flood plain bordering Pihana. The southern corridor of the project area consists of both residential and commercial properties. Many of the homes in Pihana date back to the plantation period; there are three known *kuleana* lots. According to Winifred Cockett, a third generation Pihana resident and *kuleana* lot owner, the remaining two lots are between her property and the *heiau*. The remainder of the Pihana area is largely settled by non-Hawaiians whose ancestors may have once worked for the sugar plantation.

Commercial development is restricted largely to the southern corridor of the project area. (There are a few older businesses such as Takamiya Store, in upper Pihana, just outside the northern corridor of the project area). Eha Street (Fig. 2) which runs parallel to the project area, is a mixture of newly built homes (within last three years), the ʻIao Parkside condominium complex, and several businesses at either end of the project area portion of this roadway. Older homes exist on both the *mauka* (above Millyard) and *makai* (below Waiehu Beach Road) ends of the southern corridor of the project area. The types of businesses vary significantly. At the eastern most end of the project area is Sak & Save Supermarket; at the western most end, is Maui Waste Disposal and several legal, accounting and real estate firms. A levee, which also serves as the maintenance road for Maui County vehicles, separates many of the homes from the stream. It is this levee and maintenance road, along with the streambed, that also serves as a recreational area.

Farming is occurring within the flood plain area in Pihana; it is restricted to the northern corridor of the stream. A total of four farms, all on leasehold land, were identified. These are mostly banana and papaya patches owned by farmers of Filipino descent. A newly established horse stable, operated by one of the Hawaiian homeowners, lies adjacent to a *kuleana* lot. Several families have backyard/kitchen gardens but none of these are near the stream area.

Recreational uses of the project area consist primarily of walking/jogging (on the maintenance road), bicycling and dirt bike/small motorcycle use. There are occasional boogie boarders and swimmers in the stream but they are confined to areas where water level gets high enough to be used for these activities. Of the area residents interviewed, only two used the levee maintenance road for leisure walks; the majority of those who appear to use the area regularly for recreational purposes do not live adjacent to the stream. Fishing within the project area portion of ʻĪʻao Stream does not seem to take place.

This mixture of land use along the project area does not seem to be in conflict with one another in any way. While noise from the dirt bikes and their use of people's backyards has been a problem, most individuals have put up fences and would be pleased to see the area improved for further recreational use.

4.0 Identification of Traditional Cultural Properties and Cultural Impacts

One of the two goals of this project was to identify TCPs and oral traditions associated with ʻĪʻao Valley that meet the criteria established in the National Register; the second was to complete a CIA of the potential effects of the proposed project. While no TCPs were identified in the project area, oral and written history indicates TCPs within the general vicinity of the project area; they also identify historic properties that hold local cultural significance. The following sections present the findings of this study, first addressing TCPs, and second, the CIA.

4.1 Traditional Cultural Properties in the Project Area: Findings

Although no specific features that can be classified as a TCP were located within the project area, the overall traditional significance of Wailuku is to be noted. There has been substantial change to this cultural landscape, yet remnants of its highly significant past remain. The following discussion on TCPs is presented in a question/answer format to simplify the essential findings of this study.

Were any new Traditional Cultural Properties identified within the Project area?

No, not any that can be identified. This question was asked during each field interview, especially with Hawaiian *kūpuna*. At present, no one can identify any TCPs within the immediate vicinity of the project area.

Are there any existing TCPs within the general vicinity of the project area?

Yes, there are *heiau*, fresh water springs, burials, and *loi.* While some have already been labeled as a TCP, the remaining qualify based on significance criteria. These are as follows:

1. Haleki`i-Pihana Heiau State Monument lies above the northeastern corridor of the project area, in the *ahupua`a* of Paukükalo. *Haleki`i* means the "house of images", and *Pihana* means "fullness", is believed to be the only complex remaining of pre-contact Hawaiian structure of religious and historical importance in the Wailuku-Kahului area (Yent 1995:1). Some area residents refer to Pihana as "Pi`ihanakalani", which means ''ascending into heaven" (M.J.K. Kolb and G.M. Murakami 1994:61). The *heiau* (Figure 6), State of Hawaii Site number 50-50-04-592, is under the jurisdiction of the Division of State Parks.

2. A second *heiau* or *ko`a* (fishing shrine) is believed to have been located at Mele-ha`a-ko`a, the Singing Reef. According to Ashdown, whose father had a house, corrals and slaughterhouse near the shrine, it was "along the old road between Wailuku and Kahului by the present Maui Dry Goods building in the area called Kawela" (Ashdown 1970:38). She adds that the shrines and temple were ruined, and "most of the buildings taken out to sea" in the tidal wave of 1946 (ibid). According to D. Sevilla, the remnants of this *heiau* may presently lie on private property near the shoreline.

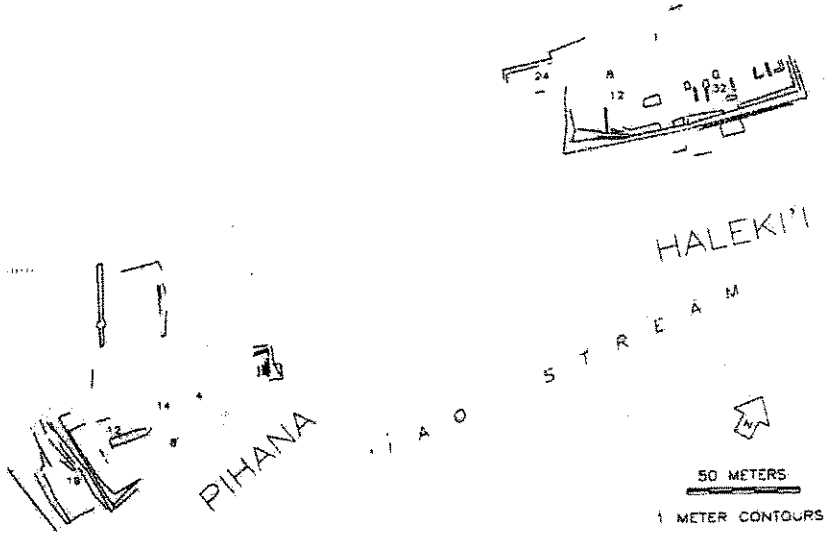

Figure 6. Location of the Halekii-Pihana Complex, along ʻÏ`ao Stream (Source: Kolb and Murakami 1994).

3. A fresh water spring, presently known as Waiola, located on the Sevilla property in Waiehu (Tax Map Key No. 3-3001-054), is believed to be part of an ancient fish pond (Commission on Water Resource Management, 1990). The true name of the spring is no longer known (C. Keau and D. Sevilla, pers. comm.) but some refer to it as Waiola. C. Keau believes the name may have been "Wailuku" (pers. comm..). The spring measures six feet wide and five feet deep. There are three main sections to the spring, most of which are separated by stone walls (Fig. 7). The spring was dry

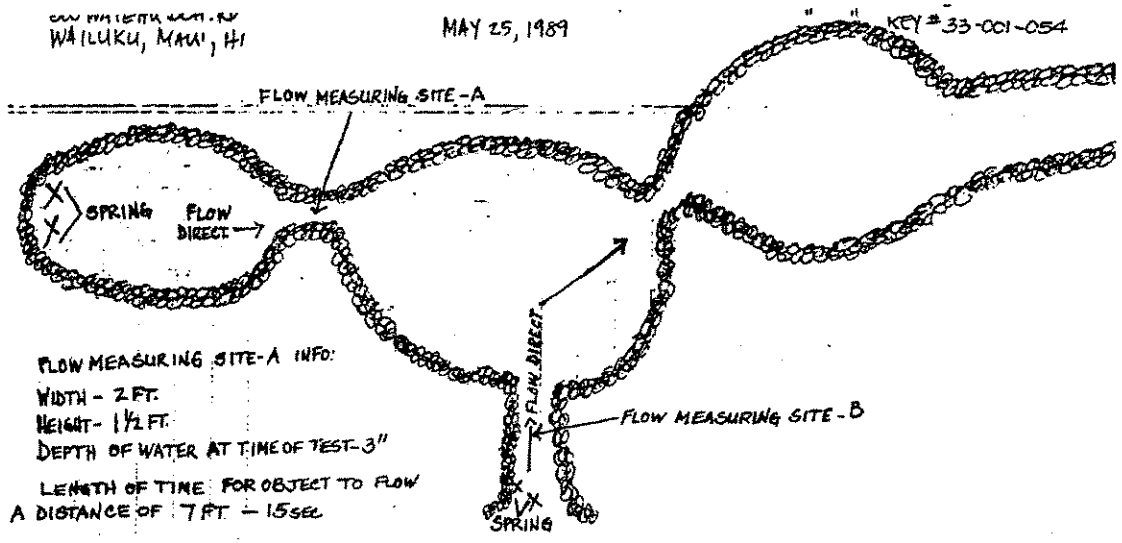

Figure 7. Waiola Spring, Waiehu, Maui (Source: Commission on Water Resource Management, 1990).

during the time this study was being conducted. According to D. Sevilla (pers. comm.), a mullet (fish) pond lay immediately east (*makai*) of Waiola, on the Kekona property. However, "Uncle Kekona filled up the pond once the water started to dry up" (ibid). The absence of water in both Waiola and the mullet pond are believed to have occurred after the diversion was placed in ʻĪʻao Stream.

4. Burials in the *ahupuaʻa* of Waiehu and Wailuku. As briefly discussed in section 3.1, prehistoric and historic burials are known from the vicinity of the project area. Most of these have been identified from the *Puʻu One* sand dunes that lie north of the project area; some are also known from Mahalani Cemetery (the majority of these burials are believed to be from the plantation era). A recent excavation a *kuleana* lot in the north easternmost corner of the flood plain area (down slope from the *heiau* complex), led to the discovery of several burials. According to W. Cockett (pers. comm.), who identified the area in which the burials were located, there will be no further ground disturbance for the sake of the burials.

5. Ancient and historic period *loi* are known to exist upstream of the project area. M. Duarte (pers. comm.) recalls several Hawaiians who used to grow taro nearby the Duarte residence. Many of these individuals had *kuleana* lots and *kuleana* water rights. As observed behind the 'Tropical Gardens of Maui', many of these *kuleana* still have *po`alima* within their boundaries. At present, *loi* are known from several family lots but the majority of taro appears to be grown in the adjacent *ahupua`a* of Waihee and Kahakuloa.

Based on observations and the information gathered fro *kūpuna* and knowledgeable individuals/residents, traditional land uses of the project area have been discontinued. 'Ï`ao Stream, or Wailuku River as once called by some of the older area residents, was known as a source for *o`opu* and *opai*, water for *loi*, and swimming/washing. However, none of these activities are currently taking place. While development along the stream's banks has changed accessibility to 'Ï`ao, earlier diversion measures have also brought about significant changes. The latter will be briefly addressed as known impacts to the project area in this report (c.f. the Environmental Assessment being prepared for the current project for a more detailed, in-depth review of diversion-related impacts).

As with traditional uses of the project area, land uses associated with the historic period also no longer take place. Both fishing and recreational uses (swimming/washing) were known to take place during the early to mid-1900s. Farming along the stream banks (raising hogs and cattle) was known up until shortly after the initial diversion measures. (The Duarte family, who live further upstream of the project area, maintained a hog farm until approximately two months ago). Historic uses of the project area, such as washing cars in the stream near Waiehu Beach Road, also appear to have been fairly common until recently. Rose Duey (pers. comm.) recalls that Waiehu Beach Road was at one time a rock and pebble roadway that crossed through 'Ï`ao Stream. In the event the water was too high, cars had to pull over and wait until their vehicles could safely cross the stream (ibid). Often on such occasions, their father would pull over the car/truck so it could be washed in the stream. Several other individuals recall Waiehu Beach Road before it was cemented; many remember driving across or having to wait for the water level in 'Ï`ao to go down. Kanji Wakamatsu, present owner of the Wakamatsu Fish Store in Wailuku, recalls catching *o`opu* and catfish, and picking *hi`iwai*, between Market Street and Waiehu Beach Road (K. Wakamatsu, pers. comm.). He would sell his catch to the Chinese families that lived in a camp near Paukūkalo. "The fish were large size, and the *hi`iwai* were 'big enough to use as whistles" (ibid).

4.2 Cultural Impacts from the Proposed Flood Control Project

The following section summarizes the major issues or cultural impacts identified through the survey questionnaire and interviews; it is presented in both quantitative and qualitative format. First, the issues and/or impacts are addressed in question/answer format; these were not questions asked directly but are the result of people's perceptions of the proposed project. (Many of the people interviewed were not aware of the flood control project until approached for this survey). Second, results of the questionnaire are presented in table format to show a numerical breakdown of the survey population's responses.

4.2.1 Is flooding of 'Ï`ao Stream a concern (fear) for area residents?

Generally, no. While most area residents have witnessed the 'flash' floods that can occur of 'Ï`ao Stream, they do not feel further channelization is necessary. This was true of both the relatively new short-term residents, and the long-term, older residents who have witnessed at least one or two large floods. K. Wakamatsu, now 84 years old, recalls a young boy being swept away during the flood in the 1940s. The Cocketts remember a storm in the 1950s when pigs were floating in the stream, and the water level reached their doorstep (at their current home in the floodplain). In this undated photo (Figure 8), Ashdown captured the impact of a major flood/storm on a house in the flood plain area, and the cane haul bridge (possibly the same location as the bridge shown in Figure 2). The photograph notes 'cane'and 'part of Iao Mts.', in the upper left corner.

Several present day residents have become familiar with the 'tell-tale' signs of impending floods. John Duey who lives in the upper portion of 'Ï`ao Valley, and Emmett Rodrigues who lives in the lower portion of the valley within the project area, know that when gray clouds and heavy rains occur up in the mountains, it is time to watch for the water to come rushing downstream. Some of these individuals have timed the sequence of events (development of clouds, rainfall) in order to prepare for the heavy flow that passes near their residence.



Figure 8. Aftermath of the 1950 Flood, photo taken by Inez Ashdown (Courtesy of Bailey House Museum).

Unlike the upper portions of the valley where flooding can impact homes along the stream banks, in the project area itself, there does not appear to be great concern about flooding. Previous flood control measures have acted to protect the stream banks from overflowing, but it is also a matter of experience. Residences (and residents) in the upper portion of the valley have likely been there for several generations, whereas most of the residences and businesses along the project area portion of ʻĪʻao Stream have been built within the past three to ten years. The people higher up in the valley have witnessed many more flood related events, whereas, the people in the lower portion have likely been present only since the initial flood control measures were put in place. Many of the present day residents who live off of Eha Street, are new to the area...hence they are not aware of the potential dangers from major floods. Most, however, have witnessed flash floods that periodically occur.

While flooding may not be a major concern, the erosion caused by heavy, rapid moving stream water, is. This is particularly true for the businesses located in the immediate 'erosion path', along Wili Pa Loop (Figure 2). Much of the area adjacent (immediately downstream) to these businesses are somewhat protected by concrete lining along the streambanks. However, there are no protective barriers lining the streambank behind the buildings housing these businesses.

Tables 1 through 6 present the quantitative results of the survey questionnaire. Included in the survey population are individuals with whom interviews were held for the identification of TCPs. A total of thirty two residents/business owners were approached and/or interviewed about the proposed project, including representatives of the four primary businesses within and across Wili Pa Loop (two of which have experienced severe erosion by the present stream flow). And important factor to note is that the majority of the people interviewed/surveyed were not aware of the proposed Flood Control Project. This will be discussed further in the conclusions.

Table 1. Population Surveyed, by Approximate Area of Residence

Participants in the Survey	Total
Men	21
Women	11
Total	32
Place of Residence	
Within immediate vicinity of Project Area	21
Wailuku side	15
Pihana side	06
Wailuku (general)	07
Outside of Wailuku *ahupua`a*	04

Table 2. Quantifiable Responses to Survey Questions[1]

	Yes	No	Unable to comment
Do you live near *Ï`ao* Stream	15	17	
Do you use *Ï`ao* Stream for recreational and/or subsistence purposes?	02	29	
Have you witnessed any changes to the stream over the years (e.g. stream flow, erosion, floods, etc.)?	11	21	
Are you familiar with the proposed flood control project (and or measures)?	05	27	
Are you familiar with any or all of the alignments (alternatives) proposed?	05[1]	27	
Do you have a preference for any one alterative	07[2]	17	8

[1] All of these individuals had either attended or were aware of the Public Scoping Meeting, or had red newspaper announcements about the proposed project.

[2] Includes individuals to whom the diagrams of the proposed alternatives were shown for the first time.

Table 3. Uses of *'Ï`ao* Stream in the Vicinity of the Project Area[1]

1.	Recreational (bicycling, dirt biking, jogging, swimming, boogie boarding)
2.	Farming (presently done only in the flood plain)
3.	Fishing and food gathering (catching/gathering *O`opu, opai,* or *hi`iwai* in the stream beds)

[1] Activities identified as either known about or personally performed, in order of occurrence.

Table 4. Knowledge about Traditional Uses and/or Sites along *'Ï`ao* Stream[1]

	Yes	No
Do you know of any traditional uses of *'Ï`ao* Stream?	07	25
Are you familiar with any traditional sites/features along the stream and/or within the flood plains area?	02	30
Would the proposed flood control affect/impact any of these traditional sites or features	0	

[1] The sites known to most people are *Haleki`i-Pihana Heiau,* the *Pu`u One Sand Dunes,* and the spring located behind the Sevilla property; all of these are outside of the project area.

4.2.2 *Are further flood control measures perceived as being needed?*

While the survey questionnaire did not include this question, based on the responses and inquiries made by the interviewees, the issue of whether or not further flood control measures are necessary became important. This question was formulated based on the lack of response or absence of knowledge about the proposed project. Table 5 summarizes the general response that was received.

Table 5. How would you Characterize the Effect(s) of Further Flood Control Measures for 'Ï`ao Stream?

Necessary (Positive)	09
Not necessary (Negative)	21[1]
No opinion/unable to judge	02

[1] five individuals saw negative effects as a result of the "cumulative" impacts of stream channelization and/or diversion techniques.

An overwhelming number of the people interviewed saw no need for further stream channelization and/or alignment. Part of this judgment appears to be based on past and existing experiences and observations of 'Ï`ao Stream; there is also great support for wanting the stream to be reverted back to its more original form. The latter includes many newcomers to the area, several of whom enjoy

and/or chose to live along the stream. Perhaps not so surprisingly, it also includes a significant number of the *kūpuna* and long term residents.

Table 6. Suggestions/Observations on how the Corps of Engineers can help the Community better Understand the Flood Control Project

		Frequency
1.	Provide further information about the proposed project[1]	16
2.	Hold [another] public meeting where the alternatives can be reviewed	07
3.	Help stop the erosion	11
4.	Identify who will benefit for these measures	04
5.	Restore the stream by placing back the animals that once lived in it	14

[1] seven individuals acknowledged that they were aware of the Public Scoping Meeting but just were not able to or did not attend.

The following is a summary of the potential negative and positive cultural impacts identified:

4.3 Summary and Recommendations: Cultural [impact] Mitigations and Enhancements

Potential Long-term "Direct" Cultural Impacts (Negative) from the Proposed 'Ï`ao Flood Control Project

1. Continued reduction or additional decrease in water flow. Most people would like to see a return of some regular flow of water. Further flood measures are seen as possibly further reducing water flow.
2. Additional concrete/cementing within streambed will add aggravate existing hazards, e.g. further compounding erosion action along stream banks. At present, physical impacts of erosion are greatest along the southeastern portion of the project area. (Many doubt the potential positive impacts from new flood control measures based on these impacts that are likely from previous channelization measures).
3. Further channelization measures will further discourage the return of original stream biota (e.g. *o`opu, opai* and *hi`iwai*). For people who are familiar with the biota of 'Ï`ao Stream, or know of the various animals that are found in fresh water, there is a desire to see these return to the stream. This is part of the greater desire to help return the stream to its earlier, pre-channelization, stage. There are also a few people who would like to enhance the stream by [re]introducing some of these species (some of this has already been done by the Hawaii Division of Aquatic Resources).

Potential Short-term "Indirect" Cultural Impacts (Negative) from the Proposed 'Ï`ao Flood Control Project

1. Inconveniences to area residents as a result of construction activities in the streambed, e.g. re-directing of traffic, dust and noise.
2. Restricted access to the maintenance road and stream for walking, biking and other recreational uses.

No Cultural Impacts (Positive) from the Proposed 'Ï`ao Flood Control Project

1. Threat of potential floods will be further removed.
2. Recreational features can be included as part of the flood control measures, e.g. walkways and safer guidelines for kids whom swim/bike within and along the streambed
3. Aesthetic value of the stream will increase with safer and more pleasant surroundings.
4. Measures can include improvements to existing water flow patterns, thereby allowing some of the original stream fauna to return. (While there isn't a direct desire to fish/gather in the stream, there is a strong desire to have it return to a more natural, biologically thriving system).

No Cultural Impacts to known Traditional Cultural Properties in the Vicinity of the Proposed 'Ï`ao Flood Control Project Area

No immediate/direct changes are foreseen to known Traditional Cultural Properties within the vicinity of the project area as a result of the proposed project. The only TCP that lies immediately along the banks of the 'Ï`ao Stream is the Haleki`i-Pihana Heiau State Monument. This site is situated well above the stream bank. However, if flood control measures lead to severe erosion along the stream bank that lies directly below the monument, the land area on which the *heiau* sits may be compromised. The potential impacts to the heiau should be monitored on a continuous basis. Other features and sites such as Mahalani Cemetery and the *Pu`u One* Sand Dunes are not likely to be affected by future flood control measures.

4.3.1 Recommendations

Based on requests made and observations, the following are recommended:

- Repair cement cracking along existing wall (off `Iao Place). At least two residents pointed to these cracks that lie behind their property. Both have concerns about the further widening of the cracks and the potential for water-flow to be compromised during heavy flows (e.g. flash floods).
- Help contain (repair) the eroding of the streambank along Wili Pa Loop.

- Incorporate recreational features and/or visual enhancement to the stream's levee. This can be done with the community's input and assistance.
- Schedule another meeting prior to implementation of any measures. While this may not dramatically increase the attendance of area residents, it allows individuals a second opportunity to participate in the 'decision-making' process.
- Clarify which agency is responsible for maintaining the stream (clearing of debris, etc.), and general contact information for area residents.

4.3.2 General Concerns/Issues

It would appear that most people who live and work along 'Ï`ao Stream have become familiar with the stream's somewhat 'predictable' nature as it concerns the occasional flash floods. As discussed earlier, a few people have become rather savvy to the expectations resulting from heavy rain pours can lead to.

No one interviewed currently uses the streambed for recreational activities; at least two residents use the access/levee road for leisurely walks but this is on a limited basis. The majority of individuals who seem to use the streambed are either children or from homes located away from the levee road. Some people expressed concerns over who will maintain/upkeep the stream in the event there is debris build-up. There isn't a clear knowledge about who is responsible; the question of whether it's the County, the State or the Corps of Engineers often arose. Most are concerned about erosion and/or feel sympathy with the owners of the land being impacted, several see it as the owner's responsibility for purchasing lands that had the potential to erode. Several have questioned diversion of water by the large companies and the county, and water rights access. There is a fair amount of distrust of the companies requesting water diversions (e.g. Wailuku Sugar Company), and their future intentions (e.g. directing water towards Kihei/Makena side, for further housing development, etc.).

In general, flood control does not seem to be a concern/issue, including for those residents and businesses living along the access/levee road. The concern over erosion is far greater, particularly for the two businesses directly affected. The community appears to be more concerned (or desires) about the social/recreational values of the stream. If control measures are enacted, there would be a greater sense of accomplishment (and cooperation) if it was done in consideration of the community's present needs and desires. This opinion was fairly common, from both the newcomers and the individuals who have experienced flooding, either at 'Ï`ao or elsewhere.

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APPENDIX A

GUIDELINES FOR ASSESSING CULTURAL IMPACTS Adopted by the Environmental Council, State of Hawaii November 19, 1997

I.

INTRODUCTION

It is the policy of the State of Hawaii under Chapter 343, HRS, to alert decision makers, through the environmental assessment process, about significant environmental effects which may result from the implementation of certain actions. An environmental assessment of cultural impacts gathers information about cultural practices and cultural features that may be affected by actions subject to Chapter 343, and promotes responsible decision making. Articles IX and XII of the State Constitution, other state laws, and the courts of the state require government agencies to promote and preserve cultural beliefs, practices, and resources of native Hawaiians and other ethnic groups. Chapter 343 also requires environmental assessment of cultural resources, in determining the significance of a proposed project.

The Environmental Council encourages preparers of environmental assessments and environmental impact statements to analyze the impact of a proposed action on cultural practices and features associated with the project area. The Council provides the following methodology and content protocol as guidance for any assessment of a project that may significantly affect cultural resources.

II.

CULTURAL IMPACT ASSESSMENT METHODOLOGY

Cultural impacts differ from other types of impacts assessed in environmental assessments or environmental impact statements. A cultural impact assessment includes information relating to the practices and beliefs of a particular cultural or ethnic group or groups.

Such information may be obtained through scoping, community meetings, ethnographic interviews and oral histories. Information provided by knowledgeable informants, including traditional cultural practitioners, can be applied to the analysis of cultural impacts in conjunction with information concerning cultural practices and features obtained through consultation and from documentary research.

In scoping the cultural portion of an environmental assessment, the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment. Thus, for example, a proposed action that may not physically alter gathering practices, but may affect access to gathering areas would be included in the assessment. An ahupua'a is usually the appropriate geographical unit to begin an assessment of cultural impacts of a proposed action, particularly if it includes all of the types of cultural practices associated with the project area. In some cases, cultural practices are likely to extend
beyond the ahupua'a and the geographical extent of the study area should take into account those cultural practices.

The historical period studied in a cultural impact assessment should commence with the initial presence in the area of the particular group whose cultural practices and features are being assessed. The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs.

The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural, including submerged cultural resources, which support such cultural practices and beliefs.

The Environmental Council recommends that preparers of assessments analyzing cultural impacts adopt the following protocol:

(1) identify and consult with individuals and organizations with expertise concerning the types of cultural resources, practices and beliefs found within the broad geographical area, e.g., district or ahupua 'a;

(2) identify and consult with individuals and organizations with knowledge of the area potentially affected by the proposed action;

(3) receive information from or conduct ethnographic interviews and oral histories with persons having knowledge of the potentially affected area;

(4) conduct ethnographic, historical, anthropological, sociological, and other culturally related documentary research;

(5) identify and describe the cultural resources, practices and beliefs located within the potentially affected area; and

(6) assess the impact of the proposed action, alternatives to the proposed action, and mitigation measures, on the cultural resources, practices and beliefs identified.

Interviews and oral histories with knowledgeable individuals may be recorded, if consent is given, and field visits by preparers accompanied by informants are encouraged. Persons interviewed should be afforded an opportunity to review the record of the interview, and consent to publish the record should be obtained whenever possible. For example, the precise location of human burials are likely to be withheld from a cultural impact assessment, but it is important that the document identify the impact a project would have on the burials. At times an informant may provide information only on the condition that it remain in confidence. The wishes of the informant should be respected.

Primary source materials reviewed and analyzed may include, as appropriate: Mahele, land court, census and tax records, including testimonies; vital statistics records; family histories and genealogies; previously published or recorded ethnographic interviews and oral histories; community studies, old maps and photographs; and other archival documents, including correspondence, newspaper or almanac articles, and visitor journals. Secondary source materials such as historical, sociological, and anthropological texts, manuscripts, and similar materials, published and unpublished, should also be consulted. Other materials which should be examined include prior land use proposals, decisions, and rulings which pertain to the study area.

III. CULTURAL IMP ACT ASSESSMENT CONTENTS

In addition to the content requirements for environmental assessments and environmental impact statements, which are set out in HAR §§ 11-200-10 and 16 through 18, the portion of the assessment concerning cultural impacts should address, but not necessarily be limited to, the following matters:

1. A discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints or limitations which might have affected the quality of the information obtained.

2. A description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken.

3. Ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained.

4. Biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area.

5. A discussion concerning historical and cultural source materials consulted, the institutions and repositories searched, and the level of effort undertaken. This discussion should include, if appropriate, the particular perspective of the authors, any opposing views, and any other relevant constraints, limitations or biases.

6. A discussion concerning the cultural resources, practices and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site.

7. A discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project.

8. An explanation of confidential information that has been withheld from public disclosure in the assessment.

9. A discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs.

10. An analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place.

11. A bibliography of references, and attached records of interviews which were allowed to be disclosed.

The inclusion of this information will help make environmental assessments and environmental impact statements complete and meet the requirements of Chapter 343, HRS. If you have any questions, please call us at 586-4185.

APPENDIX B

Transcripts of Oral Interviews completed for
TCP and CIA Study of `Iao Flood Control Project

(to be inserted)

APPENDIX C

Questionnaire for Oral History Studies for the Determination of Traditional Cultural Properties and Cultural Impact Assessment for the `Iao Flood Control Project, Maui Island, Hawaii

Name: _____ **Contact #** (optional): _____

Place of Residence: _____

1. Do you live near `Iao Stream? Yes_____ No_____
   Adjacent to levee _____ Nearby _____

2. How much time have your spent around the stream area?_____

3. Do you use `Iao Stream for recreational and/or subsistence purposes?
   If yes, describe activity_____

4. Do you know of any traditional uses of `Iao Stream?_____

   a.. Are you familiar with any of the traditional sites/features along the stream and/or within the flood plains area?
   If yes, list here (provide complete description)
   _____
   _____

5. Have you witnessed any changes to the stream over the years (e.g., stream flow, erosion, floods, etc.)?
   If yes, describe the change_____
   _____

6. Do you feel flood control efforts are necessary for `Iao Stream? Yes_____ No_____
   Have you observed any of the activities:_____

7. Are you familiar with the proposal to repair erosion along the stream? Yes_____ No_____
   If yes, is there one particular proposed alignment you favor others? (List by #)
   Why_____
   Which other alternative alignment would want to see?_____

   a. Will one or any of these alternatives impact your use of the stream?
   If YES, then how?_____

8. Do you think that any of the proposed flood control measures will affect traditional sites/features along the stream?

8. Do you think that any of the proposed flood control measures will affect traditional sites/features along the stream?
   If YES, then
   how?_____

9. In general, how would you characterize the effect(s) of the proposed flood control measures for `Iao Stream?

   a. Positive: _____
   a. Negative:_____
   b. None foreseen:_____
   c. Unable to form opinion:_____

10. Do you have any concerns/issues about the proposed flood control measures?

    _____
    _____

1. Do you have any suggestions/observations of what the Corps of Engineers can do to help the community better understand their proposal(s) for `Iao Stream?

   _____
   _____

2. Is there anything else you would like to add or say?

   _____
   _____

APPENDIX D

List of Individuals Interviewed and/or Contacted for Oral History Studies for the Identification of TCPs in the `Iao Flood Control Project, Maui Island, Hawaii

3. Charles Keau
4. Sam Ka`a`ai
5. Ned Purdy, Division of Forestry
6. Skippy Hau, area resident and employee of Department of Land and Natural Resources
7. John Duey
8. Rose Duey
9. Bob Hobdy, Division of Forestry
10. Ed Lindsey
11. Duke Sevilla, area resident
12. Kaimu Willstein, Office of Hawaiian Affairs
13. Melissa Kykendall, State Historic Preservation Office, Maui
14. Leona Ryder, `Iao Valley School
15. Manual and Margaret Duarte
16. Manual Duarte Jr.
17. Joe Duarte (Manual's nephew)
18. Charlie Duarte
19. Takamiya Family
20. Kamita family
21. Honda family
22. Kanji Wakamatsu (Wakamatsu Fish Market)
23. Gordon Cockett
24. Winifred Cockett
25. Tom Cerizo
26. Alan K. Bernaldo
27. Ken and Beverly Kurokawa
28. Greg Apa
29. Emmett Rodrigues

Appendix D:

Hazardous, Toxic, and Radioactive Waste Assessment

HAZARDOUS, TOXIC AND RADIOACTIVE WASTE (HTRW)
INITIAL ASSESSMENT
FOR
IAO STREAM FLOOD CONTROL PROJECT MODIFICATION
WAILUKU, MAUI, HAWAII
January 13, 1997

1. PURPOSE

An HTRW initial assessment was conducted for the study area as required by U.S. Army Corps of Engineers regulations (ER 1165-2-132) to address the existence of, or potential for, HTRW contamination which could impact, or be impacted by, the proposed improvements to the Iao Stream Flood Control Project.

For the purposes of ER 1165-2-132, HTRW is defined as any material listed as a hazardous substance under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, Public Law 96-510, 42 U.S.C.A. 9601 et seq.), except for dredged material and sediments beneath navigable waters proposed for dredging. Section 6.b of ER 1165-2-132 states as policy that construction of Corps Civil Works projects in HTRW-contaminated areas should be avoided where practicable.

2. STUDY AREA AND PLANNED MODIFICATION

The Iao Stream Flood Control project is located on the western portion of the Island of Maui, in the town of Wailuku. The stream drains an area of approximately 9.4 square miles. The existing flood control project consists of a debris basin located 2.5 miles upstream from the stream mouth, a 3,500-foot long concrete channel downstream from the debris basin, levees along the right bank and floodplain management along 6,950 feet of the left bank and stream realignment for a 1,730-foot reach to the shoreline.

The planned modification consists of extending the concrete channel from the end of the existing channel to the Waiehu Beach Road bridge. The concrete channel would have a bottom width of 40 feet, two horizontal to one vertical side slopes and would be about twelve feet deep.

3. METHODS

This preliminary assessment is based upon a review of existing documents, the results of agency interviews and observations made during site visits on 5 July, 1996 and 10 January, 1997.

3.1 Existing documents

Existing environmental and planning documents for previous development of the Iao Stream Flood Control Project were reviewed for information about known or potential sources of contamination in the study area.

3.2 Interviews

Telephone interviews about HTRW problems, including violations or other actions associated with the study area, were conducted with staff of the agencies listed. below.

Department of Health (DOH), State of Hawaii
- Solid and Hazardous Waste Branch
  - Hazardous Waste Section
  - Office of Solid Waste Management
  - Underground Storage Tank Section
- Hazard Evaluation and Emergency Response Office

Environmental Protection Agency, Honolulu

U.S. Fish and Wildlife Service, Honolulu

3.3 Site visit

A site visit to the study area was conducted on 5 July, 1996 and again on 10 January, 1997 by Corps of Engineers staff to look for indications of potential HTRW. Accessible areas along the proposed modification reach and the existing project reach including the debris basin were visually surveyed for partially buried containers, discolored soil, seeping liquids, films on water, abnormal or dead vegetation or animals, suspect odors, dead-end pipes, abnormal grading, fills, depressions, or other evidence of possible contamination.

4. RESULTS

4.1 Stream reach

The area along Iao Stream has not been designated as a CERCLA action site, nor did the search of the DOH data base indicate any spills or other HTRW activity in the immediate area. Material excavated from the stream channel and its margins will likely be used for fill in other sections of the project. During the site visits there was no

physical evidence to indicate that any of this material contained HTRW. Excess quantities of this material will likely be disposed in the County land fill and it will be subject to testing and evaluation for suitability for such disposal in accordance with the appropriate guidelines and criteria adopted by the U. S. Environmental Protection Agency.

4.2 Contractor's work and storage area

Although the contractor's work and storage area has not yet been designated, several potential areas were surveyed during the 10 January 1997 site visit. There was no evidence to indicate contamination by HTRW in these areas, and the DOH data base did not indicate any HTRW activity in these areas. If an area not previously surveyed is selected for the contractor's work and storage area it will be surveyed for HTRW.

5. CONCLUSION

Since no response actions and no National Priority List sites under CERCLA have been identified for the project area, any material which might be excavated will not be considered HTRW. The material will still be subject to testing and evaluation as appropriate in accordance with federal and State of Hawaii regulations if the material is to be placed in the County landfill.

6. REFERENCES

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CEPOH-PP (415-15k) 21 August 2002

MEMORANDUM FOR COMMANDING GENERAL, PACIFIC OCEAN DIVISION, ATTN: CEPOD-MM, FORT SHAFTER, HI 96858-5440

SUBJECT: Honolulu Engineer District (POH) Project Review Board (PRB) Executive Summary

1. Date of District PRB Meeting: 8 August 2002

2. Report for the Month of: August 2002

3. PRB Participants: See enclosure.

4. The POH PRB considered all PRB projects and discussed upward reportable and command interest projects, with focus on red and amber projects. Highlights of these discussions follow:

a. **Name of Project: FY02 DLA PN003002 Replace Hydrant Fuel System, Hickam AFB, HI (R. Inouye)**

(1) Reason for submitting to POD: For information only and amber.

(2) Discussion: Contract awarded to Nova Group, Inc. on 30 July 2002 in the amount of $25,750,000. Awaiting funding from the Hickam BCE for awarding of the Government Options to remediate the excessed contaminated soils and liquids to be encountered during construction.

(3) Recognition and Management of Issues: None.

b. **Name of Project: FY99 OMAF Clear Veg/Expl Ord DE 2/3, Bellows AFB (R. Inouye)**

(1) Reason for submitting to POD: For information only and green.

(2) Discussion: UXB completed its cleanup required under the consent decree on 6 August 2002. UXB will be completing and submitting its draft final clearance report for review and comments. Briefing for COL Riggle and COL Hoarn scheduled for 12 August 2002 at 1500 hrs.

(3) Recognition and Management of Issues: Resolve issue on clearance requirement. Continue communications with Joe Ryan and complete FOIA action with him.

(a) District Action: None.

(b) Division Action Requested: None.

(c) HQUSACE Action Requested: None.

c. **Name of Project: FY98 OMA Pkg A-57 Repair Sewer Force Main, Fort Shafter, HI (K. Cabalce)**

(1) Reason for submitting to POD: For information only and red.

(2) Discussion: A-E check in the amount of $50K was received as part of the A-E settlement agreement. These funds will be used to pay the cost of the corrective repairs to the broken liner. Negotiations with the contractor is stalemated. DPW was briefed on Friday, 26 July. PDT is developing a course of action to implement the DPW preferred course of action.

(3) Recognition and Management of Issues: None.

d. **Name of Project: Whole Barracks Infantry Brigade FY00 MCA PN 46902 Phase 2A, Schofield Bks, HI (K. Cabalce)**

(1) Reason for submitting to POD: Upward reportable and green.

(2) Discussion: Design for Pump Station No. 2 stand-by power generator is being finalized. Award of stand-by generator construction is scheduled for early October 2002. Design for 1 mgal water tank is being reviewed. Water tank was reprogrammed to FY04, but may be dropped by ACSIM. Coordinating with DOIM to insure that telecom infrastructure meets local standards. DOIM is slow in providing the proper local standards and construction is continuing without the availability of the local standards.

(3) Recognition and Management of Issues: None.

e. **Name of Project: FY02 MCA PN 55038 WBR Aviation Brigade, Phase 6A, Wheeler AAF, HI (C. Tomihara)**

(1) Reason for submitting to POD: Upward reportable and green.

(2) Discussion: Discussion questions generated from the Source Evaluation Board were forwarded to Contractor. SEB scheduled to reconvene on 14 August 2002. Post closing amendment to incorporate review comments from 100% design being processed. Submission date of 23 August 2002 for price proposals will be delayed.

(3) Recognition and Management of Issues: None.

f. **Name of Project: FY02 MCA PN 053761 Consolidated Command and Range Control Building, Pohakuloa Training Area, HI (R. Tamashiro)**

(1) Reason for submitting to POD: For information only and green.

(2) Discussion: This project calls for a command and range control building--10,010 SF facility to include admin offices, conference room, military police station, special rooms and related facilities for range control functions. The project is scheduled for award in FY02 through a design/build process. An A-E completed the preliminary concept (15%) design and Design Branch prepared the design/build RFP. The RFP was advertised on 3 June, and the proposals were submitted on 26 July 2002. All offerors did not submit sufficient data to comply with the minimum technical criteria of the RFP, therefore the price proposals could not be revealed. Clarifications will be requested from each offeror and the award date rescheduled to 20 September 2002 vice 31 August 2002.

(3) Recognition and Management of Issues: None.

g. **Name of Project: FY03 and beyond MCA Transformation Program, 2nd Brigade, U.S. Army HI (L. Kawasaki)**

(1) Reason for submitting to POD: Command interest and green.

(2) Discussion: POH held a kick-off meeting with the Transformation Office on 8 August 2002 to develop a program management plan (PgMP) for the SBCT Program. Meetings will continue on a bi-weekly basis to further develop the PgMP and to resolve issues that cannot be solved by the PDTs. The next meeting will be held with Huntsville District on Wednesday, 21 August 2002. Potential agenda items for the meeting are to set a vision and mission for the program; and to discuss Huntsville District's capabilities and overall role in the Hawaii Transformation projects. POH staff also continues to provide support to USAG-HI Transformation Office in revising and completing DD1391s for projects programmed in FY05 through FY07. Details continue to be coordinated with the proponents, as well as NEPA actions.

(3) Recognition and Management of Issues:

(a) District Action Required: Maintain smooth coordination with the IBCT Transformation cell, POD, and USARPAC.

(b) Division Action Requested: Coordinate with USARPAC and HQUSACE on projects with critical schedules.

(c) HQUSACE Action Requested: Coordinate with ACSIM and Congressional offices on projects with critical schedules.

h. **Name of Project: FY98 MCA PN44839 WBR, Ph 1D1/1D2, Schofield Bks, HI (L. Oh)**

(1) Reason for submitting to POD: Upward reportable and green.

(2) Discussion: Mold has appeared on the sisal wall coverings in the two soldier community buildings and two barracks modules. The mold was tested to determine cause and possible health risks. Results of the test indicated no immediate health threat provided the mold growth is controlled. As for the cause, coupled with Hawaii's high humidity climate, heat from the laundry area, enclosed air conditioning, and the sisal material itself, has created an environment conducive to mold growth.

(3) Recognition and Management of Issues:

(a) District Action Required: PDT will meet within the month to recommend permanent solution to remove and prevent further mold growth.

(b) Division Action Requested: None.

(c) HQUSACE Action Requested: None.

i. **Name of Project: FY04 MCA PN57226 Drum Road Upgrade, Helemano, HI (M. Smith)**

(1) Reason for submitting to POD: Upward reportable and green.

(2) Discussion: Received Code 3 23 May 2002 with a PA of $72.0M. ENG Form 3086 due 1 July 2002. Per USAG-HI Transformation Office, this project to be programmed for incremental funding over two years, $50.0M in FY04, remaining balance of $22.0M in FY05.

(3) Recognition and Management of Issues:

(a) District Action Required: None.

(b) Division Action Requested: None.

(c) HQUSACE Action Requested: None.

j. **Name of Project: FY2002 South Range Land Acquisition, Schofield Bks, HI (C. Adams)**

(1) Reason for submitting to POD: Upward reportable, command interest and green.

(2) Discussion: Received Customer comments on EA SOW on 5 July 2002. Belt Collins submitted Revised Final Documents AA and EA and revised Waiver request on 8 July 2002. Belt Collins will submit Final EBS 4 weeks after receiving ROE to complete site survey. The DD1391 was changed so that the Land Acquisition Project is now 1402 acres. PA revised to $24M. Project is FY04 that is expected to be pulled up to FY03. PPMD requested $307,000 for the Environmental Assessment. POH received MIPR on 6 August 2002 for EA. EC-E has revised the SOW per customer comments and will send SOW to Contracting Division on or before 15 August 2002. Customer has been told that POH does believe land can be acquired before 1 October 2003. OSD waiver is expected to be approved before 1 September 2002.

(3) Recognition and Management of Issues:

(a) District Action Requested: Continue effort to shorten NEPA process time by managing government review periods.

(b) Division Action Requested: None.

(c) HQUSACE Action Requested: None.

k. **Name of Project: FY2002 MCA PN054095 Kahuku Windmill Land Purchase, Schofield Bks, HI (C. Adams)**

(1) Reason for submitting to POD: Upward reportable, command interest and amber.

(2) Discussion: NEPA is missing EBS. The Installation signed EBS and sent to USARPAC on 8 August 2002. Government appraisal was revised to $858K. HQUSACE requires both NEPA documentation and government approved appraisal before issuing real estate directive. Campbell Estate made offer to sell for $990,000 on 12 July 2002. Acquisition date has been extended from 31 July to 30 September 2002.

(3) Recognition and Management of Issues:

(a) District Action Requested: Continue to pursue acquisition. Keep all parties informed.

(b) Division Action Requested: None.

(c) HQUSACE Action Requested: None.

l. **Name of Project: FY2002 MCA PN52148 Land Purchase and Condemn, Schofield Bks, HI (C. Adams)**

(1) Reason for submitting to POD: Upward reportable, command interest and amber.

(2) Discussion: Purchase 1,010,629 acres in PTA. Need NEPA document (EA). NEPA documentation was sent to USARPAC on 8 July 2002. Appraisal was contracted through the Sacramento District. Government appraisal was received for $2.7M. Sacramento found errors in appraisal and asked the contractor to redo the appraisal; revised appraisal is $2.0M. Reprogramming will be required. The acquisition date has been extended from 30 July 2002 to 14 February 2003.

(3) Recognition and Management of Issues:

(a) District Action Requested: Continue to pursue acquisition.

(b) Division Action Requested: None.

(c) HQUSACE Action Requested: None.

m. **Name of Project: FY01 MAI Repair Damage Quarters (Qtrs), Palm Circle, Various Qtrs, Palm Circle, Fort Shafter, HI (T. Luke)**

(1) Reason for submitting to POD: Command interest and green.

(2) Discussion:

Qtrs #5: Task order awarded on 22 March 2001. Start date of 25 October 2002 has been postponed by DPW. No change in status. Awaiting start date.

Qtrs #9: All work complete.

Qtrs #11: Task order awarded on 15 May 2002. Final inspection held 7 August 2002.

Qtrs #3: Task order awarded on 10 June 2002. Final inspection held 7 August 2002.

Qtrs#17: Funds received on 30 May 2002. Site visit for design team scheduled on 26 June 2002. Site visit with the Contractor held on 10 July 2002. Negotiations with contractor on going. Electrical analysis being performed by in-house EE.

(3) Recognition and Management of Issues: None.

n. **Name of Project: FY00 NMD PN BMDO-54206, In-Flight Interceptor Communications System (IFICS) Data Terminal, Kwajalein Island, USAKA. PA = $4.4M (R. Leong)**

(1) Reason for submitting to POD: For information only and green.

(2) Discussion: FM-200 system modification has been negotiated and awarded. New contract BOD is 29 September 2002 (originally 27 August 2002), with some of the FM-200 work to be completed NLT 20 October 2002. The customer has acknowledged that these dates are acceptable, since the IFICS equipment will arrive o/a 28 October 2002 for installation. KRO is coordinating final testing with the follow-on equipment contractor.

(3) Recognition and Management of Issues: Partial BOD of the storage area is being considered to satisfy the customer's needs.

o. **Name of Project: TAMC Program Summary (O. Okada/R. Kurashige)**

(1) Reason for submitting to POD: For information only and green.

(2) Discussion: Program continues toward FY02 year end execution. Projects are running late, but we are making best efforts to execute. Meetings and site visits to be scheduled for week of 12 August 2002 scoping of next year's design projects.

(3) Recognition and Management of Issues: None.

p. **Name of Project: FY06 DMFO Biomedical Research Center, TAMC (O. Okada/R. Kurashige)**

(1) Reason for submitting to POD: For information only and green.

(2) Discussion: There is language in the Senate Rpt. 107-202 - Military Construction Appropriation Bill, 2003 saying "...that not less than $2 million be made available for the design of the facility." However, TAMC anticipates that based on the current project amount, P&D funding of $4.5 million is needed.

(3) Recognition and Management of Issues: None.

q. **Name of Project: FY01 MCA/BUP PN 52265/52266 WBR, Quad F, Phase 4A, Schofield Bks, HI (G. Kuioka)**

(1) Reason for submitting to POD: For information only and green.

(2) Discussion: Conjunctively funded MCA - $43.8M and BUP (OMA) - $21M. Award date: 28 December 2001.

(3) Recognition and Management of Issues: Several issues of concern:

Demolition plans reviewed. Contractor started demolition on 24 July 2002.

Review of 50% design completed 19 July 2002.

Ongoing discussion with ACES (dining facilities authority) regarding two deviations from standard design by occupant. Formal waiver may be needed.

(a) District Action Requested: None.

(b) Division Action Requested: Participation in discussion with ACES and USACE regarding dining facility revisions.

(c) HQUSACE Action Requested: None.

r. **Name of Project: FY00 Miscellaneous Renovations, Building 525, Fort Shafter, HI (G. Kuioka)**

(1) Reason for submitting to POD: Information only and green.

(2) Discussion: The renovation contract was awarded to Aylward on 30 September 2001 for $499K. The Contractor started work 1 March 2002. SHPO has submitted a letter to define their restrictions. Except for minor check list items, restrooms completed. Lanai screens being installed. Safety issues regarding railing for new stairway being discussed. New office windows (fire rated glass) fronting lanai stairwells not yet installed.

(3) Recognition and Management of Issues: None.

s. **Name of Project: Palau Compact Road Project, Republic of Palau (ROP) (D. Kern)**

(1) Reason for submitting to POD: Upward reportable and amber.

(2) Discussion: After a dry spell January-April 2002, rainy weather has returned with the resultant reduction in progress. Contractor-hired aggregate barge ran aground 29 June near West Channel. Resource agencies assessing damage to corals. Request for Equitable Adjustment (REA) received on 30 March. Backup information on the REA has been collected and is now in analysis. Contracting Officer's Final Decision (COFD) due 1 August. Engineer

Research and Development Center (ERDC) conducted an outbrief of proposed Traffic Compacted Reinforced Fill initiative findings at the District on 13 June. POH-Daewoo meeting held 7 August 2002. Daewoo will continue their claim. POH will suspend actions on test fills to validate a TCF method. Daewoo can still independently pursue TCF. Safety: an accident on 25 June (dump truck rear-ending another) resulted in about $2K property damage and only minor injury to one driver. Actual percent complete: 46%.

(3) Recognition and Management of Issues: Several offices (OC, Contracting and Construction Services) are working to determine if REA has merit.

(a) District Action Requested: Action scheduled for completion 1 August 2002. Preliminary report to DOI on findings due 23 July 2002.

(b) Division Action Requested: None.

(c) HQUSACE Action Requested: None.

t. **Name of Project: Kaumalapau Harbor, Lanai, HI (J. Hatashima)**

(1) Reason for submitting to POD: For information only and amber.

(2) Discussion: The current plan of improvements provides for reshaping and rebuilding the existing breakwater to an approximate length of 320 feet with an estimated construction cost of $15,000,000. The Final EA has been completed. The contract documents have been finalized. The conditional Section 401 Water Quality Certification was received 22 July 2002. The Division's comments on the draft decision document are being incorporated. Comments from the State AG's office are being incorporated into the draft PCA. The award of construction contract is April 2003.

(3) Recognition and Management of Issues:

(a) District Action Required: Intensive management on the approvals of PCA and decision document to maintain the current project schedule.

(b) Division Action Requested: None.

(c) HQUSACE Action Requested: None.

u. **Name of Project: Kikiaola SBH, Kauai, HI (S. Ishikawa)**

(1) Reason for submitting to POD: Upward reportable and amber.

x. **Name of Project: Waikiki Beach Erosion Control Study, Honolulu, HI (M. Yoshimoto)**

(1) Reason for submitting to POD: For information only and green.

(2) Discussion: The Waikiki Beach Erosion Control Project was originally authorized for construction by the River and Harbor Act of 1965 (Public Law 89-298). Reevaluation report completed and submitted to POD for review with a recommendation of continued Federal participation in PED phase. If the report is approved by HQUSACE/ASA(CW), PED phase will be initiated in FY03 using funds provided by FY02 Congressional add.

(3) Recognition and Management of Issues:

(a) District Action Requested: Report completion will slip from the projected May 2002 to July 2002.

(b) Division Action Requested: None.

(c) HQUSACE Action Requested: None.

y. **Name of Project: Kahului Deep Draft Harbor, HI (O&M - Maintenance & Repair) (P. Tom)**

(1) Reason for submitting to POD: For information only and green.

(2) Discussion:

(a) Construction Mod #1 awarded on 25 April 2002, in the amount of $133,310 - majority of existing armor stones found to be unsalvageable as originally thought; mod requires the contractor to purchase new armor stones.

(b) Construction Mod #2 awarded on 13 June 2002, in the amount of $205,695 - at no fault of the construction contractor, existing toe stones have become dislodged from the revetment structure; mod requires the contractor to reset toe stones and remove and reset adjacent armor stones. Contractor re-started construction work on 1 July 2002; targeted construction completion date scheduled for 31 July 2002.

(c) Construction Mod #3 to be awarded on or about 12 August 2002, in the amount of $64,173. This work entails the repair of an additional 75 feet of revetment and is similar to the type of repair done in Construction Mod #2.

(d) Contractor's target completion date to complete all repair work, including work on all construction mod items, is scheduled for early September 2002.

(3) Recognition and Management of Issues:

(a) District Action Requested:

(1) Remaining funds received from POA and reprogrammed available POH CW O&M FY02 funds used to fund and execute Construction Mod #2.

(2) Part of the original $160K in funds transferred from POA to POH in June 2002, with assistance from POD, to accelerate POH design work for Manele Harbor Maintenance Dredging Project and the Port Allen Breakwater Repair Project, will be reprogrammed to fund Construction Mod #3. Design work on the Manele project will continue, however, design work on the Port Allen project will be deferred until FY04.

(b) Division Action Requested: POD facilitated transfer of available funds ($250K) from POA to execute Construction Mod #1.

(c) HQUSACE Action Requested: None.

z. **Name of Project: Tanapag Village PCB Contamination, Tanapag Saipan, CNMI (C. Adams)**

(1) Reason for submitting to POD: Upward reportable, command interest and amber.

(2) Discussion: The unit started processing soil on 20 April 2002. Contractor has treated 20,500 tons as of 8 August 2002. Harmon Slappy is on site doing ordnance avoidance while the stockpiles are being screened and crushed. Mod #8 will bring total tonnage to be cleaned to 20,750. Contractor is scheduled to have cleaned 20,750 tons by the end of 12 August 2002. An additional 5,000 tons has been identified requiring an additional $1.41M before the end of the FY. If additional funds are not received before 10 August 2002 contractor will have to go on standby or demobilizes until additional funds are obtained. The Work Plan for groundwater investigation was revised by Wil Chee and resubmitted to EPA on 10 June 2002 for approval.

(3) Recognition and Management of Issues:

(a) District Action Requested: Continue to coordinate processing of the soil.

(b) Division Action Requested: Continue to seek additional funding to complete the project.

(c) HQUSACE Action Requested: Provide funding.

aa. **Name of Project: FY2001 DESC RA Waikakalaua and Kipapa Tank Farms and Pipeline Cleaning, Oahu, HI (F. Nakahara)**

(1) Reason for submitting to POD: For information, command interest and green.

(2) Discussion: Defueling operations continues. Launch and receive sites being investigated. Pigging operations planned for next month.

(3) Recognition and Management of Issues: None.

bb. **Name of Project: FY2002 E-007 Makua Military Reservation EIS, Makua, Oahu, HI (G. Takishita)**

(1) Reason for submitting to POD: For information only and green.

(2) Discussion: POH has been tasked to prepare the EIS for military training activities at Makua Military Reservation, Oahu, Hawaii. The EIS will be conducted IAW the Settlement Agreement and Stipulated Order between Malama Makua and the United States Department of Defense, filed 4 October 2001. Current status: NOI published 20 March 2002, public scoping meetings held on 9 & 13 April 2002 and transcripts posted at public libraries. Phase II contract for the EIS awarded to Tetra Tech. The draft Decision of Proposed Action & Alternatives (DOPAA) review comments are being incorporated into the final DOPAA document. Draft Sampling and Analysis Plans (SAPs) were submitted 8 June for 60-day public comment period. SAP review comments were due and received on 6 August 2002. The review comments are currently being consolidated and analyzed. Current completion date is 6 February 2004.

(3) Recognition and Management of Issues: Burn Plan for UXO Clearance/Archaeological Survey scheduled for September, EA for plan execution in progress. I/O public briefings were held on 16 & 18 July 2002.

(a) District Action Requested: AAR scheduled for 14 November 2003.

(b) Division Action Requested: None.

(c) HQUSACE Action Requested: None.

cc. **Name of Project: DERP/FUDS Waikoloa Maneuver Area, Waikoloa Village and Surrounding Areas, Island of HI (C. Streck)**

(1) Reason for submitting to POD: For information only and green.

(2) Discussion: Construction support for County of Hawaii/Waikoloa Village Association road programmed. HND acquisition plan for clean-up contract completed and submitted to HQ, reviewed, revised, and accepted August 2002. Preliminary construction schedule received from Department of Hawaiian Homelands for project at Lalamilo to be supported through ordnance safety construction support. Notice to be published for ordnance clearance project end of August 2002. Pre-bid site visit scheduled mid-September 2002.

(3) Recognition and Management of Issues:

(a) District Action Requested: None.

(b) Division Action Requested: None.

(c) HQUSACE Action Requested: None.

dd. **Name of Project: SBCT EIS, Various Locations, HI (E. Nagasawa)**

(1) Reason for submitting to POD: For information only and green.

(2) Discussion: All seven scheduled scoping meetings have been held, and last day to submit comments extended to 29 June 2002. To date we have 100 speakers at the scoping meetings, and received 30 letters, 17 email comments, 11 website comments, 1 petition, and 214 form letters. Draft EIS scheduled for public review 19 February 2003; the Final EIS for public review, 15 August 2003; and completion of the EIS/Record of Decision date on 8 October 2003. Completed botanical and cultural surveys for PTA and lower PTA Tank Trail on non-Parker Ranch lands. Botanical surveys complete for Parker Ranch Keamuku land; however, and the cultural surveys are at 60%. Draft Biological Assessment (BA) under review with suspense of 4 September 2002, and the Final BA to be submitted to USFWS in January 2003. Biological Opinion from USFWS expected in May 2003.

(3) Recognition and Management of Issues: None.

5. Specific Issues Submitted for action/information: None.

6. PRB Chairman Comments: None.

Encl

RAY H. JYO, P.E.
Deputy District Engineer for
Programs and Project Management

CEPOH-PP
SUBJECT: POH PRB Executive Summary

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CEPOH-PP
SUBJECT: POH PRB Executive Summary

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Ms. Helene Takemoto, CEPOH-PP-E
Mr. Edward Yamada, CEPOH-EC-E
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Mr. James Pennaz, CEPOH-EC-T
Mr. Stanley Boc, CEPOH-EC-T
Mr. Patrick Tom, CEPOH-EC-T

ROSTER OF ATTENDEES
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8 AUGUST 2002, 0830 HRS, RM 322, CONFERENCE ROOM

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CEPOH-DE

MAJ Scott A. Schriner
CEPOH-DD

Mr. Ray H. Jyo
CEPOH-PP

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*Alternate

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Encl

Appendix E:

Water Quality Baseline Monitoring Program Reports

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 2-96
October 29, 1996

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

November 1, 1996

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is to be conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at five (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on October 29, 1996. Weather and sea conditions consisted of strong northeasterly tradewinds and waves of 3-5 feet breaking in the nearshore zone. As a result of the strong winds and large waves, nearshore waters in the area of sampling were extremely turbid with very limited visibility. Samples were collected during a falling tide at a height of approximately +1.0 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break.

Results of water sampling reveal no distinct patterns. Turbidity and pH were similar at all stations. TSS and pH were slightly higher at Stations 1 and 2 on the south side of the stream mouth, compared to stations 3 and 4 on the north side of the stream. TSS, however, was slightly lower at Stations 1 and 2 compared to Stations 3 and 4.

Appendix A shows cumulative results of all surveys to date at Iao Stream. The previous survey on October 1, 1996 was conducted during conditions with calm winds and substantially smaller surf than on October 29. It can be seen that TSS and turbidity on October 29 were approximately 2 to 4 fold higher than on October 1. It is apparent that the increased turbulence has a direct effect on suspended material in the water column.

The next phase of monitoring will be conducted on November 19, 1996.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: October 29, 1996; 10:30
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	3.20	0.38	8.091
IAO-2	4.00	0.30	8.111
IAO-3	4.07	0.26	8.071
IAO-4	4.87	0.25	8.079

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 3-96
November 26, 1996

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

December 15, 1996

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at five (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on November 26, 1996. Weather and sea conditions consisted of strong northeasterly tradewinds of 10-15 knots, and waves of 1-2 feet breaking in the nearshore zone. As a result of the moderately strong winds and breaking waves, nearshore waters in the area of sampling were extremely turbid with very limited visibility. Samples were collected during a falling tide at a height of approximately +1.0 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break. During the sampling, there was a small discharge of stream water to the ocean from Iao stream. While no rain occurred during the 24-hour period preceding the sampling, torrential rains, flooding and very large surf occurred during a period approximately two weeks prior to the monitoring.

Results of water sampling reveal no distinct patterns. TSS and pH were slightly higher at stations 1 and 2 on the south side of the stream mouth, compared to stations 3 and 4 on the north side of the stream. Turbidity, on the other hand, was slightly higher at stations 3 and 4 on the north side of the stream mouth. TSS was also slightly higher at both inshore stations (1 and 3) compared to the corresponding offshore stations (2 and 4). Turbidity did not reflect the same pattern with a value higher at station 4 compared to station 3.

Appendix A shows cumulative results of all surveys to date at Iao Stream. The initial survey on October 1, 1996 was conducted during conditions with calm winds and substantially smaller surf than on the subsequent samplings on October 29 and November 26, 1996. It can be seen that TSS and turbidity on October 29 and November 26 were approximately 2 to 4 fold higher than on

October 1. It is apparent that the increased turbulence from wave action has a direct effect on suspended material in the water column.

The next phase of monitoring will be conducted on December 24, 1996.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: November 26, 1996; 10:30
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	4.60	0.18	8.208
IAO-2	3.53	0.17	8.214
IAO-3	2.93	0.22	8.186
IAO-4	1.60	0.39	8.179

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 4-96
December 24, 1996

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

January 5, 1997

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at four (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling site water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were

stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on December 24, 1996. Weather conditions consisted of heavy rain that had fallen for several days prior to sampling and continued during the sampling. As a result of the heavy prolonged rain, there was high flow through Iao Stream to the ocean during the sampling. Water flowing into the ocean from the stream was observed to be clear with little visible turbidity or suspended material. Sea conditions consisted of no wind and waves of 2-4 feet breaking in the nearshore zone. Even with the breaking waves, nearshore waters in the area of sampling were relatively clear, especially considering the amount of stream water entering the ocean. Samples were collected during a falling tide at a height of approximately +0.4 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break. During the sampling, there was a major discharge of stream water to the ocean from Iao stream.

Results of water sampling reveal distinctly elevated TSS at Station 2 compared to the other three sites. Other measurements show no distinct pattern with respect to proximity to the shoreline or to location on either side of the stream.

Appendix A shows cumulative results of all surveys to date at Iao Stream. The initial survey on October 1, 1996 was conducted during conditions with calm winds and substantially smaller surf than on the subsequent samplings on October 29 and November 26, 1996. It can be seen that TSS and turbidity on October 29 and November 26 were approximately 2 to 4 fold higher than on October 1. It is apparent that the increased turbulence from wave action has a direct effect on suspended material in the water column. The survey conducted on December 24 occurred during both high surf and high stream flow. It can be seen in Appendix A that turbidity is elevated by approximately an order of magnitude at Stations 1-3 in December compared to the other three sampling periods. The measure of turbidity at Station 2 in December of 16.4 mg/L is also substantially elevated compared to all measurements

in previous surveys.

The next phase of monitoring will be conducted on January 21, 1996.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: December 24, 1996; 10:30
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	2.67	1.80	7.943
IAO-2	16.40	1.35	7.969
IAO-3	3.47	2.20	8.161
IAO-4	5.27	0.51	8.149

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 1-97
January 21, 1997

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

February 5, 1997

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at four (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling site water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on January 21, 1997. Weather conditions consisted of sunny skies with south winds of 8-10 knots. While no rainfall occurred in the 24-hour period preceding sampling, heavy rain had fallen during the previous week, and stopped approximately 48 hours prior to sampling. As a result of the heavy prolonged rain, there was high flow through Iao Stream to the ocean during the sampling. Water flowing into the ocean from the stream was observed to be clear with little visible turbidity or suspended material. Sea conditions were calm with waves of 1-2 feet breaking in the nearshore zone. Even with the breaking waves, nearshore waters in the area of sampling were relatively clear, especially considering the amount of stream water entering the ocean. Samples were collected during a falling tide at a height of approximately +0.4 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break. During the sampling, there was discharge of stream water to the ocean from Iao stream.

Results of water sampling reveal distinctly elevated TSS and turbidity at Station 1 compared to the other three sites. Other measurements show no distinct pattern with respect to proximity to the shoreline or to location on either side of the stream.

Appendix A shows cumulative results of all surveys to date at Iao Stream. The initial survey on October 1, 1996 was conducted during conditions with calm

winds and substantially smaller surf than on the subsequent samplings on October 29 and November 26, 1996. It can be seen that TSS and turbidity on October 29 and November 26 were approximately 2 to 4 fold higher than on October 1. It is apparent that the increased turbulence from wave action has a direct effect on suspended material in the water column. The survey conducted on December 24 occurred during both high surf and high stream flow. It can be seen in Appendix A that turbidity is elevated by approximately an order of magnitude at Stations 1-3 in December compared to the other three sampling periods. The measure of turbidity at Station 2 in December of 16.4 mg/L is also substantially elevated compared to all measurements
in previous surveys. While stream flow also occurred during the January 1997 sampling, it can be seen in Appendix 1 that TSS and turbidity were among the lowest of all samplings. It appears that the prolonged period of rain that may have washed much of the particulate material from the stream bed in the days prior to sampling, and the low surf height may result in relatively low levels of turbidity and suspended material in the nearshore water column.

The next phase of monitoring will be conducted on February 18, 1997.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: January 21, 1997; 10:30
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	2.67	0.26	8.183
IAO-2	0.80	0.14	8.159
IAO-3	0.67	0.15	8.167
IAO-4	0.73	0.14	8.152

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 2-97
February 18, 1997

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

March 21, 1997

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at four (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling site water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on February 18, 1997. Weather conditions consisted of sunny skies with northeast winds of 10-12 knots. Sea conditions were choppy with waves of approximately 1-2 feet breaking in the nearshore zone. No rain occurred during the sampling nor for the 24-hr. period preceding the sampling. No water was flowing from the stream. Samples were collected during a rising tide at a height of approximately +0.8 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break.

Results of water sampling reveal distinctly elevated TSS and turbidity at Stations 1 and compared to Stations 3 and 4. Turbidity was elevated at Station 1 compared to the other three sites. pH showed no distinct pattern with respect to proximity to the shoreline or to location on either side of the stream.

Appendix A shows cumulative results of all surveys to date at Iao Stream. The initial survey on October 1, 1996 was conducted during conditions with calm winds and substantially smaller surf than on the subsequent samplings on October 29 and November 26, 1996. It can be seen that TSS and turbidity on October 29 and November 26 were approximately 2 to 4 fold higher than on October 1. It is apparent that the increased turbulence from wave action has a direct effect on suspended material in the water column. The survey conducted on December 24 occurred during both high surf and high stream flow. It can be seen in Appendix A that turbidity is elevated by approximately an order of magnitude at Stations 1-3 in December compared to the other three sampling periods. The

measure of turbidity at Station 2 in December of 16.4 mg/L is also substantially elevated compared to all measurements in previous surveys. While stream flow also occurred during the January 1997 samplings, it can be seen in Appendix 1 that TSS and turbidity were among the lowest of all samplings on these dates. It appears that the prolonged period of rain that may have washed much of the particulate material from the stream bed in the days prior to sampling, and the low surf height may result in relatively low levels of turbidity and suspended material in the nearshore water column. With no stream flow during the February 1997 sampling, and small wave height, there were characteristically low values of suspended material in the water column.

The next phase of monitoring will be conducted on March 18, 1997.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: February 18, 1997; 10:00
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	1.93	0.23	8.199
IAO-2	1.33	0.16	8.223
IAO-3	0.73	0.16	8.238
IAO-4	0.67	0.15	8.193

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 3-97
March 18, 1997

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

March 31, 1997

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at four (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling site water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on March 18, 1997. Weather conditions consisted of sunny skies with north winds of 10-12 knots. Sea conditions were choppy with waves of approximately 2-3 feet breaking in the nearshore zone. A storm front passed through Maui during the two days prior to sampling with rainfall accumulations of about 1.4". As a result, Iao stream was flowing during the sampling. Stream water appeared clear with little suspended particulate material, while nearshore ocean water appeared turbid. Samples were collected during a rising tide at a height of approximately +1.0 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break.

Results of water sampling reveal somewhat higher TSS, turbidity and pH at Stations 1 and 2 compared to corresponding Stations 3 and 4. Appendix A shows cumulative results of all surveys to date at Iao Stream. The initial survey on October 1, 1996 was conducted during conditions with calm winds and substantially smaller surf than on the subsequent samplings on October 29 and November 26, 1996. It can be seen that TSS and turbidity on October 29 and November 26 were approximately 2 to 4 fold higher than on October 1. It is apparent that the increased turbulence from wave action has a direct effect on suspended material in the water column. The survey conducted on December 24 occurred during both high surf and high stream flow. It can be seen in Appendix A that turbidity is elevated by approximately an order of magnitude at Stations 1-3 in December compared to the other three sampling periods. The measure of

turbidity at Station 2 in December of 16.4 mg/L is also substantially elevated compared to all measurements in previous surveys.

While stream flow also occurred during the January 1997 samplings, it can be seen in Appendix 1 that TSS and turbidity were among the lowest of all samplings on these dates. It appears that the prolonged period of rain that may have washed much of the particulate material from the stream bed in the days prior to sampling, and the low surf height may result in relatively low levels of turbidity and suspended material in the nearshore water column. With no stream flow during the February 1997 sampling, and small wave height, there were characteristically low values of suspended material in the water column. Recent rain and stream flow during the March survey resulted again in elevated TSS and turbidity compared to periods of no stream flow.

The next phase of monitoring will be conducted on April 15, 1997.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: March 18, 1997; 10:00
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	5.33	0.39	8.166
IAO-2	4.67	0.28	8.115
IAO-3	4.93	0.32	8.155
IAO-4	3.87	0.22	8.111

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 4-97
April 15, 1997

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

May 11, 1997

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at four (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling site water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on April 15, 1997. Weather conditions consisted of sunny skies with northeast winds of 5-10 knots. Sea conditions were choppy with waves of approximately 2-3 feet breaking in the nearshore zone. No rainfall had occurred in the 48 hours preceding the sampling, and no stream flow was entering the ocean at the time of monitoring. Samples were collected during a rising tide at a height of approximately +0.8 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break.

Results of water sampling reveal somewhat higher TSS and turbidity at Stations 1 and 4 compared to Stations 2 and 3. Appendix A shows cumulative results of all surveys to date at Iao Stream. It can be seen that the values of TSS and turbidity for the April 1997 survey are among the lowest of any survey. The initial survey on October 1, 1996 was conducted during conditions that were similar to the April survey; calm winds and small surf. During samplings on October 29 and November 26, 1996 wind and surf were substantially greater. It can be seen that TSS and turbidity on October 29 and November 26 were approximately 2 to 4 fold higher than on October 1 and April 15. It is apparent that the increased turbulence from wave action has a direct effect on suspended material in the water column. The survey conducted on December 24 occurred during both high surf and high stream flow. It can be seen in Appendix A that turbidity is elevated by approximately an order of magnitude at Stations 1-3 in December compared to the other three sampling periods. The measure of turbidity at Station 2 in

December of 16.4 mg/L is also substantially elevated compared to all measurements in previous surveys.

While stream flow also occurred during the January 1997 samplings, it can be seen in Appendix 1 that TSS and turbidity were among the lowest of all samplings on these dates. It appears that the prolonged period of rain that may have washed much of the particulate material from the stream bed in the days prior to sampling, and the low surf height may result in relatively low levels of turbidity and suspended material in the nearshore water column.

The next phase of monitoring will be conducted on May 13, 1997.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: April 15, 1997; 10:00
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	1.33	0.15	8.138
IAO-2	0.73	0.12	8.148
IAO-3	0.67	0.11	8.155
IAO-4	1.93	0.17	8.128

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 5-97
May 15, 1997

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

May 30, 1997

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at four (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling site water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on May 15, 1997. Weather conditions consisted of partly cloudy skies with northeast winds of 5-10 knots. Sea conditions consisted of a slight wind chop with waves of approximately 2-3 feet breaking in the nearshore zone. No rainfall had occurred in the coastal area during the 48 hours preceding the sampling. However, there was stream flow entering the ocean at the time of monitoring, presumably from rainfall at higher elevations. Samples were collected during a rising tide at a height of approximately +0.6 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break.

Results of water sampling reveal somewhat higher TSS and turbidity at Stations 1 and 3 compared to Stations 2 and 4. Appendix A shows cumulative results of all surveys to date at Iao Stream. It can be seen that the values of TSS and turbidity for the May 1997 survey ranged from the lowest values of any survey (0.73 mg/L at station 2) near the highest (3.87 mg/L at Station 1). Observation of the water draining from the stream flowed through the area of Station 1. It is apparent that the increased turbulence from wave action and stream flow has a direct effect on suspended material in the water column at Station 1 compared to the more offshore site at Station 2.

While stream flow also occurred during the January 1997 samplings, it can be seen in Appendix 1 that TSS and turbidity were among the lowest of all samplings on these dates. It appears that the prolonged period of rain that may have washed much of the particulate material from the stream bed in the days prior to sampling, and the low surf height may result in relatively low levels of turbidity and suspended material in the nearshore water column.

The next phase of monitoring will be conducted on June 10, 1997.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: May 15, 1997; 10:00
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	3.87	0.25	8.202
IAO-2	0.73	0.11	8.143
IAO-3	2.00	0.18	8.150
IAO-4	1.87	0.17	8.126

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 6-97
June 10, 1997

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

June 30, 1997

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at four (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling site water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on June 10, 1997. Weather conditions consisted of sunny skies with northeast winds of 15-20 knots. Sea conditions consisted of a moderate wind chop with waves of approximately 2-3 feet breaking in the nearshore zone. Rainfall had occurred in upland elevations but not in the coastal area during the 48 hours preceding the sampling. As a result of the upland rainfall there was stream flow entering the ocean at the time of monitoring. Samples were collected during a slightly falling tide at a height of approximately +0.5 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break.

Results of water sampling reveal somewhat higher TSS and turbidity at Stations 1 and 3 compared to Stations 2 and 4 (Table 1). Appendix A shows cumulative results of all surveys to date at Iao Stream. It can be seen that the values of TSS and turbidity for the June 1997 survey were very consistent for entire data set. Turbidity ranged from 0.19 to 0.24 n.t.u., while TSS ranged from 2.07 to 3.00 mg/L. In past surveys, there was often considerable differences between TSS and turbidity in the inshore stations compared to the offshore stations. Increased turbulence from wave action and stream flow often has a direct effect on suspended material in the water column at Stations 1 and 3 compared to the more offshore sites at Stations 2 and 4. Such was not the case in the present survey.

While stream flow also occurred during the January 1997 samplings, it can be seen in Appendix 1 that TSS and turbidity were among the lowest of all samplings on these dates. It appears that the prolonged period of rain during January 1997 may have washed much of the particulate material from the stream bed in the days prior to sampling, and the low surf height may result in relatively low levels

of turbidity and suspended material in the nearshore water column. During the present sampling, rainfall preceding the sampling was substantially lower than in January, while values of TSS and turbidity were higher.

The next phase of monitoring will be conducted on July 8, 1997.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: June 10, 1997; 10:00
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	3.00	0.24	8.334
IAO-2	2.33	0.20	8.171
IAO-3	2.67	0.23	8.200
IAO-4	2.07	0.19	8.174

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 7-97
July 8, 1997

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

August 12, 1997

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at four (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling site water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on July 8, 1997. Weather conditions consisted of sunny skies with northeast winds of 8-10 knots. Sea conditions consisted of a moderate wind chop with waves of approximately 1-2 feet breaking in the nearshore zone. Rainfall had occurred in upland elevations and at the coastal area during the 48 hours preceding the sampling (0.03" recorded). As a result of the rainfall there was stream flow entering the ocean at the time of monitoring. Samples were collected during a slightly falling tide at a height of approximately +0.5 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break.

Results of water sampling reveal somewhat higher TSS at Stations 1 and 2 compared to Stations 3 and 4, and higher turbidity at Stations 1 and 3 compared to Stations 2 and 4 (Table 1). Thus, TSS was elevated at the Stations located to the south of the stream mouth, while turbidity was elevated at the inshore stations compared to the offshore stations.

Appendix A shows cumulative results of all surveys to date at Iao Stream. It can be seen that the values of TSS and turbidity for the July 1997 survey were among the highest for entire data set. Stream flow occurring during the sampling appears to be the cause of the elevated TSS and turbidity. While stream flow also occurred during the January 1997 samplings, it can be seen in Appendix 1 that TSS and turbidity were among the lowest of all samplings on these dates. It appears that the prolonged period of rain during January 1997 may have washed much of the particulate material from the stream bed in the days prior to sampling, and the low surf height may result in relatively low levels of turbidity and suspended material in the nearshore water column. During the present sampling, rainfall

preceding the sampling was substantially lower than in January, while values of TSS and turbidity were higher.

The next phase of monitoring will be conducted on August 5, 1997.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: July 8, 1997; 10:00
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	6.53	0.60	8.317
IAO-2	4.87	0.27	8.227
IAO-3	2.67	0.43	8.305
IAO-4	4.07	0.20	8.178

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 8-97
August 5, 1997

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

August 15, 1997

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at four (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling site water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on August 5, 1997. Weather conditions consisted of sunny skies with northeast winds of 10-15 knots. Sea conditions consisted of a moderate wind chop with waves of approximately 1-2 feet breaking in the nearshore zone. No rainfall had occurred in upland elevations or at the coastal area during the 48 hours preceding the sampling (0.03". As a result there was no stream flow entering the ocean at the time of monitoring. Samples were collected during a slightly falling tide at a height of approximately +0.6 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break.

Results of water sampling reveal slightly higher TSS and turbidity at Station 3 compared to Stations 1, 2 and 4. Thus, TSS and turbidity was elevated at the inshore station to the north of the stream mouth, but not at the inshore stations to the south of the stream mouth. pH was essentially the same at all sampling locations.

Appendix A shows cumulative results of all surveys to date at Iao Stream. It can be seen that the values of TSS and turbidity for the August 1997 survey were typical of other dry months when stream flow was not entering the ocean. During periods when stream flow was entering the ocean, such as in July 1997, values of turbidity and TSS were among the highest in the cumulative data set. However, while stream flow also occurred during the January 1997 samplings, it can be seen in Appendix 1 that TSS and turbidity were among the lowest of all samplings on these dates. It appears that the prolonged period of rain during January 1997 may have washed much of the particulate material from the stream bed in the

days prior to sampling, and the low surf height may result in relatively low levels of turbidity and suspended material in the nearshore water column.
The next phase of monitoring will be conducted on September 2, 1997.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: August 5, 1997; 10:00
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	2.07	0.18	8.204
2	2.47	0.19	8.182
3	3.00	0.29	8.207
4	2.33	0.21	8.180

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 9-97
September 2, 1997

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

September 30, 1997

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at four (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling site water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on September 2, 1997. Weather conditions consisted of sunny skies with northwest winds of approximately 5 knots. Sea conditions were calm with waves of approximately 1 foot breaking in the nearshore zone. No rainfall had occurred in upland elevations or at the coastal area during the 48 hours preceding the sampling. As a result there was no stream flow entering the ocean at the time of monitoring. Samples were collected during a slightly falling tide at a height of approximately +0.6 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break.

Results of water sampling reveal slightly higher TSS and turbidity at Stations 2 and 4 compared to Stations 1 and 2. Thus, TSS and turbidity was elevated at the offshore stations to both the north and south of the stream mouth compared to the inshore stations. pH was also slightly lower at Stations 2 and 4 compared to Stations 1 and 3.

Appendix A shows cumulative results of all surveys to date at Iao Stream. It can be seen that the values of TSS and turbidity were often elevated in the inshore stations relative to the offshore stations, presumably as a result of resuspension of particulate material in the nearshore zone of wave impact. This pattern is reversed in the September 2, 1997 survey when TSS and turbidity were elevated in the offshore station relative to the inshore stations. The reversed pattern may be a result of the small surf breaking during the survey which resulted in comparatively little resuspension of particulates.

The September 2, 1997 was conducted during a period of no stream flow. During periods when stream flow was entering the ocean, such as in July 1997, values of

turbidity and TSS were among the highest in the cumulative data set. However, while stream flow also occurred during the January 1997 samplings, it can be seen in Appendix 1 that TSS and turbidity were among the lowest of all samplings on these dates. It appears that the prolonged period of rain during January 1997 may have washed much of the particulate material from the stream bed in the days prior to sampling, and the low surf height may result in relatively low levels of turbidity and suspended material in the nearshore water column.

The next, and last, phase of monitoring will be conducted on September 30, 1997.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth of Iao Stream, M
Collection Date: September 2, 1997; 10:00
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	2.67	0.19	8.149
2	3.93	0.25	8.066
3	2.00	0.16	8.141
4	3.45	0.23	8.086

WATER QUALITY BASELINE MONITORING PROGRAM

IAO STREAM FLOOD CONTROL PROJECT

WAILUKU, MAUI, HAWAII

REPORT 10-97
September 30, 1997

Prepared for

U.S. ARMY ENGINEER DISTRICT, HONOLULU
Bldg. 230
Fort Shafter, HI 96858-5440

by

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

October 10, 1997

PURPOSE and METHODS

The purpose of the program is to conduct water sampling and analyses at specified sampling stations as part of the pre-construction planning for modification to the Iao Stream flood Control Project, on Maui, Hawaii. The water sampling and analyses is conducted at four stations located in the nearshore ocean off of the mouth of Iao Stream. The goal of the sampling program is to obtain a representative group of samples that will define the dimensions of the envelope of natural variability in oceanic water quality constituents that may be affected by future construction of the flood control features in upper Iao Stream. The establishment of this baseline data set is a necessary prerequisite for determining if, and to what extent, construction of the flood control features is altering ocean water quality beyond the level of natural variability.

As specified by the Corps of Engineers, the baseline water quality monitoring is comprised of sampling at four (4) stations; Stations 1 and 3 are located approximately 25 m (80 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively. Stations 2 and 4 are located approximately 75 m (240 feet) from the shoreline off the southern and northern sides of the mouth of Iao Stream, respectively (see Figure 1).

In order to obtain a representative sampling that has equal chance of encountering all conditions of tide and weather, each sampling is conducted at a set time. The time selected is every fourth Tuesday at 10:30. The initial sampling was conducted at this time on October 1, 1996.

The area off of Iao Stream is composed of a shallow, boulder covered bottom with a gradual slope. During many conditions of sea and swell, breaking surf occurs along the shoreline in the region of sampling. As a result, use of a boat to collect samples is prohibitive. Sampling, therefore, is conducted by divers swimming from shore and opening bottles at the desired locations. Sampling locations are determined by triangulation with shoreline landmarks. Latitude and longitude at each of the sampling points were determined with a hand-held global positioning system (GPS) during the initial sampling (see Figure 1).

At each sampling site water was collected in 1-liter pre-washed sampling bottles in the approximate center of the water column. pH was measured in the field immediately following sample collection using a field meter. Sample splits were stored on ice and returned to Honolulu for other analyses. Turbidity was measured on a 90 degree nephelometer with a precision of 0.01 nephelometric turbidity units (n.t.u). Total suspended solids (TSS) was determined gravimetrically. All laboratory analyses are conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

RESULTS and DISCUSSION

Table 1 shows results of the water quality constituents collected on September 30, 1997. Weather conditions consisted of sunny skies with northwest winds of approximately 10-12 knots. Sea conditions were slightly choppy with waves of approximately 1 foot breaking in the nearshore zone. No rainfall had occurred in upland elevations or at the coastal area during the 48 hours preceding the sampling. As a result there was no stream flow entering the ocean at the time of monitoring. Samples were collected during a rising tide at a height of approximately +1.0 feet. Samples 1 and 3 were collected in the region where waves were breaking; samples 2 and 4 were collected seaward of the break.

Results of water sampling reveal slightly higher TSS and turbidity at Stations 2 and 4 compared to Stations 1 and 2. Thus, TSS and turbidity was elevated at the offshore stations to both the north and south of the stream mouth compared to the inshore stations. pH was also slightly lower at Stations 2 and 4 compared to Stations 1 and 3.

Appendix A shows cumulative results of all surveys to date at Iao Stream. It can be seen that the values of TSS and turbidity were often elevated in the inshore stations relative to the offshore stations, presumably as a result of resuspension of particulate material in the nearshore zone of wave impact. This pattern is reversed in the September 2 and September 30, 1997 surveys when TSS and turbidity were elevated in the offshore station relative to the inshore stations. The reversed pattern may be a result of the small surf breaking during the survey which resulted in comparatively little resuspension of particulates.

The September 30, 1997 was conducted during a period of no stream flow. During periods when stream flow was entering the ocean, such as in July 1997,

values of turbidity and TSS were among the highest in the cumulative data set. However, while stream flow also occurred during the January 1997 samplings, it can be seen in Appendix 1 that TSS and turbidity were among the lowest of all samplings on these dates. It appears that the prolonged period of rain during January 1997 may have washed much of the particulate material from the stream bed in the days prior to sampling, and the low surf height may result in relatively low levels of turbidity and suspended material in the nearshore water column.

Table 2 shows the results of all fourteen surveys by station, along with maximum, minimums, geometric means and standard deviations of each constituent.

Steven Dollar, Ph.D.
Principal Investigator

TABLE 1. Water quality measurements off of the mouth
Collection Date: September 30, 1997; 10:00
For station locations see Figure 1.

Sample ID	TSS (mg/l)	Turb (ntu)	pH (rel)
IAO-1	1.93	0.12	8.191
2	2.20	0.14	8.182
3	1.87	0.12	8.211
4	2.73	0.18	8.111

Appendix F:

Coastal Zone Management Act Chapter 205 A, HRS Evaluation Report

HAWAIʻI COASTAL ZONE MANAGEMENT PROGRAM

Hawaiʻi Coastal Zone Management (CZM) Program, Chapter 205A, HRS, was publicized in response to the Federal Coastal Zone Management Act of 1972. The CZM area consists of the entire state of Hawaiʻi, including all marine waters seaward to the extent of the state's police power and management authority. The objective of the act is to protect, preserve, and restore scenic, historic, and recreational resources as well as implementing the state's ocean resources management plan and protecting coastal ecosystems. The act involves a system of permits to manage development within the coastal areas and encourages public participation.

The objective and policies of the CZM in relation to the proposed action alternatives are listed below. Possible short-term and long-term impacts of the project are examined in the following analysis.

Recreational resources
Objective: Provide coastal recreational opportunities accessible to the public.

Federal regulation 36 CFR 327, supplemented by Army regulation ER 1130-2-504, contains guidelines for rules and regulations regarding USACE public use of water resource development projects. The policy of the Army is to "…manage the natural, cultural and developed resources of each project in the public interest, providing the public with safe and healthful recreational opportunities while protecting and enhancing these resources."

1) Improve coordination and funding of coastal recreational planning and management; and

The objective of the proposed project is flood control. Planning and funding of coastal recreational opportunities are subject to regulations stated above, and management of coastal recreational areas is not within the scope of the proposed project.

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

There are no coastal recreational areas within the project area, or in the immediate vicinity of the project area.

b) 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;

Alternatives do not involve adverse impacts to existing recreational resources.

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

Short term land use impacts may be generated from construction activities which may limit access to and from public and/or recreational areas for use by the community. USACE will

require its contractor to work closely with local police and fire authorities and provide early planning for alternate routes, as well as traffic control plan.

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

The objective of the proposed project is flood control, and supplying shoreline parks and other recreational facilities is not within the scope of this project.

The project will not decrease the number of recreational facilities currently available in the project area. Providing additional coastal recreational opportunities is subject to funding as well as state and local requirements.

e) Ensuring public recreational uses 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;

Ensuring consistency between recreational value and public safety/conservation is not within the scope of this project.

f) Adopting water quality standards and regulating point and non-point sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;

All available action alternatives involve short-term construction related impacts, and would involve a discharge into waters of the United States. The preparation of a Section 404(b) (1) evaluation by the USACE, and a Section 401 State Water Quality Certification (WQC), as well as a National Pollutant Discharge Elimination System (NPDES) permit from the State of Hawai‘i Department of Health (DOH) will keep possible pollution to accepted levels. In addition, soil management measures in accordance with County standards will be implemented to further monitor runoff discharges during construction into nearby shores. Adherence to Federal, state, and local regulations, as well as monitoring of proposed construction activities via jurisdictional permits, will allow negligible amounts of suspended sediment to enter the ocean as a result of construction activities. The required permits for the proposed project are discussed in detail in Section 9.0 of the Environmental Assessment.

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

The objective of the proposed project is flood control, and supplying additional shoreline parks and other recreational facilities is not within the scope of this project. Providing additional coastal recreational opportunities are subject to funding as well as state and local requirements.

h) 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 objective of the proposed project is flood control, and supplying additional shoreline parks and other recreational facilities is not within the scope of this project. Providing additional coastal recreational opportunities are subject to funding as well as state and local requirements.

Historic resources

Objective: 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.

1) Identify and analyze significant archaeological resources;

Undisturbed areas within the vicinity of ʻĪao Stream are predicted to still contain intact prehistoric and historic cultural deposits that have survived modern agricultural use. It is expected that such remains and deposits would still be extant in undisturbed areas.

One resource of cultural significance was identified in the near vicinity of the project site. The Haleki`i-Pihana *Heiau* State Monument lies on the northwest flank of the ʻĪao Stream, along the lower portion of the project area. The location of this *heiau* has been identified as a potentially high erosion area, and inadequate flood control measures may compromise the land on which the *heiau* is situated. Alternatives I and III are preferred over Alternative V in order to protect the *heiau* from flood and erosion damage.

2) Maximize information retention through preservation of remains and artifacts or salvage operations; and

Alternatives I, III and V will be designed to avoid identified archeological sites, and will include a suitable buffer zone during excavation and other earthmoving activities as well as monitoring by a qualified archaeologist during construction activities in the vicinity of the ʻImi Kālā Street bridge. If avoidance of designated archaeological sites cannot be avoided, a data recovery plan will be composed and implemented by a qualified archeologist.

3) Support state goals for protection, restoration, interpretation, and display of historic resources.

Alternatives I, III and V will be designed to avoid identified archeological sites, and will include a suitable buffer zone during excavation and other earthmoving activities as well as monitoring by a qualified archaeologist during construction activities in the vicinity of the ʻImi Kālā Street bridge. If avoidance of designated archaeological sites cannot be avoided, a data recovery plan will be composed and implemented by a qualified archeologist, and archeological technicians will be assigned to assist in monitoring and the facilitation of any earthmoving activities.

Scenic and open space resources

Objective: Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.

1) Identify valued scenic resources in the coastal zone management area;

The ʻĪao Stream is situated in the ʻĪao Valley, a 6.2 acre park seeped in Hawaiian history and beauty. The valley is a steep, eroded caldera of the West Maui Mountains occupied by lush green vegetation. With the exception of the existing concrete lined channels and water diversions that occupy 30 percent of the stream, it remains mostly undeveloped. The ʻĪao Stream remains a natural beauty and tourist attraction of Maui.

2) 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;

Short term visual impacts will be generated by construction activities. Temporary construction fences may be installed to minimize visibility to the public.

Long term visual impacts differ depending on the alternative chosen. As all proposed action alternatives involve some degree of re-alignment and channelization, existing visual elements of the natural environment will be impacted. Alternative III is the recommended action as this design involves the least amount of alternation to the natural environment and will have a positive impact on existing public views.

3) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and

Alternative V would effectively remove all man-made flood control improvements since 1981. With time, the stream would be restored to a completely natural condition which may or may not become more aesthetically pleasing than its current state. This alternative, however, does not provide protection from flooding or erosion, which would further degrade the quality of the stream and surrounding environment. Alternative III is the recommended action as this design involves the least amount of alternation to the natural environment and will have a minimal impact on public views. The improvement and restoration of shoreline open space and scenic resources is not within the scope of this project.

4) Encourage those developments that are not coastal dependent to locate in inland areas.

This is not applicable to the proposed project.

Coastal ecosystems

Objective: Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

The Endangered Species Act of 1973 (50 CFR 402), Section 7, requires Federal agencies to consult with other agencies to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species.

Executive Order (EO) 13089 on Coastal Reef Protection directs Federal agencies to protect and manage U.S. coral reef ecosystems by identifying actions that may affect these ecosystems and to protect and enhance them to the extent permissible by law.

The Fish and Wildlife Coordination Act of 1946 states that projects by any agency under Federal permit or license that involves the "waters of any stream or other body of water (which) are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" must consult with the Fish and Wildlife Service and the fish and wildlife agencies of the States where the project is to take place.

USACE, ER 1130-2-540 states that consultation and environmental maintenance is to be undertaken for the purpose of preventing loss and/or damage to wildlife/environmental resources.

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

The above listed Federal and Army regulations are guidelines utilized in the development of this project which provide conservation ethic and stewardship in protection of valuable coastal ecosystems.

2) Improve the technical basis for natural resource management;

The objective of the proposed project is flood control, and improving technical basis for natural resource management is not within the scope of this project.

3) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

EO 13089 on Coastal Reef Protection directs Federal agencies to protect and manage U.S. coral reef ecosystems, by identifying actions that may affect these ecosystems and to protect and enhance them to the extent permissible by law.

All available action alternatives involve short-term construction related impacts, and would involve a discharge into the ocean which may affect existing coastal ecosystems. The preparation of a Section 404(b) (1) evaluation by the USACE, and a Section 401 State Water Quality Certification (WQC), as well as a National Pollutant Discharge Elimination System (NPDES) permit from the State of Hawai‘i DOH will keep possible pollution to accepted levels. In addition, soil management measures in accordance with County standards will be implemented to further monitor runoff discharges during construction into nearby shores. Adherence to Federal, state, and local regulations, as well as monitoring of proposed construction activities via jurisdictional permits, will allow negligible amounts of suspended sediment to enter the ocean as a result of construction activities. Information on required permits for the proposed project is presented in detail in Section 9.0 of the Environmental Assessment.

4) 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

The USFWS FWCA 2b report submitted to the USACE in 2006 concluded that all project alternatives share the potential for temporary construction-related impacts. During the period of construction, earthmoving and related activities would create a risk for the entry of terriginous sediments into the stream channel and adjacent near shore marine waters. This is especially the case during periods of wet weather. A variety of voluntary and regulatory controls function to minimize this risk. Runoff is inevitable, however, during torrential rains which occur regularly, but unpredictably in Hawai‘i. Development of site-specific Best Management Practices (BMPs) are integral elements in the planning and application process for CWA section 404 permits and the concurrent CWA section 401 Water Quality Certification administered by the HDOH Clean Water Branch.

The USFWS 2006 report also strongly recommended that water use patterns in the area be reallocated such that stream flow be restored no less than 80 percent of the time. In a follow-up discussion between USFWS, USACE, and the COM, stream flow restoration was discussed and was recognized as being outside the authority or purpose of the USACE. Mitigation measures proposed by the USACE include alignment of the low-flow channel along vegetated stream banks to allow overhanging vegetation to shade the channel and reduce water temperatures, and a retrofit of improved portions of the channel that are currently lacking low-flow design elements or that pose a hindrance to migration of aquatic organisms. These mitigation measures have been agreed to by the USFWS in a recent revised mitigation recommendation letter (Appendix J of the main EA document) as sufficient compensation for unavoidable impacts to the natural environment.

Alternative III is designed to facilitate upstream and downstream migration of aquatic organisms, given sufficient water flow. Stream flow restoration is a topic that is currently under discussion by state and federal resource agencies, community groups, and private entities that hold licenses for diversion and out-of-stream consumptive use of ʻĪao Stream water. This decision is outside the function and authority of the USACE, however. If and when stream flow is partially restored, the low-flow design elements of Alternative III will function to enhance passage of native stream fauna.

5) 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 non-point source water pollution control measures.

Water quality during the construction phase of the project will be maintained within acceptable levels with the preparation of a Section 404(b) (1) evaluation by the USACE, and a Section 401 State Water Quality Certification (WQC), as well as a National Pollutant Discharge Elimination System (NPDES) permit from the State of Hawaiʻi DOH. In addition, soil management measures in accordance with County standards will be implemented to further monitor runoff discharges during construction into nearby shores. Adherence to Federal, state, and local regulations, as well as monitoring of proposed construction activities via jurisdictional permits, will allow negligible amounts of suspended sediment to enter the ocean as a result of construction activities. Information on required permits for the proposed project is presented in detail in Section 9.0 of the Environmental Assessment.

The objective of the proposed project is flood control, and the planning and management of marine ecosystems is not within the scope of this project.

Economic uses

Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

1) Concentrate coastal dependent development in appropriate areas;

The objective of the proposed project is flood control, and no structures are proposed as part of this project. Concentrating land use developments to appropriate areas is not within the scope of this project.

2) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry 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

The objective of the proposed project is flood control, and no structures are proposed as part of this project. This section does not apply to the project.

3) 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:

Use of presently designated locations is not feasible;

b) Adverse environmental effects are minimized; and

c) The development is important to the State's economy.

The objective of the proposed project is flood control, and no structures or coastal dependent developments are proposed as part of this project. This section does not apply to the project.

Coastal hazards

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.

Under the legislative authority of the Flood Control Act of 1948, Section 205, Public Law 80-858, as amended, 33 U.S.C. 701s; Public Law 93-251, as amended; Public Laws 97-140 and 99-662, the USACE is authorized to implement flood damage reduction improvements to the ʻĪao Stream that meet or exceed Standard Project Flood (SPF) requirements to protect the existing Wailuku community.

1) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and non-point source pollution hazards;

National Environmental Policy Act (NEPA) of 1969, as amended, CEQ regulations (40 CFR 1500-1508); ER 200-2-2, Environmental Quality Procedures for Implementing NEPA; and Chapter 343, HRS and Act 50, as amended, require public involvement and agency consultation at various stages of the development of the EA process.

2) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and non-point source pollution hazards;

The control of future development projects in flood prone areas is the jurisdiction of the County of Maui, and is not within the scope of this project.

3) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

The proposed project consists of flood control measures and does not involve structures or buildings that are subject to development requirements for flood prone areas.

4) Prevent coastal flooding from inland projects.

The proposed project is to prevent flooding from streams and is not related to prevention of coastal flooding from inland projects.

Managing development

Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

NEPA of 1969, as amended, CEQ regulations (40 CFR 1500-1508); ER 200-2-2, Environmental Quality Procedures for Implementing NEPA; and Chapter 343, HRS and Act 50, as amended, require public involvement and agency consultation at various stages of the development of the EA process.

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

The use, implementation, and enforcement of existing law to regulate coastal zone development is within the scope of the County of Maui.

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

Facilitation of processing development permits and other requirements is within the scope of the County of Maui.

3) 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.

A public and agency scoping meeting was held in August, 2003. An additional public informational meeting will be scheduled to discuss the draft report and the recommended plan. A public notice will be circulated prior to the scheduled meeting to notify the public of the time and place. All comments received for this draft report will be documented in the final feasibility report.

Public participation

Objective: Stimulate public awareness, education, and participation in coastal management.

NEPA of 1969, as amended, CEQ regulations (40 CFR 1500-1508); ER 200-2-2, Environmental Quality Procedures for Implementing NEPA; and Chapter 343, HRS and Act 50, as amended, require public involvement and agency consultation at various stages of the development of the EA process.

1) Promote public involvement in coastal zone management processes;

A public and agency scoping meeting was held in August, 2003. A second public informational meeting will be scheduled in the future to discuss the draft report. Public notices will be posted prior to this meeting.

2) 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

A public and agency scoping meeting was held in August, 2003. An additional public informational meeting will be scheduled to discuss the draft Environmental Assessment and the

recommended action. A public notice will be circulated prior to the scheduled meeting to notify the public of the time and place.

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

Workshops and additional community meetings will be scheduled as deemed necessary.

Beach protection

Objective: Protect beaches for public use and recreation.

1) 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;

Part of the objective of the proposed project is to minimize existing erosion problems related to seasonal flooding. No structures are proposed near the shoreline for this project that would interfere with natural shoreline processes.

2) 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

The proposed Federal flood control project takes into account aesthetic impacts to the surrounding community. Alternative III is recommended for minimal impact to visual and recreational activities, and does not include construction of structures seaward of the shoreline.

3) Minimize the construction of public erosion-protection structures seaward of the shoreline.

The proposed project design does not involve erosion prevention structures seaward of the shoreline.

Marine resources

Objective: Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

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

The objective of the proposed project is flood control. Ensuring the ecologically, environmentally, and economically sound development of marine and coastal resources and activities is not within the scope of this project.

2) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;

The objective of the proposed project is flood control. The coordination of management of marine and coastal resources and activities is not within the scope of this project.

3) 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;

In the USFWS FWCA report submitted in 2006, the agency indicated that copies of the report had been transmitted to the U.S. Environmental Protection Agency, The Hawaiʻi Department of Health Clean Water Branch and Environmental Planning Office; the State of Hawaiʻi Department of Land and Natural Resources Division of Aquatic Resources and Division of Forestry and Wildlife; and the Hawaiʻi Department of Business, Economic Development and Tourism's Coastal Zone Management Program.

4) 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

The objective of the proposed project is flood control, and the promotion of research and study of marine life and other ocean resources as they relate to ocean and coastal resources is not within the scope of this project.

5) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources. [L 1977, c 188, pt of §3; am L 1993, c 258, §1; am L 1994, c 3, §1; am L 1995, c 104, §5; am L 2001, c 169, §3]

The objective of the proposed project is flood control, and the promotion of new and innovative technologies in regards to exploring and protection of marine and coastal resources is not within the scope of this project.

Appendix G:

Section 404(b)1 Analysis

Section 404(b)1 Analysis
'Īao Stream Flood Control Project

1.0 PROJECT DESCRIPTION

The United States (US) Army Corps of Engineers (USACE) is conducting an Environmental Assessment (EA) for the modification of the 'Īao Stream Flood Control Project, Wailuku, Maui, Hawai'i, completed in 1981. During the years 1981-1989, severe flood damage caused erosion that compromised channel stability and weakened portions of the existing levees. As a result of this damage, the 'Īao Stream Flood Control Project of 1981 requires upgrades and modifications, as future flood events may cause damage to life and property in areas of Wailuku town. Certification that the 'Īao Stream Flood Control Project can pass a 100-year frequency flood of approximately 19,200 cfs with 90% probability is required by the FEMA prior to February 2009 or the area protected by the project will revert to a flood hazard area.

The USACE has determined that the damages incurred to the 1981 Flood Control Project during the years immediately following the completion of the project are due to design deficiencies to the original project. Under the legislative authority of the Flood Control Act of 1948, Section 205, Public Law (PL) 80-858, as amended, 33 United States Code (USC) 701s; PL 93-251, as amended; PL 97-140 and PL 99-662, the USACE is authorized to implement flood damage reduction improvements to the 'Īao Stream that meet or exceed Standard Project Flood (SPF)[1] requirements to protect the existing Wailuku community. The project was designed for SPF protection with a peak discharge of 27,500 cubic feet per second (cfs) at the downstream limit of the project (250 feet (ft) upstream from the mouth of the stream) and 26,000 cfs at the upstream limit of the project (2.5 miles upstream from the mouth of the stream).

1.1 Location and General Description

The 'Īao Stream drainage basin is a 10 square mile area that begins at the boundary between the Lahaina and Wailuku Judicial districts and extends along the crests of the Kahoolewa and Kapilau Ridges to the Pacific Ocean. The basin is eight miles long and averages 1.25 miles in width. It is characterized by two major topographic features: a coastal plain that extends about three miles inland, and 'Īao Valley, the largest valley in West Maui, which extends from the coastal plain to the summit of Pu'u Kukui at an elevation of 5,800 ft above sea level.

The 'Īao Stream Flood Control Project was initiated in 1977 and completed in 1981. The stream drains into a steep valley with stream flows at the upstream project limit conveyed into a debris basin. The 1981 'Īao Stream Flood Control Project consists of a debris

[1] The SPF is the flood that may be expected from the most severe combination of meteorologic and hydrologic conditions that are considered to be reasonably characteristic of the geographical region involved, excluding extremely rare combinations. The SPF represents a "standard" against which the degree of protection selected for a project may be judged and compared with protection provided at similar projects in other localities. The SPF for the 'Īao Stream is estimated as approximately 27,500 cfs.

basin located 2.5 miles upstream from the stream mouth, a 3,500-foot long channel downstream from the debris basin: levees along the left and right bank, flood plain management along 6,950 ft of the left bank, and stream realignment for a 1,730-foot reach to the shoreline. In the flood plain management reach, levees are located on the right stream bank and are offset up to 80 ft beyond the existing stream bank. The proposed improvements to the 1981 Flood Control Project extend from above Waiehu Beach Road to the debris basin at the upstream limits of the project, a distance of approximately 2.5 miles.

The lower portion of the ʻĪao Stream in its current state (i.e., the area downstream from the water diversion structure) is not conducive to aquatic life. Due to the diversion of water from the stream, and also due to the intermittent nature of the stream itself, the stream below the diversion structure is absent of water approximately 90 percent of the time. Were it not for the efforts of a local aquatic biologist to capture organisms from ponded areas near the ocean outlet and physically transport them to the upper reaches of the stream, there would likely be no instream migration of aquatic organisms from the ocean to upstream areas. In some concrete-lined portions of the stream, a low-flow channel has been constructed. This low-flow element has been identified as a positive feature for aquatic organisms, particularly where shade is present. Other barriers to instream migration of aquatic organisms include the 22-foot drop structure at Station 97+23, concrete-lined portions without a low-flow channel, and a few smooth elevation drops that lack sufficient rugosity for migrating organisms to grasp or rest.

The preferred alternative (Alternative III) involves converting 7,200 ft of natural stream bed to a roller compacted concrete -lined channel. The channel has been designed to include low-flow elements that will enhance passage of aquatic organisms during periods of stream flow. While United States Fish and Wildlife Service originally viewed the proposed alternative as a significant environmental impact, subsequent discussions between the USACE and USFWS identified ways to mitigate these impacts to an acceptable level. As a result of these discussions, the proposed alternative includes several additional design features and retrofitting of existing concrete-lined portions of the stream that are outside the project area. USFWS provided concurrence with these proposed mitigation measures in a revised mitigation recommendation letter

1.2 Authority and Purpose

The 1981 ʻĪao Stream Flood Control project was authorized by the Flood Control Act of 1968 and completed in October of 1981. The original project consisted of a debris basin, channel improvements, diversion levees, and flood plain management.

During the construction phase in January 1980 a flood occurred that caused extensive erosion of the sacrificial berm and undermined portions of the completed levees. As a result, the streamside slope of the levees was extended with a concrete riprap slope lining into the streambed. Considered to be a state of the art design at that time, the toe of the cutoff walls was imbedded 5 ft in depth as provided in the project design document.

Shortly after project completion, stream flows occurred that caused erosion of the stream bottom along an approximately 7,000 foot reach between the concrete channel and the

Waiehu Beach Road. The erosion undermined the project levee with scour depths extending to a maximum of 6 ft below the existing boulder concrete slope lining. In July 1982, the Honolulu District Corps of Engineers requested that corrective work be approved to extend the boulder concrete slope protection from the damaged portion to a minimum of 5 ft below the eroded stream bottom. The Office of the Chief of Engineers granted approval for this work in January 1983. The corrective work was completed in November 1983 under the Productive Employment Appropriation Act of 1983 and authorized under Section 205 of the Flood Control Act of 1948, PL 80-858, as amended. The stream channel has since eroded 5 ft below the 1983 repair. The USACE subsequently decided to conduct a reconnaissance study to investigate solutions to the recurring problems that are slowly undermining areas of the levee. In March 1995, a report was submitted by USACE recommending modification to ʻĪao Stream to replace the existing levee system with a trapezoidal concrete-lined channel (7,200 ft long).

A slope stability analysis was performed in 1997 to determine the stability of two areas identified as possible locations of levee failure. Stability analysis indicates instability may occur after flood waters have receded at Station 40+00. This assumes the 1996 slope geometry is further eroded to steepen the slope and deepen the stream bottom. Should a standard project flood occur prior to any repairs, flood waters would be able to pass through this portion of the levee and enter into adjacent housing areas. Water passing will further erode the levee.

The existing stream channel has a relatively narrow width of 40 to 60 ft, is boulder lined, and dry about 90% of the time. Levees with a surface of grouted riprap are interspersed along the right bank. The channel has an average slope of 2.6%. This steep stream channel results in critical and supercritical flows in the stream. The average channel velocity through the unlined portion of the stream varies between 8 and 32 feet per second with an average velocity in excess of 20 fps during annual floods. These high velocities have eroded the channel bed and caused severe undermining of the existing levees. To date, no flow larger than a 4% event has occurred in ʻĪao Stream since construction was completed in 1981.

Certification that the ʻĪao Stream Flood Control Project can pass a 100-year frequency flood of approximately 19,200 cfs with 90% probability is required by the FEMA prior to February 2009 or the area protected by the project will revert to a flood hazard area. A government agency responsible for levee construction or a Registered Professional Engineer must provide this certification. In its present condition, the project cannot be certified as providing 100-year flood protection.

Repeated floods in this area have caused high stream flows, undermining the existing flood plain levees in key locations. High stream flows resulted in downcutting of the natural streambed and erosion of the base of the east bank levee structure. Several residential and commercial structures along the right bank are in danger of being undercut if streambank erosion continues, as is the heiau along the lower reach of the left bank. The USACE has determined that the damages incurred by the 1981 Flood Control Project during the years immediately following the completion of the project are due to design deficiencies of the original project.

The purpose of the proposed action is to find a solution to stop levee and streambed erosion and to protect adjoining property from flooding during major storm events. A secondary objective is to maintain habitat for aquatic species passage by keeping a low-flow channel as recommended by the USACE Committee on Channel Stabilization. The estimated lifespan of the Flood Control Project is anticipated to be between 50 and 100 years. Five alternatives and a no action alternative have been formulated for consideration. Of these alternatives, three were considered for further evaluation in the EA.

1.3 Alternatives Considered

Section 404(b)1 guidelines of the Clean Water Act require that "except as provided under section 404(b)2, no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." The guidelines consider an alternative practicable "if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."

The six alternatives initially considered for this project were: I) Trapezoidal Concrete-Lined Channel, II) Rectangular and Compound Channel, III) Roller Compacted Concrete and Boulder Invert Channel Following Existing Alignment, IV) Levee Reconstruction, V) Removal of Flood Control Improvements, and VI) No Action. Alternatives II, IV, and VI did not meet the project objectives and are thus not considered "practicable alternatives" and as such have been dropped from further consideration. Details of the remaining alternatives are provided below.

1.3.1 Alternative I: Trapezoidal Concrete-Lined Channel.

This alternative would contain up to the SPF within the improved channel. Alternative I consists of a trapezoidal, concrete-lined channel with a 40-foot bottom width, 90-foot top width and interior splitter walls at channel curves. The new channel would mainly follow the existing stream alignment Station 22+00 (0.5 miles upstream from the stream mouth) to 92+02 (1.8 miles upstream from the stream mouth), for a distance of 7,200 ft. The channel would also be realigned to the north between Stations 76+40 to 86+60 (an approximate 950-foot length extending east and west of the ʻImi Kālā Street Bridge) to avoid affecting structures that have been constructed on the right bank. All design flows up to the standard project flood would be contained within the channel, thereby eliminating the need for the existing floodplain on the left bank and making the land available for development. Negative environmental impacts include potential objections by public and resource agencies with regard to the conversion of a natural stream bottom to a concrete-lined invert (70% conversion). Total project cost is estimated at $38.8 million. This alternative would achieve project objectives and is considered to be feasible from an engineering and economic perspective. Therefore, this alternative was further analyzed.

1.3.2 Alternative III: Roller Compacted Concrete and Boulder Invert Channel Following Existing Alignment.

This alternative was designed for SPF protection with a peak design discharge of 27,500 cfs downstream at Station 22+00 (0.5 miles upstream from the stream mouth) and 26,000 cfs upstream at Station 92+02. Typical stream stabilization improvements would consist of boulders in the main channel low flow section with RCC stream bank protection, in order to replicate a more natural stream invert. Design elements would be included into existing and planned channel segments to facilitate the movement of native fish and other aquatic organisms. Total project length extends from Station 22+00 to the debris basin (2.5 miles upstream from the shore). Modifications are described in more detail below:

A new ground water recharge basin and diversion levee were considered for inclusion by partially blocking the low flow outlets at the existing debris basin located approximately 1,100 ft upstream of Market Street at Station 127+00 and adding a levee on the left bank upstream of the existing debris basin. Water would pond in the debris basin and help facilitate percolation into the ʻĪao aquifer during rainy season. This mitigation was dropped from consideration following the recommendation of USFWS and DLNR-DAR personnel citing the presence of the recharge basin would have negative impacts on aquatic organisms.

Modify the drop structure between Stations 96+74.21 and 97+23.21. A new stepped drop structure would eliminate the dangerous 22-foot vertical drop and improve passage of in-stream fish (ʻ*o*ʻ*opu*) and other aquatic organisms.

Modify existing low flow concrete channels with small blocks to break up high velocity flows and facilitate fish passage.

Add hydraulic improvements to the concrete channel between Stations 92+02 and 95+41. These improvements include baffle blocks and a weir within the existing concrete channel to more evenly distribute flow.

Incorporate RCC side slopes and a 20-foot wide grouted boulder invert channel that would mainly follow the alignment of the existing stream between Stations 22+00 and 92+02 (approximately 7,200 ft long). The median base width range would vary between 40 to 60 ft.

Include stream realignment and widening between Stations 76+02 and 85+30. The channel would be realigned to the north on the left bank to avoid existing structures to the right bank and be widened to reduce water surface profile at the ʻImi Kālā Street Bridge. As a result of the channel widening, the 10-year flood (i.e., the low flow condition of 7,200 cfs) will be contained within the channel but floods greater than 7,200 cfs and up to the SPF of 27,500 cfs will spread out on the existing left bank flood plain area.

Construct a low flow boulder channel within the RCC portion. The 20-foot wide low flow channel would use boulders embedded in concrete to replicate a more natural streambed substrate. Retrofit design elements have also been included to facilitate the movement of native organisms through the modified channel area. These elements include a step structure at the 22-foot vertical drop (Station 97+23), widening existing

low-flow channel areas, installing low-flow channel segments in existing flat-bottomed cement channel segments and in the center of the existing debris basin, blocks along the sloped portions of the existing channel to provide a resting place for climbing organisms, and an alignment along the vegetated portions of the left bank to provide shade and reduce water temperatures. These mitigation measures have been proposed as compensation for unavoidable impacts, and have been agreed to in a revised mitigation recommendation letter by the USFWS.

Incorporate right bank levee raises. The existing right bank levee would be raised at Stations 45+37 to 48+85 by 4.5 ft using a concrete rubble masonry (CRM) wall on top of the existing earth levee and up to 0.7 ft at Stations 25+62 to 26+46. The 0.7-foot raise can be accomplished using earth levee fill material. Adjacent land uses that may have an impact to their viewscape by the levee raises include warehouses in the vicinity of the 0.7 foot levee raise and residential townhomes in the vicinity of the 4.5 foot levee raise. The impact to the viewscape of the warehouses would be minimal, but the impact to the townhomes would be noticeable. The modified levee would look similar to the levee built for the Kawainui marsh restoration on Oahu.

Channel lining, retaining walls, and raising the levee walls would be necessary due to the excessive flow velocities and higher flood levels. This alternative would achieve project objectives and is considered to be feasible from an engineering and cost perspective. Total project cost is estimated at $30.0 million. Alternative III is considered the "environmental alternative" because it would minimize or otherwise mitigate for negative environmental impacts to the project area. Therefore, Alternative III is the recommended alternative (reformulated plan) as it would best reduce the flooding problems and minimize or mitigate for environmental impacts.

1.3.3 Alternative V: Removal of Flood Control Improvements.

This would include removal of all existing man-made improvements to the existing channel and returning the stream to its original natural state. The community of Wailuku would be placed back into the flood plain, with no flood protection levees. A state-of-the-art flooding warning system would replace man-made flood control devices. The estimated project cost for this alternative is $34.5 million. This estimate does not include the costs of relocating residents in flood-prone areas, which would be required for this alternative and would be expected to be quite substantial given the costs of real estate in Maui. Although this alternative does not meet project objectives from an engineering perspective, there is an expressed public support for this alternative due to its environmental benefits, and the alternative was carried forward for further evaluation. Despite its public support, this alternative was not selected due to potential for loss of life and protection to urbanized areas.

2.0 FACTUAL DETERMINATION

2.1 Physical Substrate Determinations

2.1.1 Sediment type

Soils in the area of Wailuku retain a high organic matter, and are composed of clay, silt, and sand, mixed with varying degrees of gravel, cobble, and boulders. Major soil types in the vicinity of the stream include ʻĪao silty clay, 0 to 3 percent slopes (IaA), Puuone sand, 7 to 30 percent slopes (PZUE), Pulehu cobbly clay loam, 0 to 3 percent slopes (PtA), ʻĪao cobbly silty clay, 3 to 7 percent slopes (IbB), Jaucas sand, saline, 0 to 12 percent slopes (JcC), and stony alluvial land (rSM). In its current state, the ʻĪao Stream bed is experiencing extreme erosion of the right bank in the vicinity of station 82+12. The channel has dropped up to nine feet in some locations, and is being actively graded on a regular basis by the County of Maui to prevent accelerated erosion. This erosion is likely contributing to sedimentation of the near shore marine environment at the mouth of the ʻĪao Stream. While some degree of erosion and sedimentation is natural for any stream system, the erosion experienced during flood events is excessive. Of the proposed alternatives, I and III would eliminate this excessive erosion and resulting sedimentation, but Alternative V would potentially exacerbate it. For Alternative III, anticipated changes to deposition of terrigenous sediments at downstream locations would be minor.

2.1.2 Physical Affects on Benthos

In its current state, the ʻĪao Stream is experiencing extreme streambank erosion that leads to sedimentation. Alternatives I and III would effectively eliminate the erosion and associated sedimentation, while Alternative V would exacerbate the current situation. All three alternatives would have short-term sedimentation impacts during construction, although these can be mitigated through the incorporation of best management practices (BMPs) by the construction contractor.

Alternatives I and III include the concrete lining of an additional 7,200 feet of channel, which would replace the current natural benthic substrate in this area. Alternative I would involve smooth concrete, while Alternative III would replace the natural stream bed with RCC walls and a low-flow boulder invert channel that is envisioned to be of sufficient rugosity to create microhabitat conditions that are more suitable than flat unshaded concrete for upstream migrating organisms. Alternative V does not involve any channel hardening, but would instead remove concrete improvements at the upper and lower reaches of the project.

2.1.3 Actions to be Taken to Minimize Impacts

The general contractor is required to use silt containment devices and other best management practices (BMPs) to control turbidity to the maximum extent practicable. The USACE will monitor the marine water quality at the mouth of the stream before, during, and after construction to assure water quality standards are not exceeded.

2.2 WATER CIRCULATION, FLUCTUATIONS, AND SALINITY DETERMINATIONS

2.2.1 Water Chemistry

A temporary increase in turbidity would be expected during construction activities for all alternatives. This would depend, however, on whether water flow was occurring in the stream channel at the time of construction. No significant changes to salinity or other water quality parameters are anticipated in the stream, however during large freshwater discharge episodes into Kahului Bay, minor changes in salinity and other water quality parameters may be temporarily experienced in the nearshore environment. No significant alteration of color, odor, or taste is anticipated.

Alternatives I and III both involve paving 7,200 feet of natural stream bottom with concrete, but Alternative III incorporates a more natural substrate construction that would allow colonization by aquatic benthic communities and plants. While both alternatives provide the potential for changes in water chemistry due to the alteration of the natural stream bed, Alternative III provides the highest level of engineering controls to mitigate these changes. Alternative III comes with the recommendation to maintain adequate vegetation to maintain lower water temperatures. This vegetation would also assist in removing nutrients from stream water, and trapping water-borne particulates in place.

Alternative V involves removing all man-made, concrete-paved sections of the project area. While this would most likely enhance the removal of nutrients and pollutants in the stream system, the problematic streambank erosion along the entire length of the project area would continue and result in a heavy load of sedimentation. Additionally, this alternative does not provide adequate flood protection and is thus not a practicable alternative.

2.2.2 Current Patterns and Circulation

The length of ʻĪao Stream comprising the project area is devoid of water flow approximately 80 to 90 percent of the time (USFWS, 2006). Occasional high rainfall events provide sufficient water volume to overflow upstream water diversion structures, and water flow through the project area is temporarily restored. Previous investigations of the nearshore coastal environment, however, reported moderately strong winds and breaking waves in nearshore waters resulting in high turbidity close to the mouth of the stream. Constant wave action and strong winds would most likely provide sufficient flushing of the nearshore coastal environment, and any stream discharge would most likely have a negligible effect.

Of the alternatives considered, Alternative I would result in a straightened, concrete lined smooth channel that would result in the fastest and most direct conveyance of streamwater to the ocean during heavy rainfall events. Alternative III would also result in a concrete-lined channel, but with a boulder invert low-flow channel that will help facilitate stream flows during times of scarcer water availability. Alternative V, with a

completely restored natural stream bed, would lead to slower water movement and natural percolation of some of the water through the subsurface.

2.2.3 Actions to be Taken to Minimize the Impacts

The general contractor is required to use silt containment devices and other best management practices (BMPs) to control turbidity to the maximum extent practicable. The USACE will monitor the marine water quality at the mouth of the stream before, during, and after construction to assure water quality standards are not exceeded.

Changes to current patterns and water circulation in Kahului Bay would most likely be negligible. No actions are required to minimize impacts.

2.3 Suspended Particulate / Turbidity Determinations

The ʻĪao Stream currently experiences streambank erosion during high rainfall events. This erosion would likely result in a high degree of suspended particulate in the stream. Alternative I, with a smooth bottom, concrete-lined stream bed would eliminate most of the streambank erosion, but would result in the highest level of suspended particulates due to a faster rate of water flow and lack of vegetation or other rugged features that would trap sediment and particulates. Alternative III would eliminate most of the streambank erosion, and would also provide a vegetative buffer on the flood plain and habitat for natural aquatic plant life on the channel bottom, which would help trap and anchor particulates in place. Alternative V would not provide substantial reduction of sedimentation and streambank erosion. The natural buffering capacity of the restored natural streambed would not be sufficient to mitigate the volume of sedimentation anticipated with continued streambank erosion during high rainfall events.

2.3.1 Expected Changes at Discharge Site

Previous investigations of the nearshore coastal environment reported high levels of turbidity related to constant wave action and moderate winds. These conditions were reported consistently across multiple sampling events, both in the presence and in the absence of stream flow. The controlling factor for turbidity appeared to be wave action, with lower turbidity observed on calmer days. Turbidity and total suspended solids were higher at the nearshore stations (80 feet from the mouth of ʻĪao Stream) as compared to the seaward sites (240 feet from the mouth of ʻĪao Stream). The wind speed and constant wave action likely provide sufficient energy to re-suspend existing benthic sediments in the nearshore coastal environment. This high energy system would also likely provide sufficient water movement to regularly flush the area. Of the alternatives considered, Alternatives I and III would most likely result in a net reduction in suspended sediment entering the nearshore system, although during construction there would likely be an increase in sedimentation. The existing highly turbid nearshore system is not anticipated to be significantly affected.

2.3.2 Effects on Chemical and Physical Properties of the Water Column

The proposed project is not anticipated to have a significant effect on light penetration, dissolved oxygen, toxic metals and organics, or pathogens.

2.3.3 Effects on Biota

The length of ʻĪao Stream comprising the project area is devoid of water flow approximately 80 to 90 percent of the time (USFWS, 2006). Occasional high rainfall events provide sufficient water volume to overflow upstream water diversion structures, and water flow through the project area is temporarily restored. Migrating larval recruits that attempt to travel upstream to areas of perennially flowing water are reported as largely unsuccessful under the current conditions. Other mature fish that attempt to travel downstream to spawn in the ocean are also only partially successful due to sporadic water flow. The floodplan on the west bank supports vegetation, and within-stream vegetation provides some amount of shading that regulates water temperature to a range suitable for upstream migrating organisms.

Of the alternatives considered, Alternatives III provides an invert channel of sufficient rugosity to both facilitate water flow during times of scarce water availability and create microhabitat conditions with vegetative growth that are more suitable for organisms. The floodplain would also be left in place under this alternative. Alternative I eliminates the flood plan, and does not provide a suitable environment for migrating organisms. Alternative V would restore that natural stream bottom, but would not address the streambank erosion and is not considered a practicable alternative.

2.3.4 Actions to be Taken to Minimize the Impacts

The general contractor is required to use silt containment devices and other best management practices (BMPs) to control turbidity to the maximum extent practicable. The USACE will monitor the marine water quality at the mouth of the stream before, during, and after construction to assure water quality standards are not exceeded.

2.4 Aquatic Ecosystem and Organism Determinations

The project area includes a series of riffle and pool formations on boulder and cobble substrate. Under 404(b)1 guidelines and regulations, a high relative value is placed on these complexes, identified as special aquatic sites. Eliminating riffle and pool complexes is generally recognized as leading to impacts such as reducing aeration and filtration capabilities, reducing stream habitat diversity, reducing fish and wildlife populations through sedimentation and the creation of unsuitable habitat, scouring or sedimentation of riffles and pools, and reduction of water-holding capacity of streams resulting in rapid runoff from a watershed. Alternative V would not disturb the riffle and pool complexes; however this alternative does not provide for stream bank stabilization and does not meet project objectives. Alternatives I and III both involve converting the natural substrate to a concrete lined channel, with Alternative III providing the best strategy to reduce the negative impacts listed above.

Alternative III retains the flood plain on the west bank to provide a buffer during high flow events and natural filtration. Alternative III also reduces the impacts to the natural stream bottom and riparian vegetation anticipated under Alternative I by incorporating several mitigation measures agreed to by the USFWS. During periods of moderate to low stream discharge, water would be entrained in a low-flow channel that is envisioned to be of sufficient rugosity to create microhabitat conditions that are more suitable than flat unshaded concrete for upstream migrating organisms. Where possible, the low-flow channel would be aligned close to the stream bank so that existing vegetation could provide shade to the channel. In addition, non-woody vegetation could grow among the grouted boulders that form the low-flow channel. This streambank and channel vegetation, if appropriately managed, would function to provide critical shade and maintain lower water temperatures.

In their draft FWCA report, USFWS expressed concerns that converting 7,200 ft of natural alluvial stream bed to a RCC and boulder invert channel would have a negative impact on the ʻĪao Stream and cumulatively to the hydrologic landscape of north-shore Maui. USFWS also noted that although they would recommend Alternative V or IV as the preferred alternative, they do not meet the project requirements and thus would likely be removed from consideration. In that case, USFWS recommended selection of Alternative III as the preferred alternative, emphasizing that "the goal of the mitigation flow would be to re-establish continuous flow of ʻĪao Stream to the sea no less than 80% of the time and to enhance flow duration to maximize survival of migratory aquatic organisms." In a follow-up discussion between USFWS, USACE, and the COM, stream flow restoration was discussed and was recognized as being outside the authority or purpose of the USACE. Retrofit design elements have also been included to facilitate the movement of native organisms through the modified channel area. A site visit was conducted on 3/31/2008 to identify these areas and measures. These elements include a step structure at the 22-foot vertical drop (Station 97+23), widening existing low-flow channel areas, installing low-flow channel segments in existing flat-bottomed cement channel segments and in the center of the existing debris basin, blocks along the sloped portions of the existing channel to provide a resting place for climbing organisms, and an alignment along the vegetated portions of the left bank to provide shade and reduce water temperatures. These mitigation measures have been proposed as compensation for unavoidable impacts, and have been agreed to in a revised mitigation recommendation letter by the USFWS.

Alternative III is designed to facilitate upstream and downstream migration of aquatic organisms, given sufficient water flow. Stream flow restoration is a topic that is currently under discussion by the CWRM, state and federal resource agencies, community groups, and private entities that hold licenses for diversion and out-of-stream consumptive use of ʻĪao Stream Water. This decision is outside the function and authority of the USACE, however. If and when stream flow is partially restored, the low-flow design elements of Alternative III will function to enhance passage of stream fauna.

Coral reefs are reported to occur in the coastal environment adjacent to the mouth of the ʻĪao Stream, although not in the immediate vicinity. A series of regular water quality monitoring events consistently found the waters in the immediate vicinity of the ʻĪao

Stream to be extremely turbid with limited visibility. The substrate reported at the monitoring stations (from 80 to 240 feet adjacent to the stream mouth) consisted of a shallow, boulder-covered bottom with a gradual slope. The highly turbid water conditions currently present in this area are not conducive to coral reef growth, as corals require relatively clear, nutrient-poor waters to thrive. Some increase in turbidity would be inevitable during construction activities, although BMPs would be implemented to mitigate sedimentation to the extent practicable. Following construction, Alternative III would likely provide a net reduction in sedimentation immediately following high water flow events due to its elimination of excessive stream bank erosion.

2.5 Proposed Discharge Site Determinations

Release of sediment into waters of the United States would most likely occur during periods of construction. The general contractor will be required to use silt containment devices and other BMPs to control turbidity to the maximum extent practicable. The USACE will monitor the marine water quality at the mouth of the stream before, during, and after construction to assure water quality standards are not exceeded.

2.6 Determination of Cumulative Effects on the Aquatic Ecosystem

Cumulative impacts resulting from the incremental consequences of the proposed project when added to other past and reasonably foreseeable future actions were considered in the EA. The County of Maui is planning an upgrade to the existing 'Imi Kālā Street Bridge. This project has necessitated the inclusion of several revisions to the original proposed 'Īao Stream Flood Control Project. Notable revisions include the stream bank excavation and channel widening in the area directly upstream from the bridge. Although the bridge upgrade project has changed the scope of the proposed Flood Control Project, this is not considered a cumulative impact to the natural or social environment, other than the benefit to the community of having an improved bridge.

The County is also planning to extend 'Imi Kālā Street to connect to Kahekili Highway, as part of the development of the Hale Mua affordable housing subdivision. This may cause changes to traffic in the vicinity of the proposed project, but not as a result of any of the project design elements.

No other projects are planned for the channel or in the vicinity of the channel that would compound or increase the impact of the proposed project. Areas surrounding the channel are being developed into residential and commercial communities; however these developments are not anticipated to have a significant cumulative impact on the proposed project.

2.7 Determination of Secondary Effects on the Aquatic Ecosystem

Secondary impacts are those that are caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable. These impacts are induced directly or indirectly by the proposed project. Secondary effects to the aquatic ecosystem considered in this analysis include potential impacts to the downstream coral reef community. No significant adverse effects to downstream coral reefs were identified.

Appendix H:

Agency Communication

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

March 8, 1996

Planning and Operations Division

Mr. Gene Nitta
Pacific Area Office
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822-2396

Dear Mr. Nitta:

The U.S. Army Corps of Engineers is planning a modification of the Iao Stream Flood Control project, Maui, Hawaii. The modification is required to correct undermining of the levee toe resulting from natural streambed erosion processes in the stream.

The modification will consist of concrete lining the affected reach from river station 91+50 to 21+50. The bottom would be 40 feet wide with sloping sides and would be about 12 feet deep (see enclosed Figures).

An environmental document is in preparation for this project to update the Final Environmental Statement of April 1975.

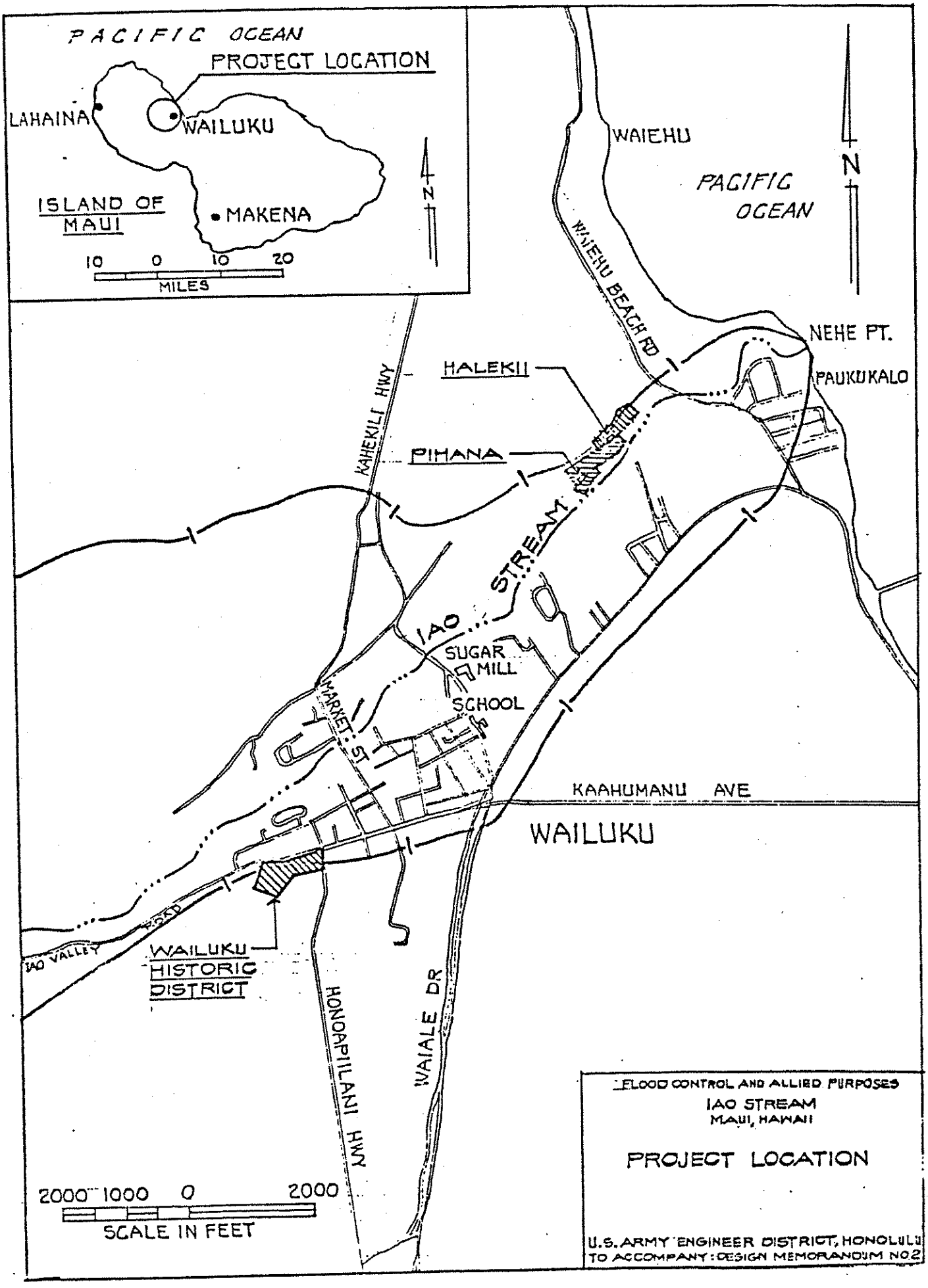
Because this project is about one-half mile inland, we believe that no candidate, proposed, or listed threatened or endangered species for which NMFS is responsible will be affected adversely, and that formal consultation under Section 7 of the Endangered Species Act is not required. In fact, we believe that by reducing the amount of sediment entering the ocean during storms, the project will have a benificial effect. We would appreciate your concurrence with this determination.

Should you have any questions, please contact Mr. Bill Lennan at 438-2264 or Ms. Sharon Okamoto at 438-2249 of my planning staff.

Sincerely,

Ray H. Jyo, P.E.
Director, Engineering
and Technical Services

Enclosure


PACIFIC OCEAN
PROJECT LOCATION
LAHAINA
WAILUKU
ISLAND OF MAUI
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PACIFIC OCEAN
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IAO STREAM
IAO
SUGAR MILL
SCHOOL
MARKET ST
KAAHUMANU AVE
WAILUKU
IAO VALLEY RD
WAILUKU HISTORIC DISTRICT
HONOAPIILANI HWY
WAIALE DR
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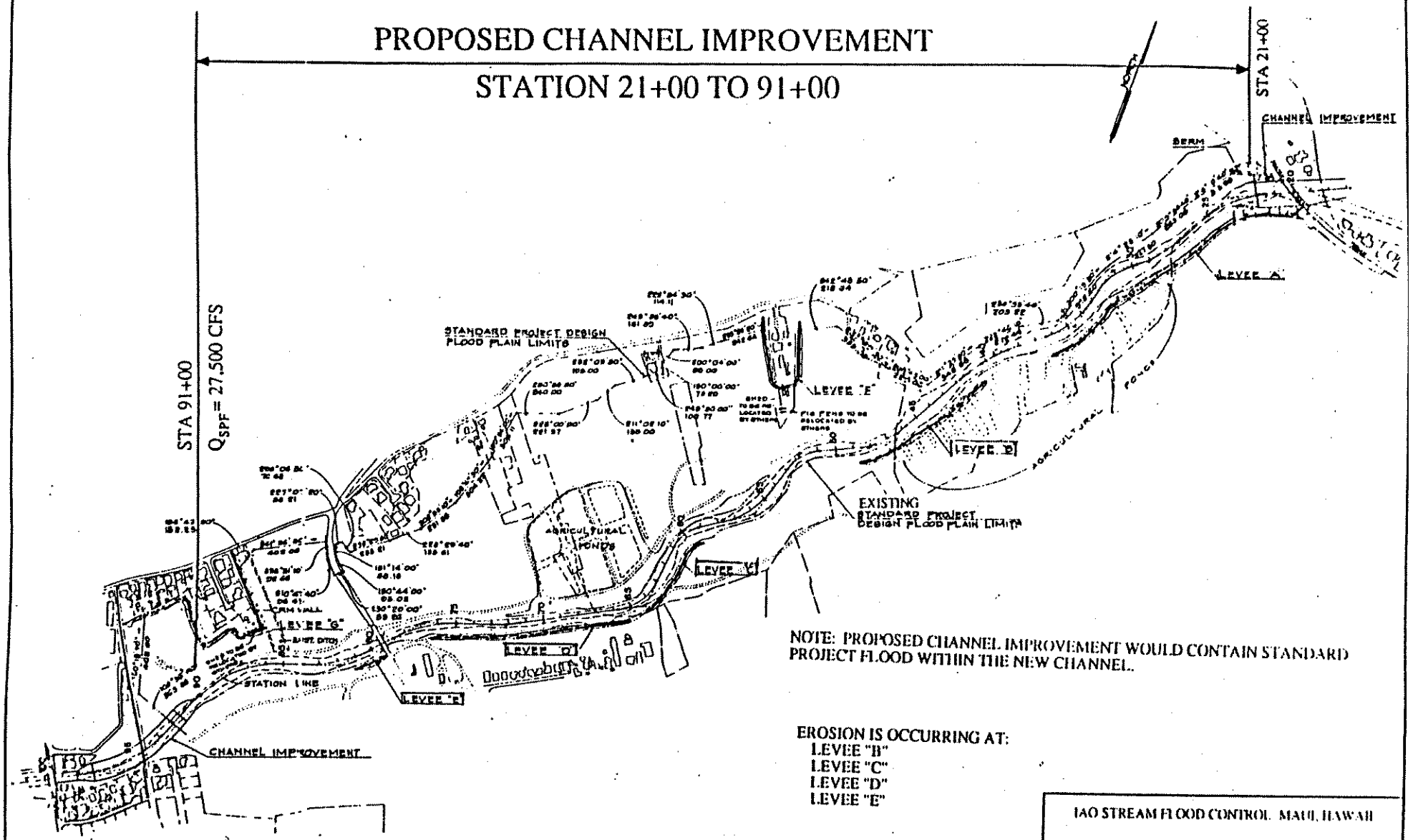
SCALE IN FEET
FLOOD CONTROL AND ALLIED PURPOSES
IAO STREAM
MAUI, HAWAII
PROJECT LOCATION
U.S. ARMY ENGINEER DISTRICT, HONOLULU
TO ACCOMPANY: DESIGN MEMORANDUM NO.2

PROPOSED CHANNEL IMPROVEMENT

STATION 21+00 TO 91+00



NOTE: PROPOSED CHANNEL IMPROVEMENT WOULD CONTAIN STANDARD PROJECT FLOOD WITHIN THE NEW CHANNEL.

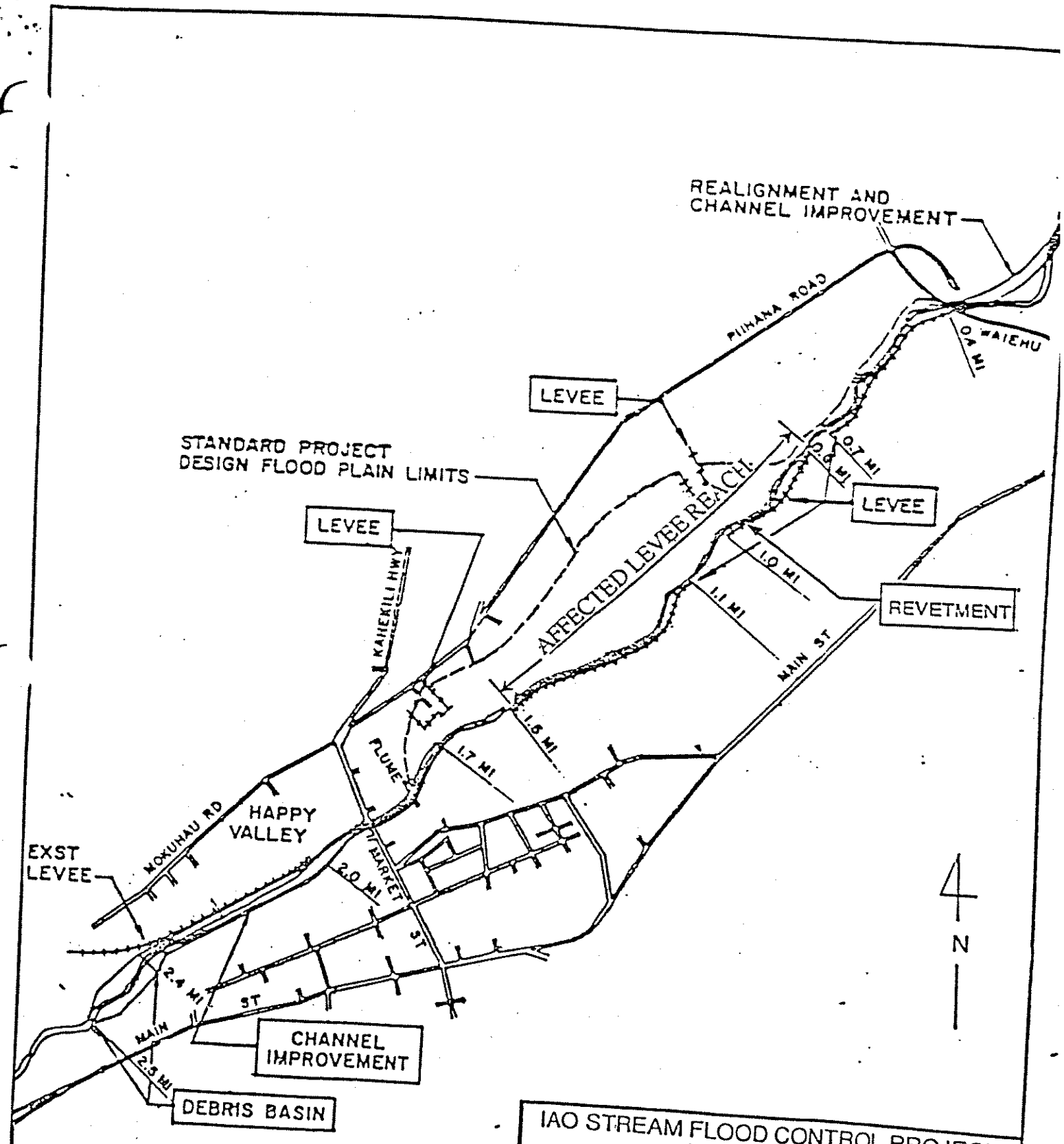
EROSION IS OCCURRING AT:
- LEVEE "B"
- LEVEE "C"
- LEVEE "D"
- LEVEE "E"

GRAPHIC SCALE

IAO STREAM FLOOD CONTROL MAUI, HAWAII

SITE MAP

US ARMY ENGINEER DISTRICT HONOLULU



IAO STREAM FLOOD CONTROL PROJECT
MAUI, HAWAII

SITE MAP

US ARMY ENGINEER DISTRICT HONOLULU

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213
TEL (310) 980-4000; FAX (310) 980-4018

March 19, 1996 F/SW033:ETN

Mr. Ray H. Jyo, P.E.
Director of Engineering and Technical Services
U.S. Army Engineer District - Honolulu
Fort Shafter, Hawaii 96858-5440

Dear Mr. Jyo:

Thank you for your letter regarding the proposed modification of the Iao Stream Flood Control project, Maui, Hawaii. The modifications would correct undermining of the levee toe resulting from natural streambed erosion processes. Critical habitat for any listed species under the jurisdiction of the National Marine Fisheries Service has not been designated or proposed within or near the project site. Based on available information I concur that the proposed project will benefit listed marine species by reducing the amount of sediment entering the nearshore environment. Accordingly, Section 7 consultation for this project will not be necessary.

The Section 7 consultation process for this project must be reinitiated if new species are listed that may be affected by the proposed activities or the activities affect listed species or critical habitat in a manner or to an extent not previously considered. I may be reached at 808/973-2987 should there be any further questions.

Sincerely,

Eugene T. Nitta

Eugene T. Nitta
Protected Species Program
Coordinator

cc: F/SWO3 - Lecky

	OFFICE	ACTION	INFO
2	Dir of Engrg	Tech Svcs	
1	Deputy		21
	Secretary		
	Cost		
	~~Des~~ Const		
	Env		
	~~Fin~~		
3	Plng	h	21
	Svcs		
	Tech		

4 pp-J SC 3125

PP-A

OFFICE	ACTION	INFO
2 Dir of Engrg/Tech Sig		
1 Deputy		2
Secretary		
Cost		
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Env		
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Svcs		
Tech		

United States Department of the Interior

FISH AND WILDLIFE SERVICE

PACIFIC ISLANDS ECOREGION
300 ALA MOANA BOULEVARD, ROOM 3108
BOX 50088
HONOLULU, HAWAII 96850
PHONE: (808) 541-3441 FAX: (808) 541-3470

In Reply Refer To: JMB

JUL - 1 1996

Bill
Sharon
file 7/8

Mr. Ray H. Jyo, P.E.
Director of Engineering and
Technical Services
Planning and Operations Division
U.S. Army Corps of Engineers
Fort Shafter, Hawaii 96858-5440

Re: Planning Aid Letter, Iao Stream Flood Control Project Modifications, Maui, Hawaii

Dear Mr. Jyo:

This Planning Aid Letter for proposed modifications to the Iao Stream Flood Control Project, Maui, Hawaii transmits U.S. Fish and Wildlife Service (Service) information and concerns regarding the proposed project and was prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*). The U.S. Army Corps of Engineers Honolulu District (HED) proposes to correct continued erosion of the streambed and levee toes by lining approximately 7,000 linear feet of the lower reaches of Iao Stream.

Information was gathered through a review of our files, maps prepared by the Hawaii Heritage Program of The Nature Conservancy, and a May 13, 1996, site visit conducted by Service biologists. The visit included the debris basin and lined stream sections immediately downstream. During the site visit, several individuals of a native goby (*Awaous guamensis, 'o'opu nakea*) as well as the introduced crustacean *Macrobrachium lar* were observed in the debris basin, indicating that the present stream configuration allows some juveniles of these species to recruit to the stream above the project limits. However, at the low flow conditions observed during the site visit, the exposed nature of the low-flow channel appear to make the lined portions of the stream unsuitable for most aquatic life. It appears that Service recommendations agreed to by HED in the original project, specifically that closely-spaced boulders be embedded in the low flow channel (Memorandum for Record, 5 March 1976, enclosed), were not implemented. Unlined portions of the stream bed within the project area may harbor native invertebrates or fishes, although this was not determined during the brief site visit.

The Service is concerned that lining of the entire stream channel below the debris basin may render Iao stream uninhabitable by native aquatic species that require connection with the ocean during their life cycle. This is partly due to the shallow, barren low flow channel provided for in the plans. At low flow rates, water in such channels rapidly heats and loses dissolved oxygen. Designs for the proposed project should be presented which would allow larger perennial flows by closing existing diversions and that would provide eddies and sheltered overhangs within the low flow channel to allow upstream migration of juvenile stream organisms.

The Service concurs with your determination that there are no proposed or listed threatened or endangered species within the project area. Therefore, formal consultation under section 7 of the Endangered Species Act is not required. However, there is a potential for two candidate species (*Megalagrion pacificum* and *M. xanthomelas*) to occur in the project area. Surveys conducted as part of the Scope of Work will determine their presence or absence.

The March 3, 1996, Scope of Work submitted to the Service is adequate and accepted with the exception of the cost estimate. The Service does not require funding for this Planning Aid Letter but does require three (3) additional biologist-days to prepare the draft and final 2(b) reports. A revised cost estimate of $13,897 is attached.

We were unable to locate any 2(b) report prepared by the Service for the original project. Our file contains several Service letters commenting on the draft Environmental Impact Statement and General Design Memorandum. Copies of these letters are available on request.

We look forward to working with HED on the design and implementation of this project. If you have any questions regarding this Planning Aid Letter, please contact Fish and Wildlife Biologist Jeff Burgett at (808) 541-3441.

Sincerely,

Brooks Harper

Brooks Harper
Field Supervisor
Ecological Services

Enclosures

cc: DAR, Maui (w/o enclosures)

COST ESTIMATE
FISH AND WILDLIFE COORDINATION ACT REPORT
IAO STREAM FLOOD CONTROL PROJECT MODIFICATIONS
MAUI, HAWAII
June 28, 1996

1. Field Expenses

4 days @ $500	$ 2,000
2 RT airfare Honolulu-Maui @ $140/RT	$ 280
4 days perdiem @ 175/day	$ 700
2 days car rental @ 45/day	$90
TOTAL FIELD COST	$ 3,070

2. Report Preparation

10 days @ $500/biologist day [draft 2(b)]	$ 5,000
4 days @ $500/biologist day [Final 2(b)]	$ 2,000
TOTAL REPORT PREPARATION	$ 7,000
SUBTOTAL	$ 10,070
38% Overhead	$ 3,827
TOTAL	$13,897

PODED-P 5 March 1976

MEMORANDUM FOR RECORD

SUBJECT: Iao Stream Flood Control Project, Maui, Hawaii
Coordination with U.S. Fish and Wildlife Service (FWS)

1. A Phase II coordination meeting was held with representatives of the USFWS to review the detailed design of the subject project and to obtain their views on the plan design. Attending the meeting were Mr. Maurice Taylor and Mr. Mike Nishimoto of FWS, and Mr. Clarence Lee and Ms Ruby Mizue of POD.

2. Mr. Lee reviewed the design of the proposed plan of improvements, describing each of the structures and the deviations from the plan discussed during Phase I. Essentially, the plan concept has not changed, but the availability of more detailed topographic maps and the refinement of the design have resulted in minor modifications and alterations in lengths, heights, and widths of certain structures.

3. In general, the FWS concurred with the present design, although several areas of concern were pointed out, and these concerns are summarized as follows:

a. The 15-foot drop structure may be an obstacle to migratory species. While some species of gobies are capable of migrating over vertical obstacles of considerable height, it is not certain that all the species in Iao Stream, particularly the rare and endangered ones, would be able to accomplish the migration. Mr. Lee pointed out that the drop structure has been reduced 10 feet from the 25-foot high drop structure proposed in Phase I studies. The drop structure is required to reduce flow velocities sufficiently and allow for preservation of the downstream sections in their natural condition. Elimination of the drop structure would essentially require complete channelization of the downstream sections.

As an alternative suggestion, Mr. Taylor recommended that the surface of the drop structure be as rough as possible. Attempts will be made by Mr. Taylor to monitor the effect of the drop structure on fish migration subsequent to project implementation. Furthermore, all concrete channel sections over which the low flows pass should be kept as rough as possible. Mr. Lee concurred that this could be done by specifying the type of finish in the construction contract.

5 March 1976

PODED-P
SUBJECT: Iao Stream Flood Control Project, Maui, Hawaii
Coordination with U.S. Fish and Wildlife Service (FWS)

b. Regarding the boulder-concrete lining of certain channel sections, Mr. Nishimoto questioned the spacing of the boulders. He recommended that spacing be as close as possible to maximize shade and places of shelter for aquatic species. In the low flow channel, he suggested that spacing be 6 inches or less between boulders. Mr. Lee agreed that the spacing would be specified in the contract as described.

4. Mr. Lee concluded the meeting by noting that construction is scheduled to begin in FY 77, provided that funds are available. He will send a summary of the recent changes in the plan to Mr. Taylor with a request for formal comments to be included in the Phase II General Design Memorandum.

Ruby Mizue
RUBY MIZUE

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

March 29, 1996

Planning and Operations Division

Don Hibbard, Ph.D.
Deputy State Historic Preservation Officer
State Historic Preservation Division
Department of Land and Natural Resources
33 South King Street, 6th Floor
Honolulu, Hawaii 96813

Dear Dr. Hibbard:

The U.S. Army Corps of Engineers, Honolulu Engineer District has assessed the potential effects of proposed modifications to the Iao Stream Flood Control Project area at Iao Stream, Wailuku, Maui Island (enclosures). The entire proposed undertaking consists of concrete drainage channel modifications confined to instream sections of the drainage way. Previous Section 106 consultation between the U.S. National Park Service and the President's Advisory Council on Historic Preservation in 1974 resulted in the Bishop Museum's identification of 2 historic properties in the uppermost portion of Iao Stream. This report is referenced in your library under Connolly, Robert, 1974, *Phase I Archaeological Survey of Iao Valley Flood Control Project Area, Maui*, Bishop Museum Manuscript Report 100374. This initial assessment did not identify any surface historic properties at the present project location and subsequent construction of the Iao Stream flood control improvements did not discover any unanticipated historic properties within the entire stream flow channel. Currently designated historic properties consisting of the Wailuku Historic District, Halekii and Pihana heiau, the Wallace System Complex, and the North Terrace System Complex are not located within the project area, nor will they be directly or indirectly impacted by any activities associated with construction of the proposed undertaking (enclosure). We request your comments and concurrence in determining that pursuant to 36 CFR Sections 800.4 and 800.5 of the regulations of the President's Advisory Council on Historic Preservation this proposed undertaking for flood control channel modifications at Iao Stream, Wailuku, Maui Island, will have No Effect on any

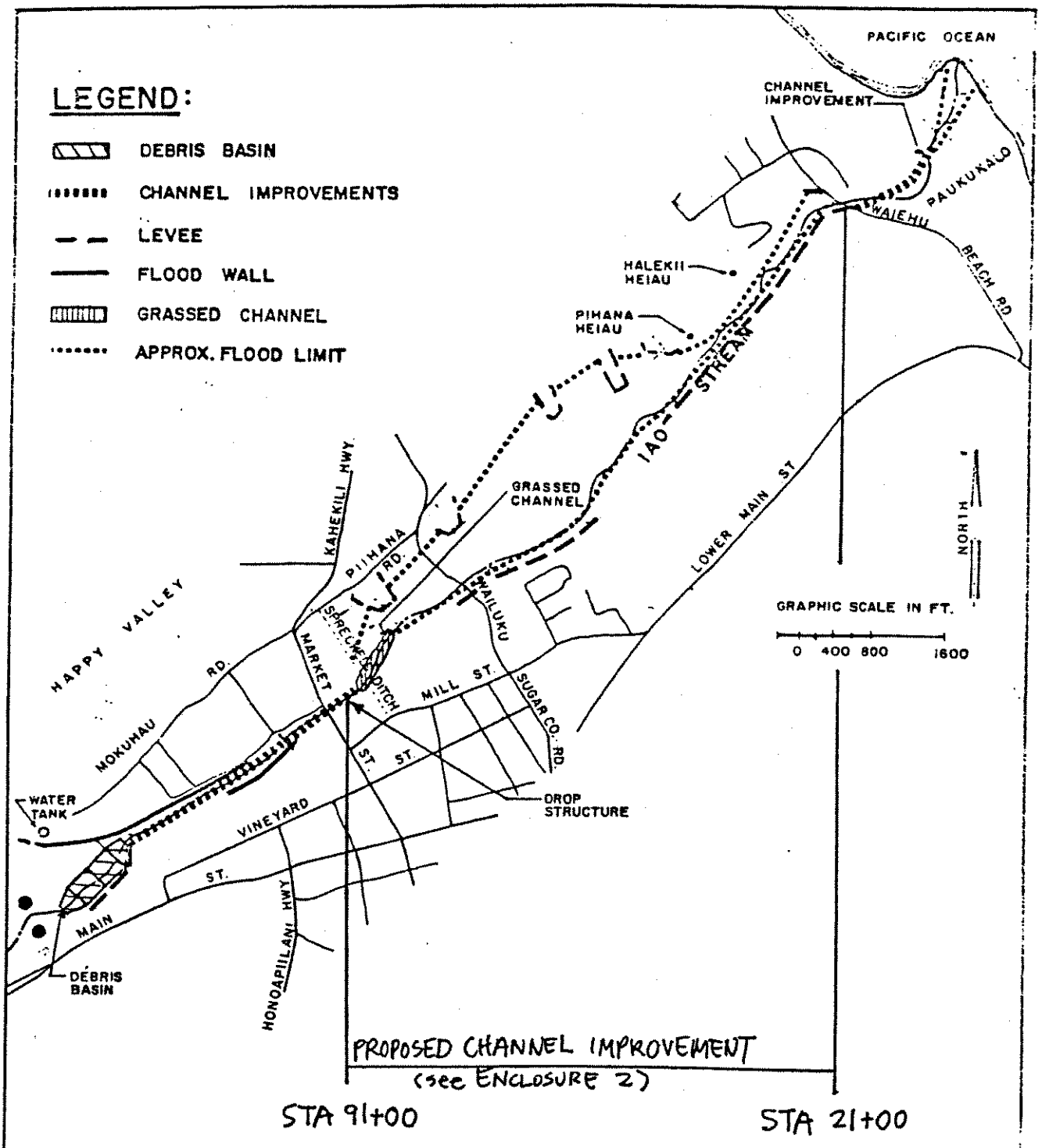
identified or potential historic properties.

Thank you for your timely response in order that we may proceed to finalize the supplementary dEA and dFONSI and complete the Section 106 compliance process. If you have any further questions or comments, please contact Mr. Farley K. Watanabe, Staff Archaeologist at 438-7007 of my Planning & Operations Division.

Sincerely,

Ray H. Jyo, P.E.
Director of Engineering
and Technical Services

Enclosures



FLOOD CONTROL AND ALLIED PURPOSES
IAO STREAM
MAUI, HAWAII

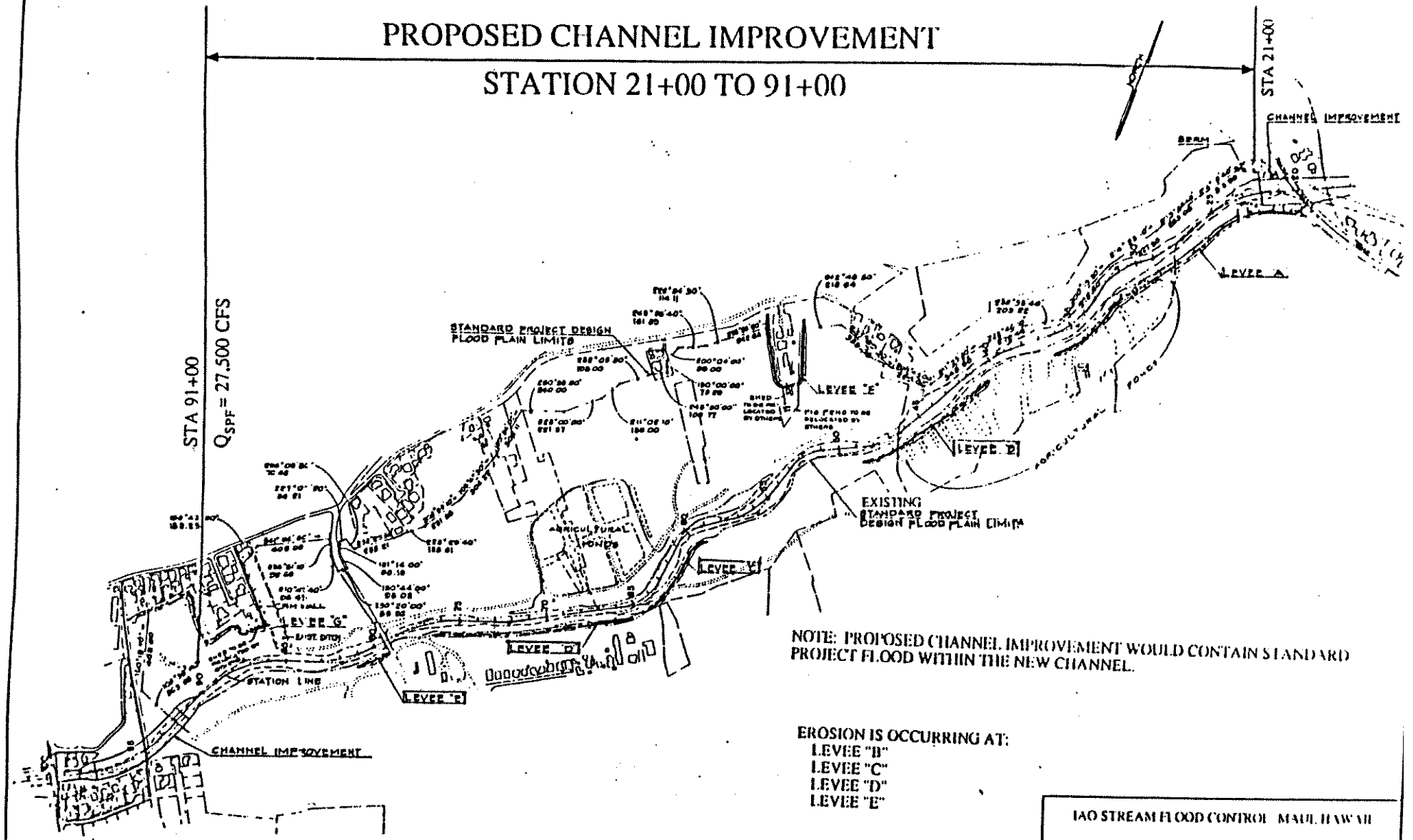
ORIGINAL PROJECT AREA,
ALTERNATIVE PLAN B

U.S. ARMY ENGINEER DISTRICT, HONOLULU
TO ACCOMPANY: DESIGN MEMORANDUM NO. 2

Enclosure 1.

Enclosure 2.

PROPOSED CHANNEL IMPROVEMENT
STATION 21+00 TO 91+00



NOTE: PROPOSED CHANNEL IMPROVEMENT WOULD CONTAIN STANDARD PROJECT FLOOD WITHIN THE NEW CHANNEL.

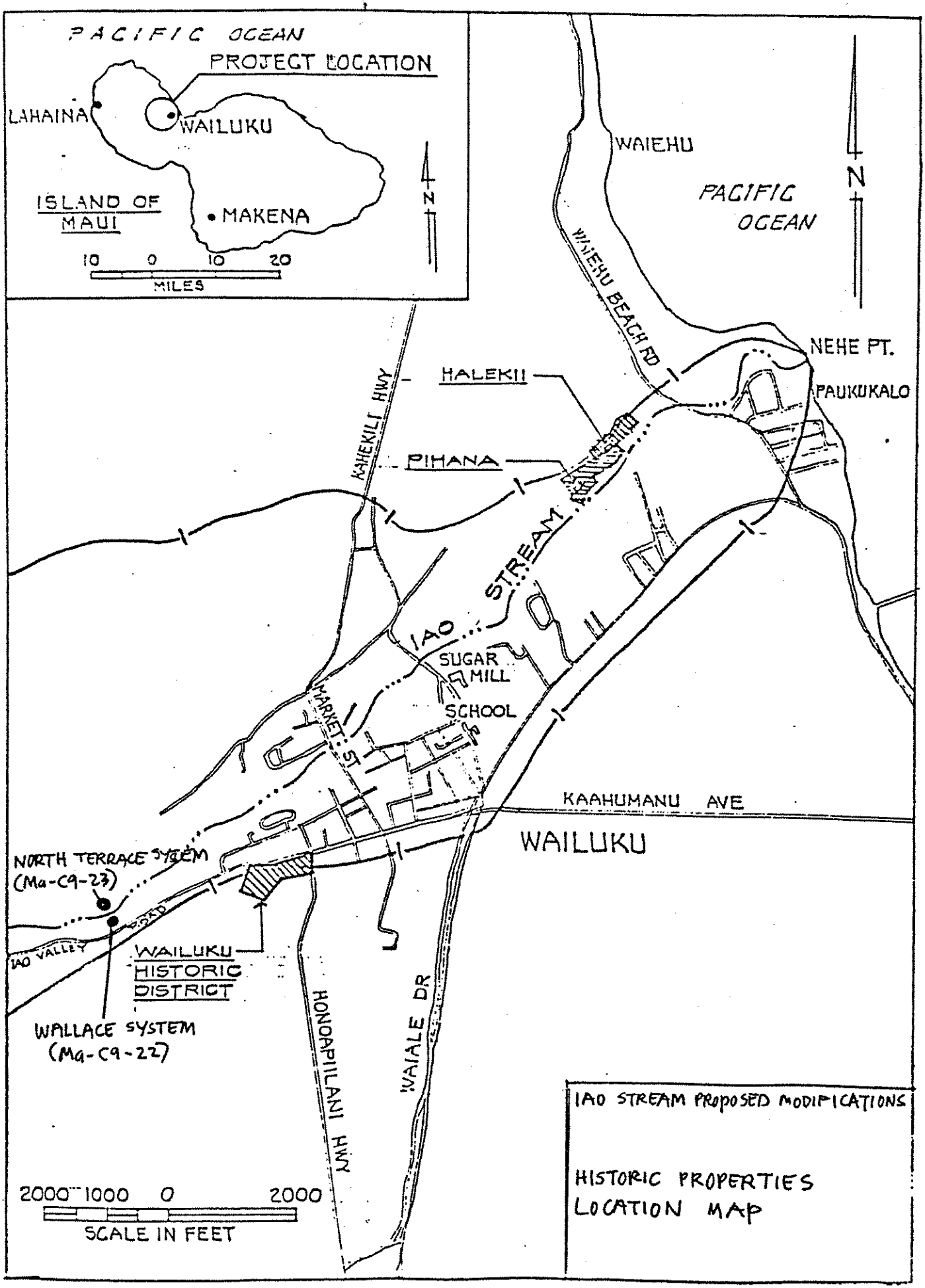
EROSION IS OCCURRING AT:
- LEVEE "B"
- LEVEE "C"
- LEVEE "D"
- LEVEE "E"

GRAPHIC SCALE

IAO STREAM FLOOD CONTROL MAUI HAWAII

SITE MAP

US ARMY ENGINEER DISTRICT HONOLULU


PACIFIC OCEAN
PROJECT LOCATION
LAHAINA
WAILUKU
ISLAND OF MAUI
MAKENA
10 0 10 20
MILES
N
WAIEHU
PACIFIC OCEAN
N
WAIEHU BEACH RD
NEHE PT.
PAUKUKALO
HALEKII
KAHEKILI HWY
PIHANA
IAO STREAM
IAO
SUGAR MILL
SCHOOL
MARKET ST
KAAHUMANU AVE
WAILUKU
NORTH TERRACE SYSTEM (Ma-C9-23)
IAO VALLEY ROAD
WAILUKU HISTORIC DISTRICT
WALLACE SYSTEM (Ma-C9-22)
HONOAPIILANI HWY
WAIALE DR
2000 1000 0 2000
SCALE IN FEET
IAO STREAM PROPOSED MODIFICATIONS
HISTORIC PROPERTIES LOCATION MAP

Enclosure 3.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT COLOMA-AGARAN

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

REF: HP-JEN

JUN 17 1996

Mr. Ray H. Jyo, Director of Engineering
Planning and Operations Division
Department of the Army
U.S. Army Engineer District, Honolulu
Ft. Shafter, Hawaii 96858-5440

LOG NO: 17189
DOC NO: 9606KD04

Dear Mr. Jyo:

SUBJECT: **National Historic Preservation Act, Section 106 Review of the Iao Stream Flood Control Project Modifications**
Wailuku, Wailuku District, Maui

The Corps of Engineers proposes to make improvements along sections of the existing Iao Stream channel, in an area between Market Street and Waiehu Beach Road in Wailuku. The improvements will be confined to the existing concrete channel area and are within the previously impacted zone of the Iao Flood Control Project.

As indicated in your letter, the proposed improvements will not occur within or near areas of known historic sites. We concur with your determination that the project will have "no effect" on historic sites.

Please contact Ms. Theresa K. Donham at 243-5169 if you have any questions.

Aloha,

Gilbert D. Coloma-Agaran
for MICHAEL D. WILSON,
State Historic Preservation Officer

KD:jen

OFFICE	ACTION	INSC
Dir of Engrg	Tech Svcs	JN
Deputy		
Secretary		
Cost		
Constr		
Env		
Plng	L	19
Svcs		
Tech		

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FT. SHAFTER, HAWAII 96858-5440
March 8, 1996

REPLY TO
ATTENTION OF

Planning and Operations Division

Gregory Pai, Ph.D.
Director
Office of State Planning
P.O. Box 3540
Honolulu, Hawaii 96811-3540

Dear Dr. Pai:

The U.S. Army Corps of Engineers, Honolulu District, is planning a modification of the Iao Stream Flood Control project, Maui, Hawaii. The modification is required to correct undermining of the levee toe resulting from natural streambed erosion processes in the stream.

The modification will consist of concrete lining the affected reach from river station 91+50 to 21+50. The bottom would be 40 feet wide with sloping sides, and would be about 12 feet deep (see enclosed report).

An environmental document is in preparation for this project to update the Final Environmental Statement issued in April 1975.

a. There were no impacts to endangered, threatened, proposed or candidate species identified during the original study, and none are anticipated; however coordination has been initiated with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service.

b. Endemic stream organisms will continue to be affected by the present withdrawal of water from the stream for agricultural purposes; however, the project will include "low flow" provisions to take advantage of water which might become available in the future.

c. The construction contractor will be required to comply with our standard environmental protection clauses contained in the contract specifications, including protection of water quality, cultural resources protection, etc.

d. The State Historic Preservation Officer has concurred with our determination that the project will have no effect on historic properties.

e. The concrete channel will be contained within the footprint of the existing channel.

We assume a CZM Consistency Determination was issued for the original project, but we have been unable to find a copy in our files. Since the project will be within the footprint of the original project, we believe that the original consistency determination is still valid for this project and that a new consistency determination will not be required. We would appreciate your concurrence with our determination.

Should you have any questions, please feel free to contact Mr. Bill Lennan at 438-2264 or Ms. Sharon Okamoto at 438-2249 of my planning staff.

Sincerely,

Ray H. Jyo, P.E.
Director of Engineering
and Technical Services

Enclosures

PP-J SO 6/25

OFFICE OF STATE PLANNING

Office of the Governor

MAILING ADDRESS: P.O. BOX 3540, HONOLULU, HAWAII 96811-3540
STREET ADDRESS: 250 SOUTH HOTEL STREET, 4TH FLOOR
TELEPHONE: (808) 587-2846, 587-2800

BENJAMIN J. CAYETANO, Governor

FAX: Director's Office 587-2848
Planning Division 587-2824

Ref. No. Z-0134

OFFICE	ACTION	INFO
Dir of Engrg	Tech	21
Deputy		
Secretary		
Cost		
~~Des~~ Const		
Env		
~~FM&S~~		
Ping	F	25
Svcs		
Tech		

June 18, 1996

Mr. Ray H. Jyo, P.E.
Director of Engineering
Department of the Army
Pacific Ocean Division, Corps of Engineers
Ft. Shafter, Hawaii 96858-5440

Dear Mr. Jyo:

Subject: Hawaii Coastal Zone Management (CZM) Program Federal Consistency Review for Modifications to the Iao Stream Flood Control Project, Maui, Hawaii

The proposal to construct modifications to the existing Iao Stream flood control project should be evaluated for consistency with Hawaii's CZM Program and a consistency determination submitted for review. We did not review the original flood control project for CZM consistency because it was started prior to the establishment of the Hawaii CZM Program. Due to this fact and because the proposed modifications will significantly change the existing conditions we cannot consider the proposal as a modification to an existing CZM consistency determination.

It is our understanding that an environmental document is being prepared for the proposed modifications. Please submit the environmental document and the CZM consistency determination to our CZM Program. We will try to complete our review as expeditiously as possible. Thank you for your cooperation in complying with Hawaii's CZM Program. If you have any questions, please call our CZM office at 587-2878.

Sincerely,

Gregory G.Y. Pai, Ph.D.
Director

cc: U.S. National Marine Fisheries Service, Pacific Area Office
U.S. Fish and Wildlife Service, Pacific Islands Ecoregion
Department of Health, Clean Water Branch
Department of Land & Natural Resources
Planning & Technical Services Branch
Commission on Water Resource Management
Planning Department, County of Maui

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

29 July, 2005

REPLY TO
ATTENTION OF
Environmental Technical Branch
Engineering and Construction Division

President
Central Maui Hawaiian Civic Club
P.O. Box 483
Kahalui, Hawaii 96733

Dear Sir:

The U.S. Army Engineer District, Honolulu (POH) is proposing to undertake a flood control project on the lower (makai) segments of Iao Stream (multiple TMK) in Wailuku, Maui Island (Figure 1). Five (5) alternatives are being considered as flood control measures and, for the most part, these measures are confined to the stream channel proper and certain areas of the northern banks of the stream in the upper (mauka) section of the project area. No modification is being envisioned along the banks of the stream in the lower portion (makai) of the project area, across from the area encompassing Halekii Heiau.

Typical cross-sections of the flood control measures are illustrated in Figures 2, 3, and 4. Alternative 1 will result in a trapezoidal concrete-lined channel. Alternative 2 will consist of a rectangular concrete-lined channel plus approximately 50-feet wide modification on the left (north) bank floodplain. Alternative 3 will have the channel concrete lined with boulder inverts and modifications to the left bank flood plain, again about 50 feet wide. Alternative 4 will consist of levee construction with toe repairs. The fifth alternative would leave the channel in its natural state with the removal of all existing flood control features.

Archaeologist from my Environmental Technical Branch visited the project area with the State Historic Preservation Office Maui Island staff archaeologist, Dr. Melissa Kirkendall. During the site visit, it was determined that potential significant subsurface cultural resources may be present in the floodplain banks along the upper sections of the project area. Proposed modification of the floodplain banks in these upper areas may potentially impact these buried significant cultural resources. It was determined that a program of archaeological monitoring during construction should ensure that these resources will not be adversely impacted by the flood control construction activities.

A cultural impact study (CIS) was also undertaken for this project. The CIS included personal interviews of a number of native Hawaiian cultural experts knowledgeable in the folklore of the project area and its surroundings. The study identified no areas of traditional importance within the project area; however, this conclusion is still in draft format and a copy of this report will be submitted to your office for review and comments. A copy of the final report will then be furnished to your office.

Based on the above information, POH has made the determination that the proposed Iao Stream Flood Control Project will have "no adverse effect on historic properties", provided a program of archaeological monitoring accompanies construction activities at the upper portion of the project area. Furthermore, an archaeological monitoring plan will need to be compiled for review and acceptance by your office prior to the start of any construction activities. Furthermore, the archaeological monitoring will be undertaken by a reputable archaeological firm with prolonged experience in Hawaiian archaeology. In compliance with the National Historic Preservation Act of 1966, pursuant to implementing regulations 36 CFR Part 800 (NHPA), your concurrence to this determination is being requested. POH is also requesting concurrence from the Hawaii State Historic Preservation Officer and the Office of Hawaiian Affairs, in accordance with the NHPA.

Should you require any additional information, please contact Kanalei Shun at 438-7000.

Sincerely,

James L. Bersson
Chief, Engineering and
Construction Division

Enclosures (4)

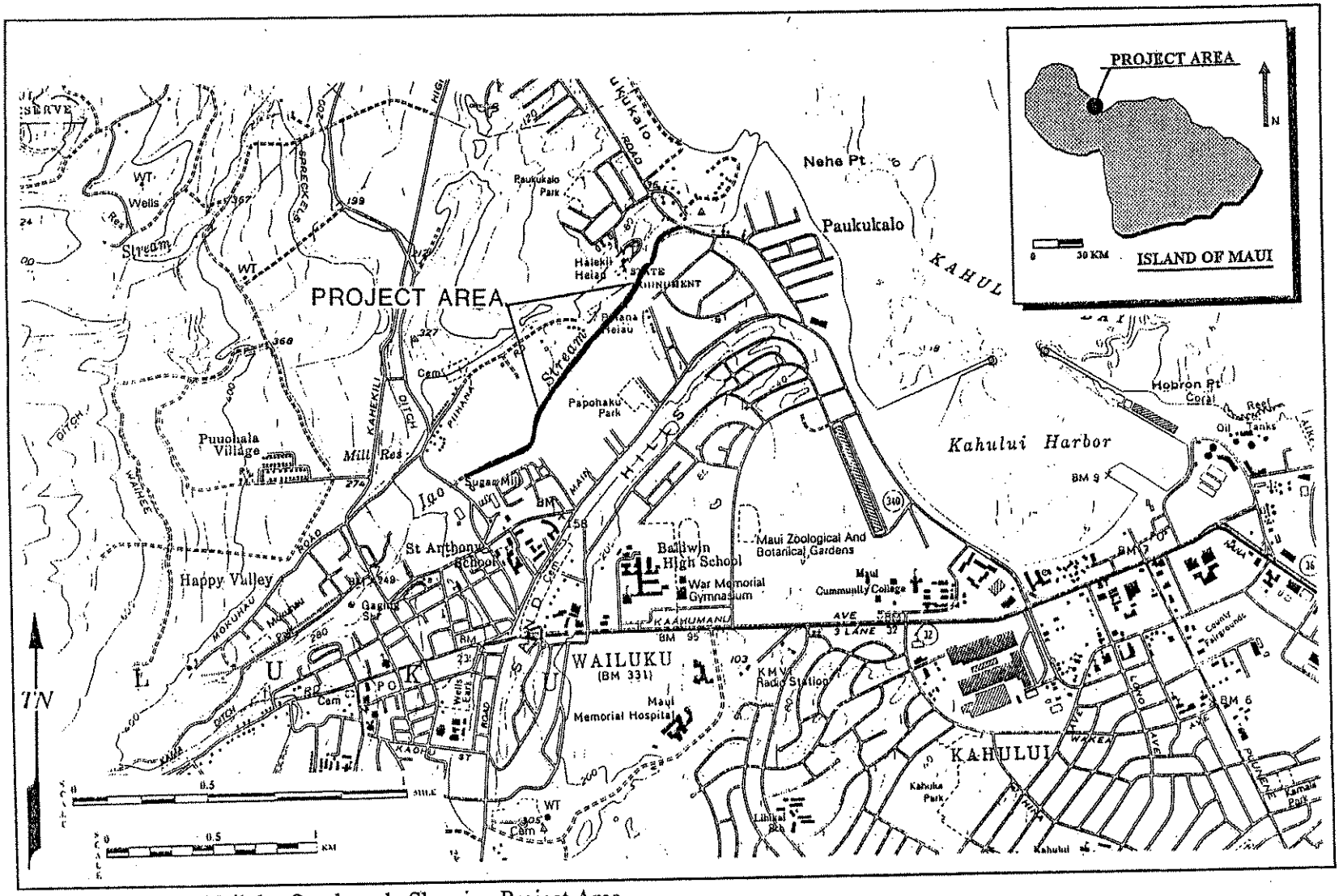


Figure 1: USGS Wailuku Quadrangle Showing Project Area.

FIG. 2

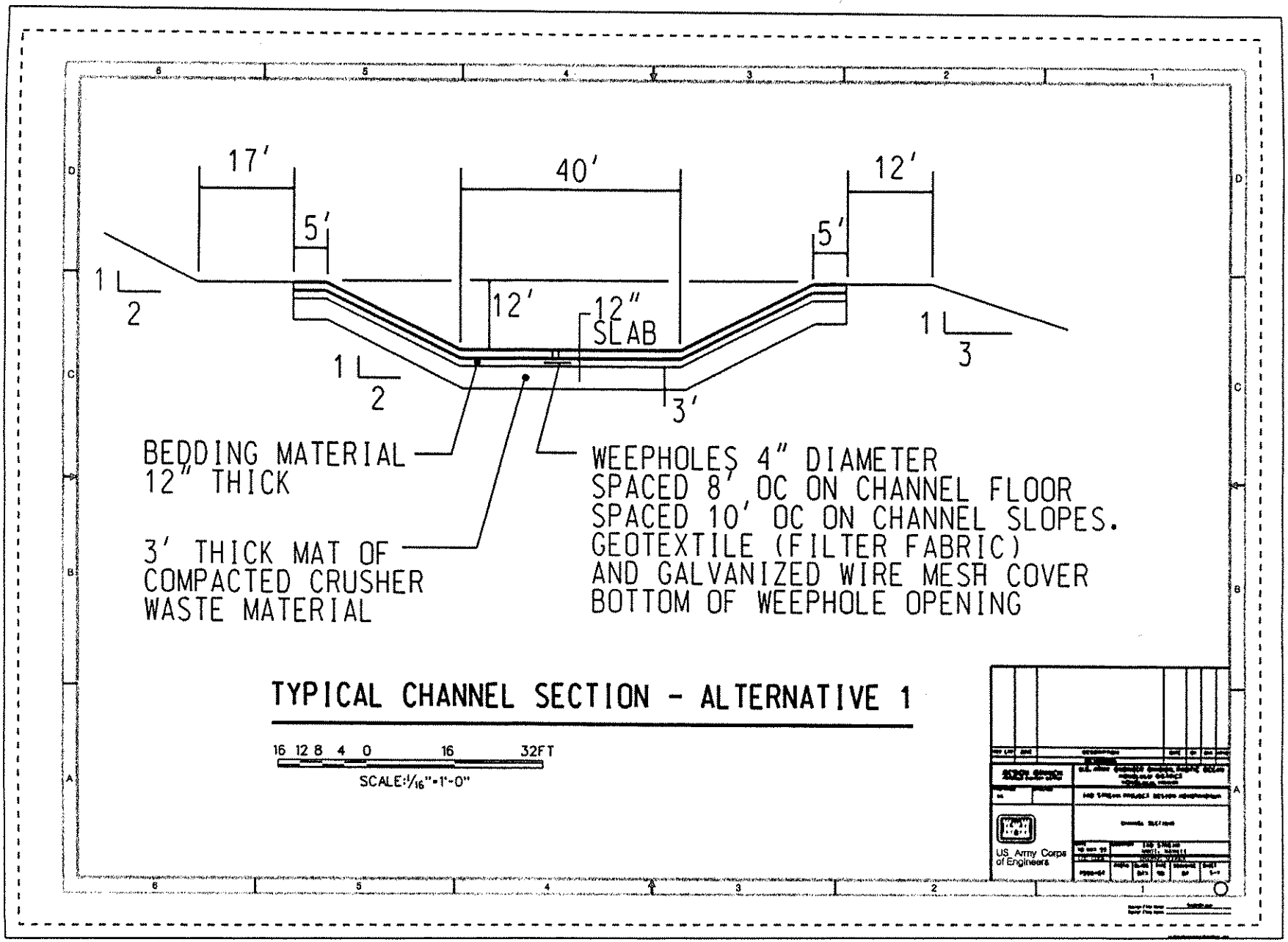


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FIG. 3

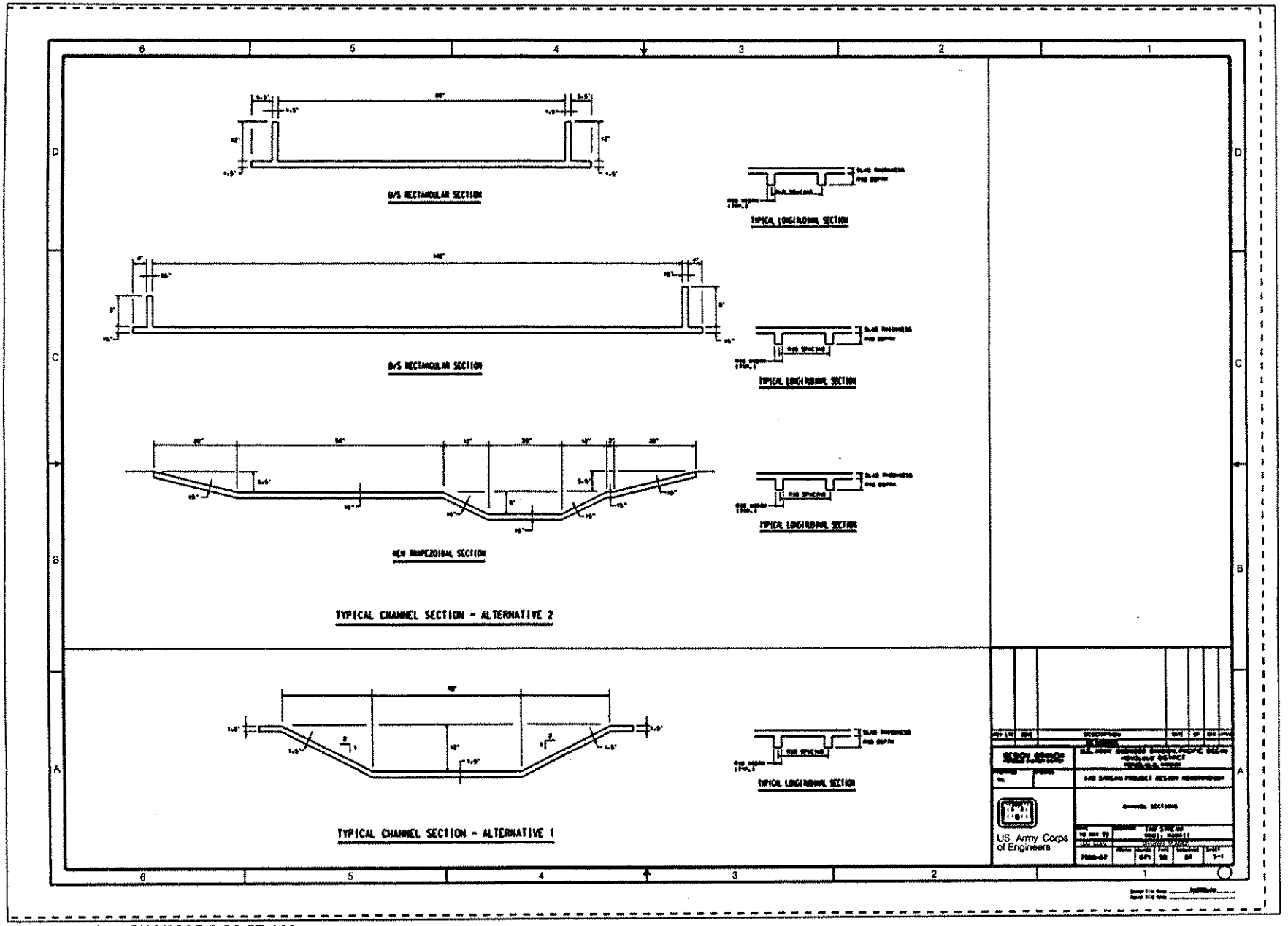

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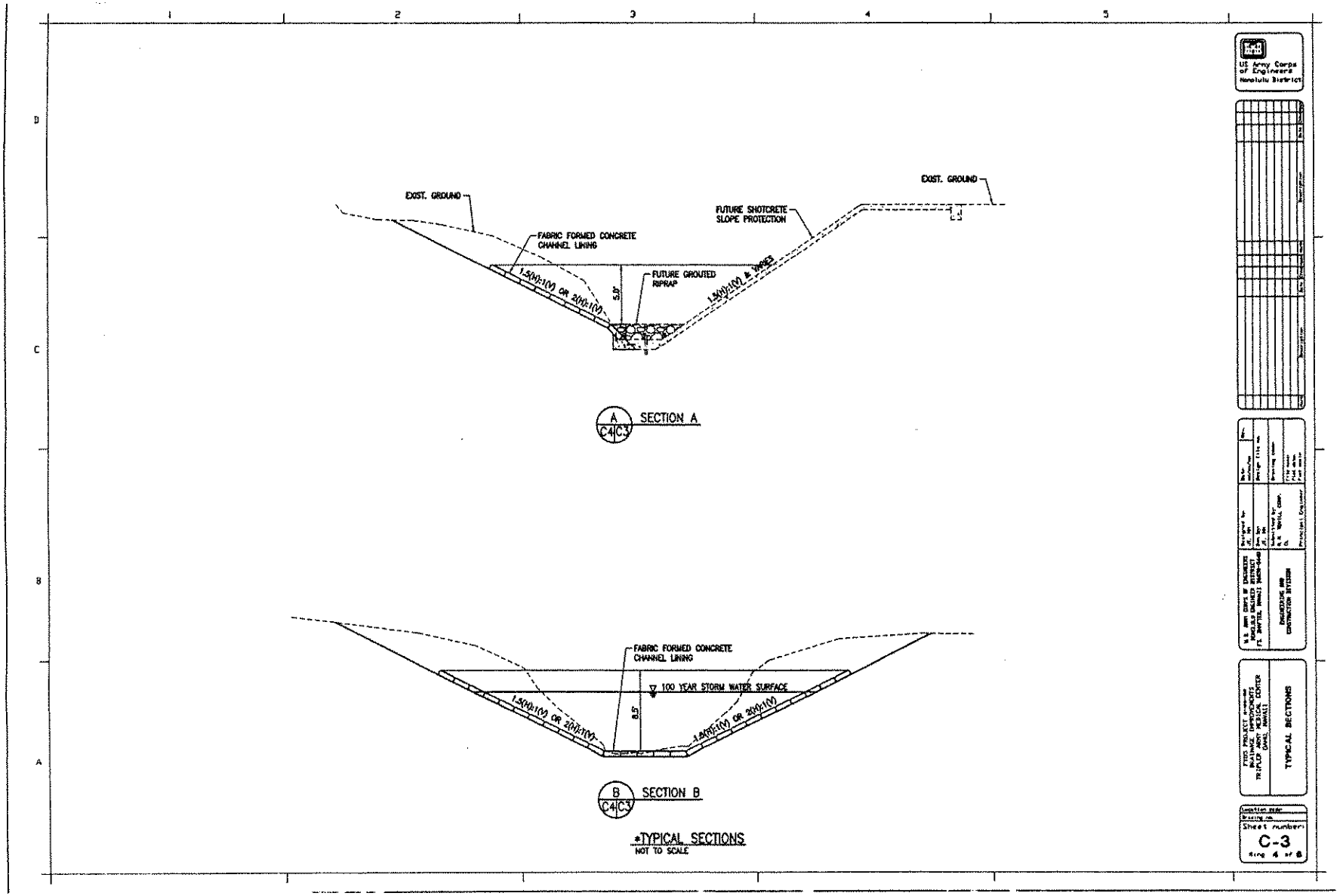
FIG. 4


EXIST. GROUND
FABRIC FORMED CONCRETE CHANNEL LINING
FUTURE GROUTED RIPRAP
FUTURE SHOTCRETE SLOPE PROTECTION
EXIST. GROUND
1.5(H):1(V) OR 2(H):1(V)
1.5(H):1(V) OR 2(H):1(V)
5.5'
A C4|C3 SECTION A
FABRIC FORMED CONCRETE CHANNEL LINING
100 YEAR STORM WATER SURFACE
8.5'
1.5(H):1(V) OR 2(H):1(V)
1.5(H):1(V) OR 2(H):1(V)
B C4|C3 SECTION B
*TYPICAL SECTIONS
NOT TO SCALE
US Army Corps of Engineers Honolulu District
TYPICAL SECTIONS
Sheet number C-3
Sheet 4 of 8

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

29 July, 2005

REPLY TO
ATTENTION OF
Environmental Technical Branch
Engineering and Construction Division

Mr. Clyde Namuo, Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Namuo:

The U.S. Army Engineer District, Honolulu (POH) is proposing to undertake a flood control project on the lower (makai) segments of Iao Stream (multiple TMK) in Wailuku, Maui Island (Figure 1). Five (5) alternatives are being considered as flood control measures and, for the most part, these measures are confined to the stream channel proper and certain areas of the northern banks of the stream in the upper (mauka) section of the project area. No modification is being envisioned along the banks of the stream in the lower portion (makai) of the project area, across from the area encompassing Halekii Heiau.

Typical cross-sections of the flood control measures are illustrated in Figures 2, 3, and 4. Alternative 1 will result in a trapezoidal concrete-lined channel. Alternative 2 will consist of a rectangular concrete-lined channel plus approximately 50-feet wide modification on the left (north) bank floodplain. Alternative 3 will have the channel concrete lined with boulder inverts and modifications to the left bank flood plain, again about 50 feet wide. Alternative 4 will consist of levee construction with toe repairs. The fifth alternative would leave the channel in its natural state with the removal of all existing flood control features.

Archaeologist from my Environmental Technical Branch visited the project area with the State Historic Preservation Office Maui Island staff archaeologist, Dr. Melissa Kirkendall. During the site visit, it was determined that potential significant subsurface cultural resources may be present in the floodplain banks along the upper sections of the project area. Proposed modification of the floodplain banks in these upper areas may potentially impact these buried significant cultural resources. It was determined that a program of archaeological monitoring during construction should ensure that these resources will not be adversely impacted by the flood control construction activities.

A cultural impact study (CIS) was also undertaken for this project. The CIS included personal interviews of a number of native Hawaiian cultural experts knowledgeable in the folklore of the project area and its surroundings. The study identified no areas of traditional importance within the project area; however, this conclusion is still in draft format and a copy of this report will be submitted to your office for review and comments. A copy of the final report will then be furnished to your office.

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Should you require any additional information, please contact Kanalei Shun at 438-7000.

Sincerely,

James L. Bersson
Chief, Engineering and
Construction Division

Enclosures (4)

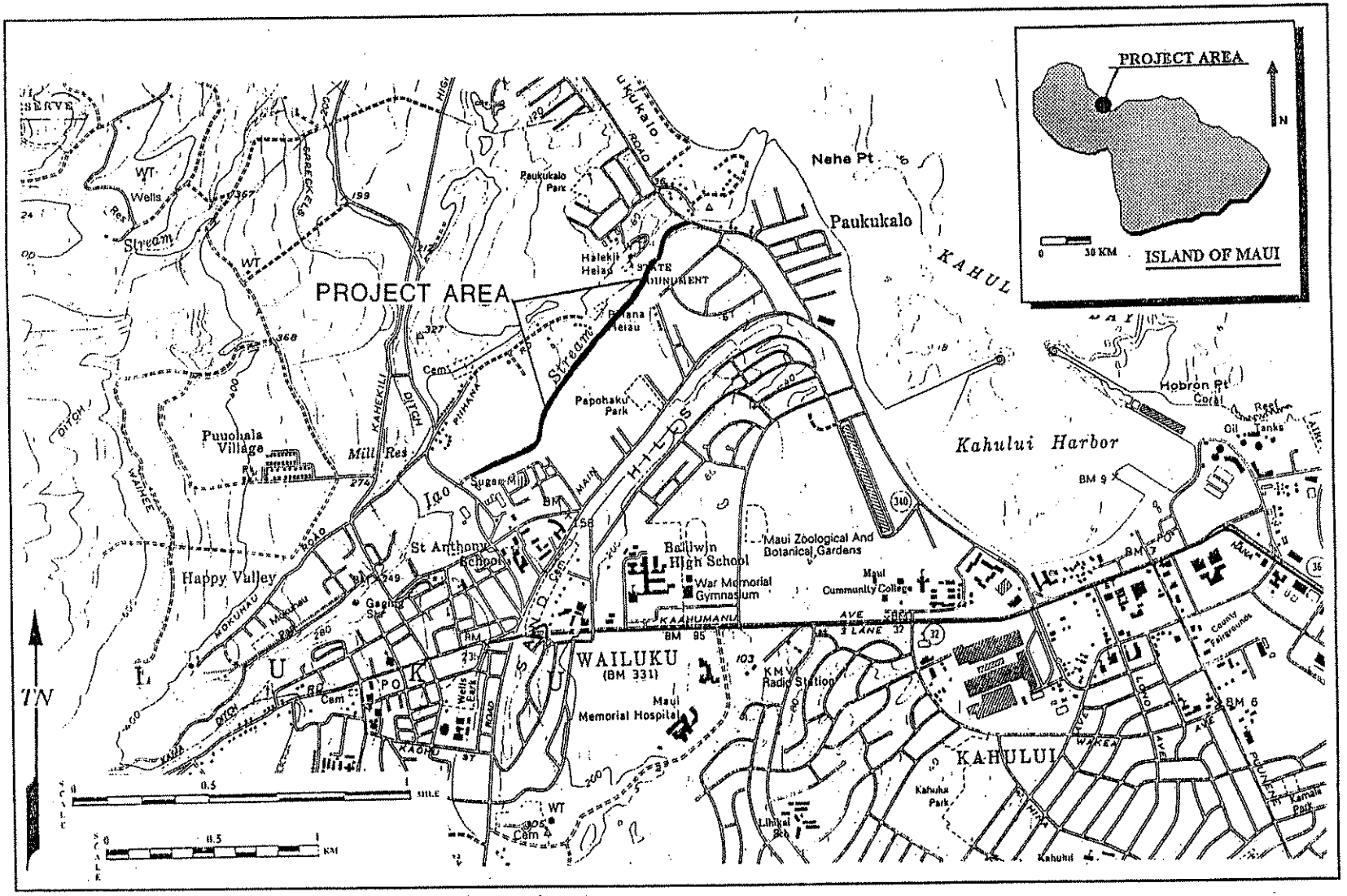

Figure 1: USGS Wailuku Quadrangle Showing Project Area.

FIG. 2

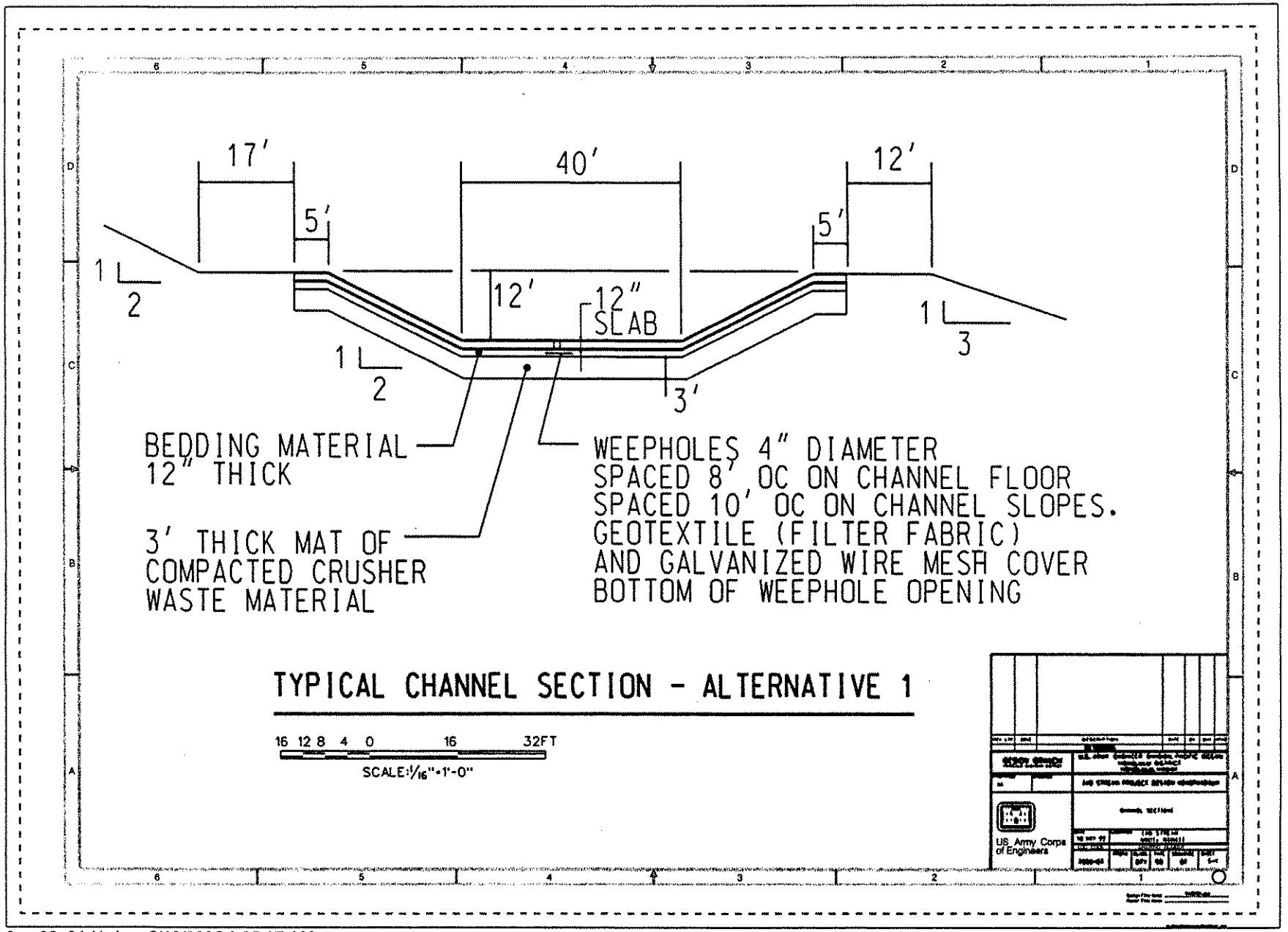

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FIG. 3

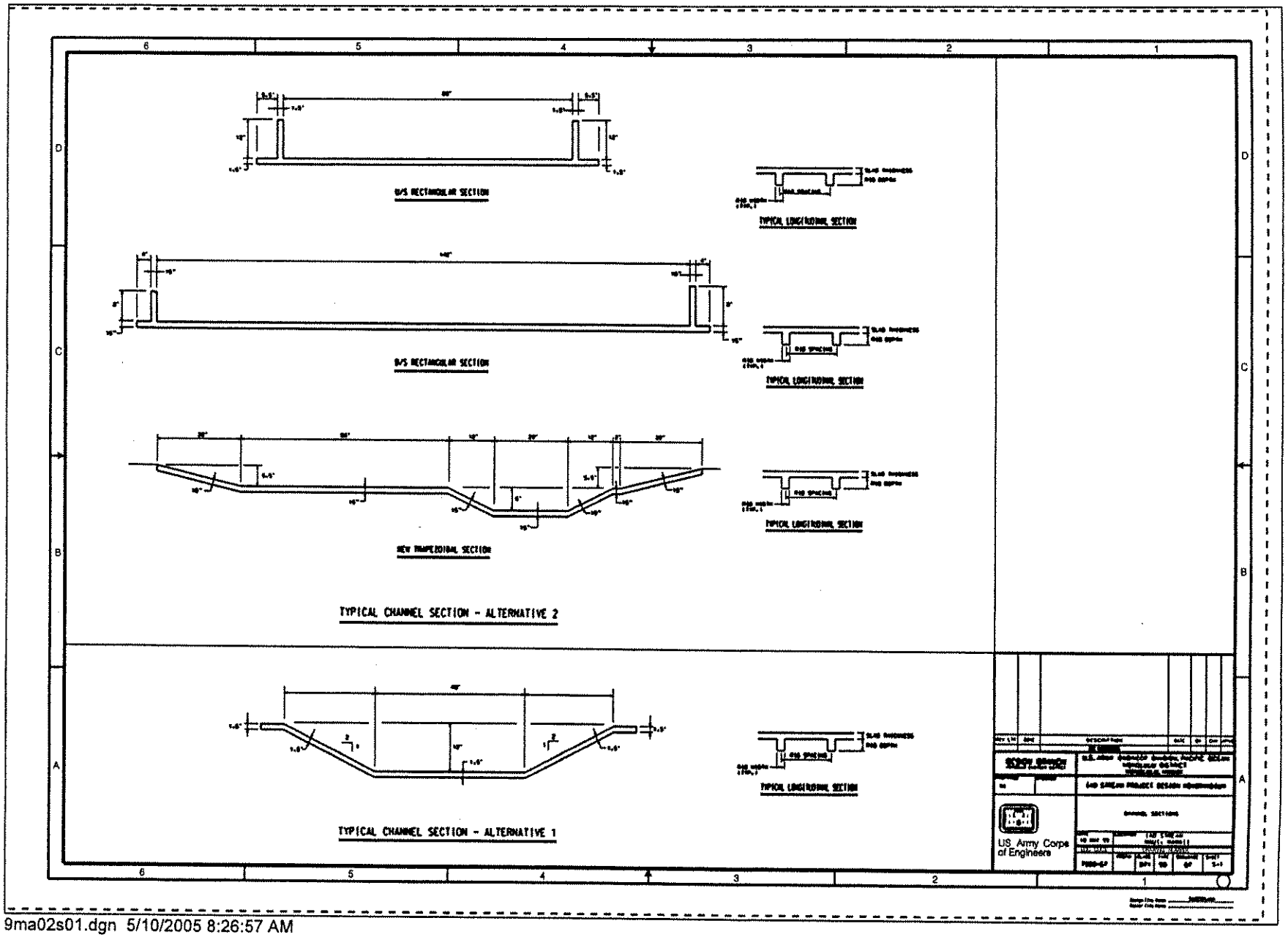

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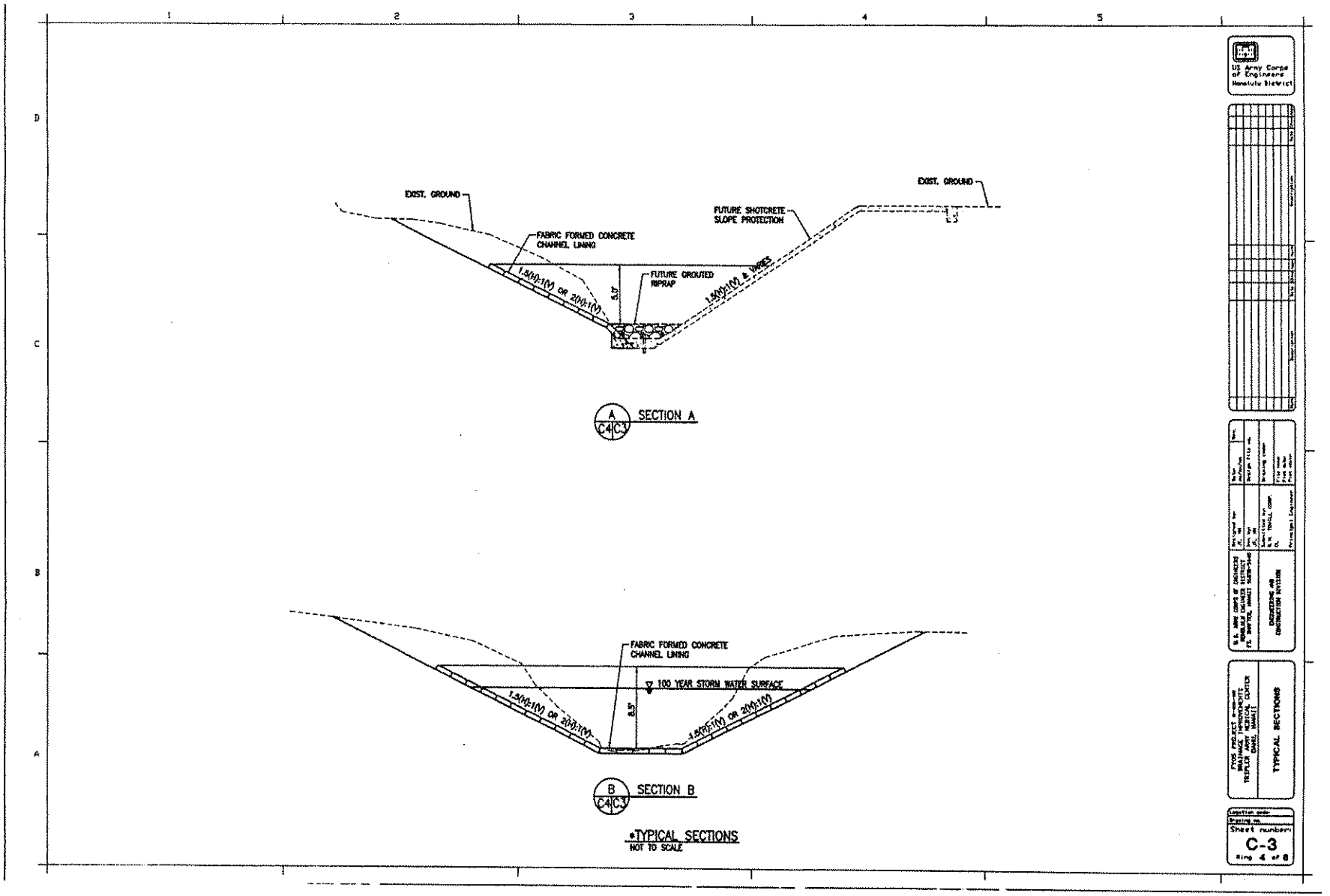
FIG. 4


EXIST. GROUND
FABRIC FORMED CONCRETE CHANNEL LINING
1.5(H):1(V) OR 2(H):1(V)
8.5'
FUTURE GROUTED RIPRAP
FUTURE SHOTCRETE SLOPE PROTECTION
1.5(H):1(V) & VARIES
EXIST. GROUND
A C4|C3 SECTION A
FABRIC FORMED CONCRETE CHANNEL LINING
100 YEAR STORM WATER SURFACE
1.5(H):1(V) OR 2(H):1(V)
8.5'
1.5(H):1(V) OR 2(H):1(V)
B C4|C3 SECTION B
*TYPICAL SECTIONS
NOT TO SCALE
US Army Corps of Engineers Honolulu District
TYPICAL SECTIONS
Sheet number: C-3

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

29 July, 2005

REPLY TO
ATTENTION OF
Environmental Technical Branch
Engineering and Construction Division

Mr. Peter Young
Chairman and State Historic Preservation Officer
Department of Land and Natural Resources
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

Dear Mr. Young:

The U.S. Army Engineer District, Honolulu (POH) is proposing to undertake a flood control project on the lower (makai) segments of Iao Stream (multiple TMK) in Wailuku, Maui Island (Figure 1). Five (5) alternatives are being considered as flood control measures and, for the most part, these measures are confined to the stream channel proper and certain areas of the northern banks of the stream in the upper (mauka) section of the project area. No modification is being envisioned along the banks of the stream in the lower portion (makai) of the project area, across from the area encompassing Halekii Heiau.

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Mr. Kanalei Shun from my Environmental Technical Branch discussed the proposed alternatives with your Maui Staff Archaeologist, Dr. Melissa Kirkendall, with a site visit occurring in August of 2004. During the site inspection, it was determined that potential significant subsurface cultural resources may be present in the floodplain banks along the upper sections of the project area. Proposed modification of the floodplain banks in these upper areas may potentially impact these buried cultural resources. To ensure no adverse impact will result to these resources from flood control construction activities, a program of archaeological monitoring during construction is being proposed. An archaeological monitoring plan will be compiled for review and acceptance by your office prior to the start of any construction activities and the archaeological monitoring will be undertaken by a reputable archaeological firm with prolonged experience in Hawaiian archaeology.

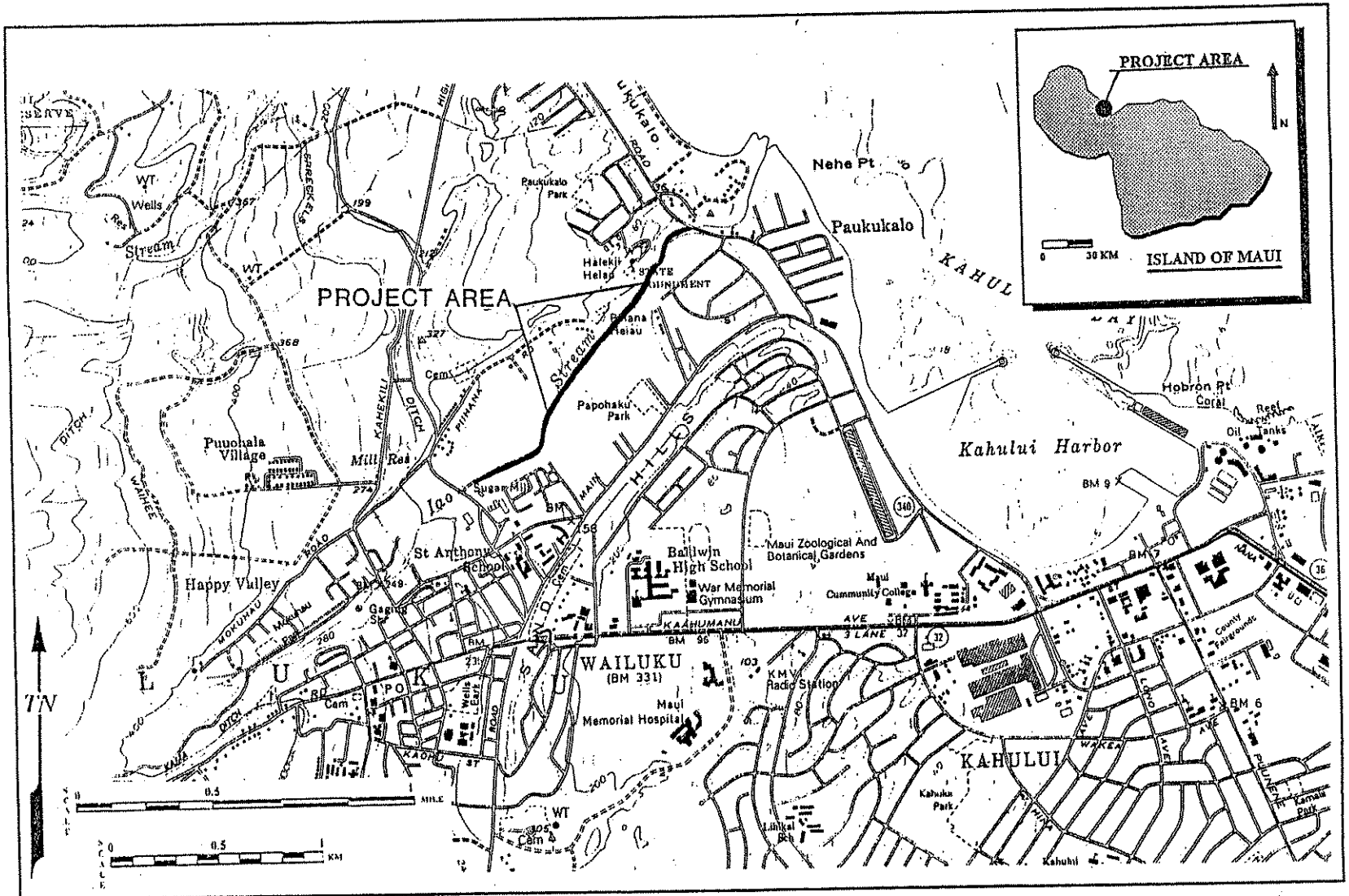
The proposed archaeological monitoring program should ensure that the Iao Stream Flood Control Project will result in a "no adverse effect to historic properties" determination. In compliance with the National Historic Preservation Act of 1966, pursuant to implementing regulations 36 CFR Part 800 (NHPA), your concurrence to this determination is being requested. POH is also requesting concurrence from the Office of Hawaiian Affairs and the Central Maui Hawaiian Civic Club, in accordance with the NHPA.

Should you require any additional information, please contact Kanalei Shun at 438-7000.

Sincerely,

James L. Bersson
Chief, Engineering and
Construction Division

Enclosures (4)


PROJECT AREA
N
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30 KM
ISLAND OF MAUI
PROJECT AREA
Nehe Pt
Paukukalo
Paukukalo Park
Hale'ki'i Heiau STATE MONUMENT
Kahului Harbor
Hobron Pt
Coral
Reef
Oil Tanks
Puuohala Village
Mill Rea
Papohaku Park
Iao Stream
Sugar Mill
Iao
Maui Zoological And Botanical Gardens
St Anthony School
Baldwin High School
War Memorial Gymnasium
Maui Community College
Happy Valley
WAILUKU
(BM 331)
KMVI Radio Station
Maui Memorial Hospital
KAHULUI
Kahului Park
Kanaha Park
Kahului
Wells
Stream
Cem
Cem A
WT
BM 9
BM 6
BM 7
BM 95
BM 156
BM 249
BM 274
BM 280
BM 305
BM 327
BM 368
BM 387
BM 399
BM 400
BM 403
BM 420
BM 440
BM 460
BM 500
BM 600
BM 700
BM 800
BM 900
BM 1000
BM 1100
BM 1200
BM 1300
BM 1400
BM 1500
BM 1600
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BM 1800
BM 1900
BM 2000
BM 2100
BM 2200
BM 2300
BM 2400
BM

FIG. 2

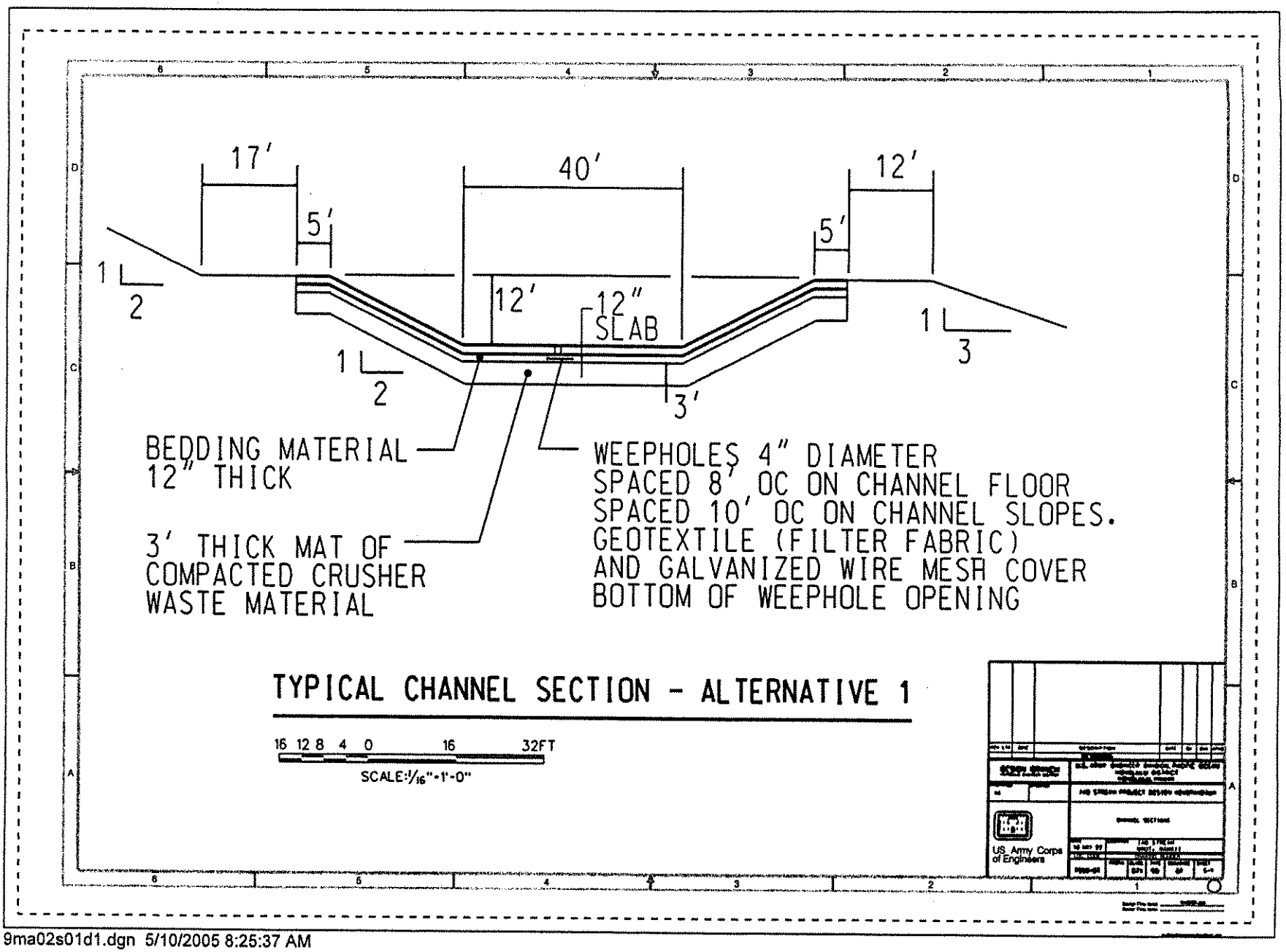

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FIG. 3

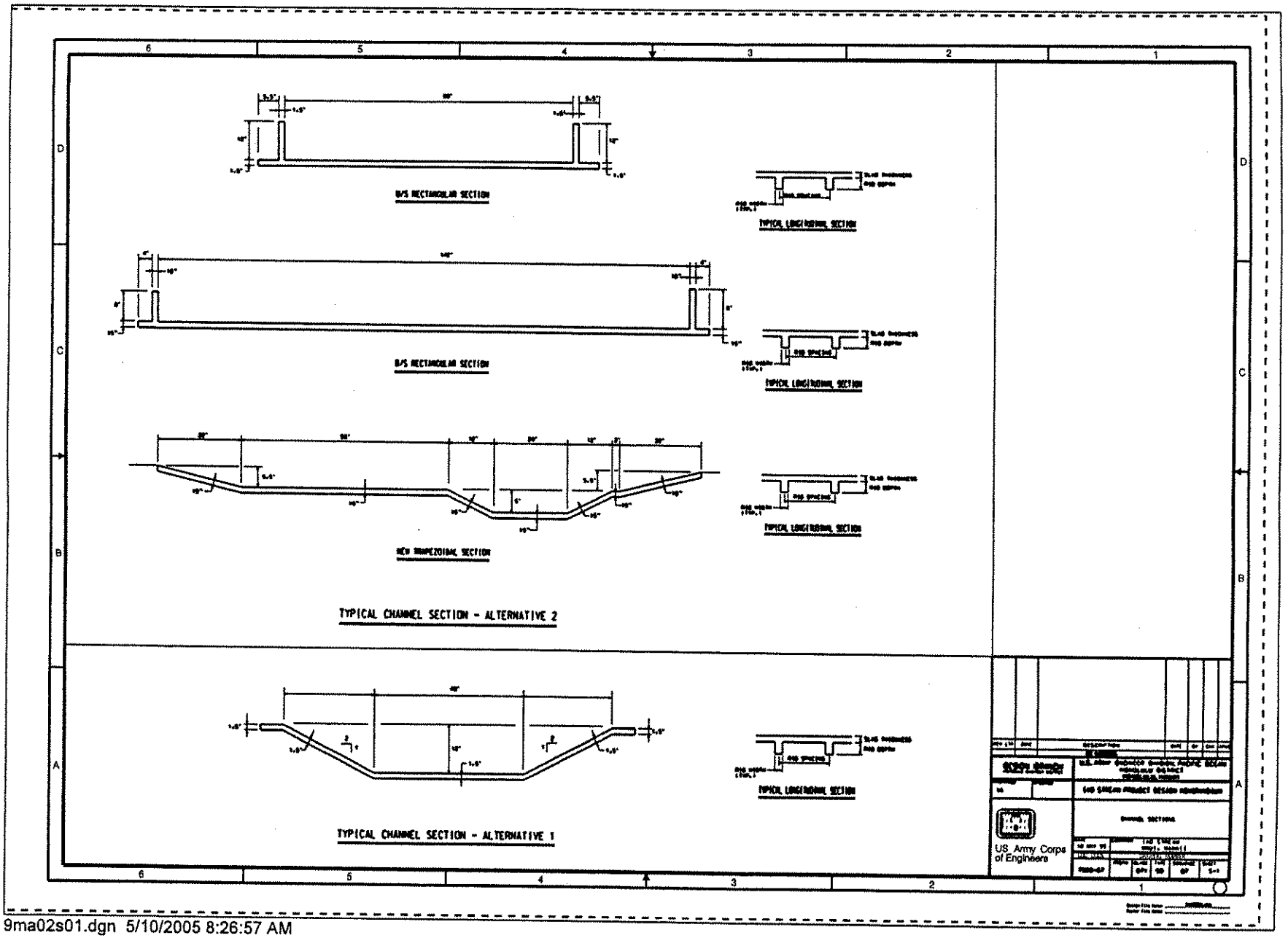

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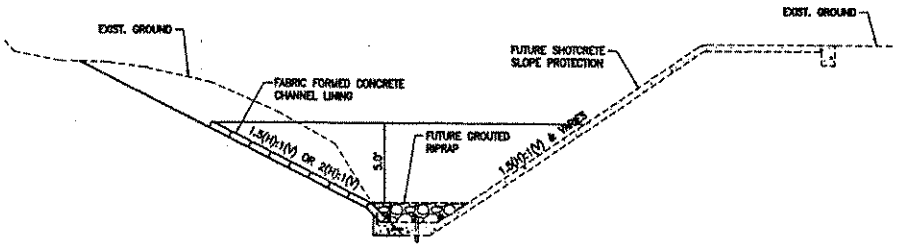
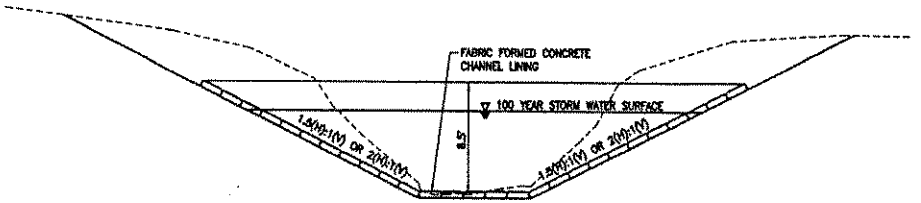
FIG. 4



A C4|C3 SECTION A



B C4|C3 SECTION B

*TYPICAL SECTIONS
NOT TO SCALE

US Army Corps of Engineers Honolulu District

U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT, FT. SHAFTER, HAWAII 96858-5440

ENGINEERING AND CONSTRUCTION DIVISION

TYPICAL SECTIONS

Sheet number: C-3
Dwg 4 of 8

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

September 10, 2007

REPLY TO

Engineering and Construction Division

Ms. Laura H. Thielen
Interim Chairman and State Historic Preservation Officer
Department of Land and Natural Resources
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

Dear Ms. Thielen:

The U.S. Army Engineer District, Honolulu (POH) is proposing to undertake a flood control project on the lower segments of Iao Stream (multiple TMK) in Wailuku, Maui Island (Figures 1, 2a, 2b, and 2c). The project area begins on the makai (east) end of Waiehu Beach Road The project was designed for Standard Project Flood (SPF) protection with a peak design discharge of 27,500 cubic feet/second (cfs) downstream at Station 22+00 and 26,000 cfs upstream at Station 92+02 (Figures 3-6). Five (5) alternatives are being considered for the flood control measures, and Alternative III has been proposed as the most viable based on engineering and cost benefits. A summary of the work under Alternative III is attached herein as Enclosure 1. Work proposed under Alternative III is an undertaking requiring consultation in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, pursuant to implementing regulations 36 CFR Part 800. The purpose of this letter is to initiate the Section 106 consultation process.

The area of potential effect (APE) of most of the work proposed under Alternative III is confined to the already highly disturbed stream channel. This work, listed under items 3-5, 7, and 9 in Enclosure 1, consists of modification to the existing channel. Such work should not affect any significant cultural resources as none is anticipated to be present within the stream channel itself.

The remaining work, listed under items 1, 2, 6, and 8, will entail new construction and/or construction excavations. A diversion levee in the form of a trapezoidal-shaped structure, 500 feet long, 65 feet wide, and 9 feet high, and a new ground water recharge basin are being proposed for construction at the upper end of the project area (see Figures 7a and 7b). Stream re-alignment and widening, anticipated to be no more than 30 feet wide, is being proposed between Stations 76+00 and 85+30 where the left (north) bank of the stream (see Figure 6) will be widen to reduce water surface profile to accommodate the County's proposed Imi Kala Bridge expansion construction. The areas of potential

effect for this work is within the Iao Stream flood plain, and in the immediate vicinity of the channel. Based on previous archaeological investigations and historical accounts, prehistoric remains, except for *auwai* to feed taro loi, would not be anticipated to be present this type of terrain. Visual inspection of the stream channel's north embankment in the Imi Kala bridge location found no evidence to indicate potential presence of an *auwai* system. Thus, a determination can be made that this new construction work will not affect potentially surface or subsurface historic sites. However, to ensure that such will remain the case, POH is recommending that a professional archaeological monitor be present during construction excavation activities associated with any work in this area. Lastly, the raising of the right bank levee in the area between stations 45+37 to 48+85 and 25+62 to 26+46 are add-ons to existing levee and should not impact any cultural resources.

Thus, POH has made the determination that the proposed modification actions to the floodplain banks and immediate adjacent areas of the existing Iao Stream channel will have no affect to historic sites. To ensure no adverse impact will result to potentially significant subsurface cultural resources from construction activities to the north embankment in the Imi Kala bridge area, a program of archaeological monitoring during construction is being proposed. An archaeological monitoring plan will be compiled for review and acceptance by your office prior to the start of any construction; the archaeological monitoring will be undertaken by a reputable archaeological firm with prolonged experience in Hawaiian archaeology. The proposed archaeological monitoring program should ensure that the Alternative III will result in a "no effect to historic properties" determination. In compliance with the National Historic Preservation Act of 1966, pursuant to implementing regulations 36 CFR Part 800 (NHPA), your concurrence to this determination is being requested. POH is also requesting concurrence from the Office of Hawaiian Affairs, the Maui County Cultural Resources Commission, and the Central Maui Hawaiian Civic Club, in accordance with the NHPA.

We are also forwarding a copy of this letter to Mr. Stanley Solamilo, Maui County Cultural Resources Commission Minute, Maui County Planning Department, 250 S. High Street, Wailuku, Hawaii 96793. If you require any additional information, please contact Mr. Kanalei Shun at 438-7000.

Sincerely,

Todd C. Barnes, P.E.
Chief, Engineering and
Construction Division

Enclosures

IAO STREAM FLOOD CONTROL PROJECT, MAUI.

ALTERNATIVE III

The project was designed for Standard Project Flood (SPF) protection with a peak design discharge of 27,500 cfs downstream at Station 22+00 and 26,000 cfs upstream at Station 92+02. Modifications are described below:

1. Construct a diversion levee, 500 feet long, 65 feet wide, and 9 feet tall on the left bank just upstream of the existing debris basin (top of project).

2. A new ground water recharge basin would be constructed by partially blocking the low flow outlets at the existing debris basin located approximately 1,100 feet upstream of Market Street at the top of the project. Water would pond in the debris basin and help facilitate percolation into the Iao aquifer during rainy season.

3. Modify drop structure between Stations 96+74.21 and 97+23.21. A new stepped drop structure would eliminate the dangerous 22-foot vertical drop and improve in-stream fish (*oopu*) passage.

4. Hydraulic improvements to the concrete channel between Stations 92+02 and 95+41. These improvements include baffle blocks and a weir within the existing concrete channel to more evenly distribute flow.

5. Roller compacted concrete (RCC) side slopes and a grouted boulder invert channel that would mainly follow the alignment of the existing stream between Stations 22+00 and 92+02 (approximately 7,000 feet long). The median base width range would vary between 60 to 80 feet.

6. Stream realignment and widening between Stations 76+02 and 85+30. The channel would be realigned to the north on the left bank to avoid existing structures to the right bank and be widened to reduce water surface profile at the Imi Kala Street Bridge.

7. Low Flow Boulder Channel within the RCC. The low flow channel would use boulders embedded in concrete to replicate a more natural Hawaiian stream and facilitate the movement of native fish through the modified channel area.

8. Right Bank Levee Raise. The existing right bank levee would be raised at Stations 45+37 to 48+85 by 4.5 feet and up to additional 0.7 feet at Stations 25+62 to 26+46 using a Concrete Rubble Masonry wall on top of the existing earth levee.

9. Downstream Channel Modifications between Stations 4+76 and 19+00. This modification would cover the existing boulder concrete invert with concrete to smooth the surface and prevent overtopping of the channel walls by the design flood. A low flow boulder channel would remain within this modified section.

Note: Channel lining, retaining walls, and raising the levee walls would be necessary due to the excessive flow velocities and higher flood levels. This alternative would achieve project objectives and is considered to be feasible from an engineering and cost perspective. Alternative III is considered the "environmental alternative" since it would minimize negative environmental impacts to the project area, by best reducing the flooding problems and minimizing environmental impacts.

ENCLOSURE 1

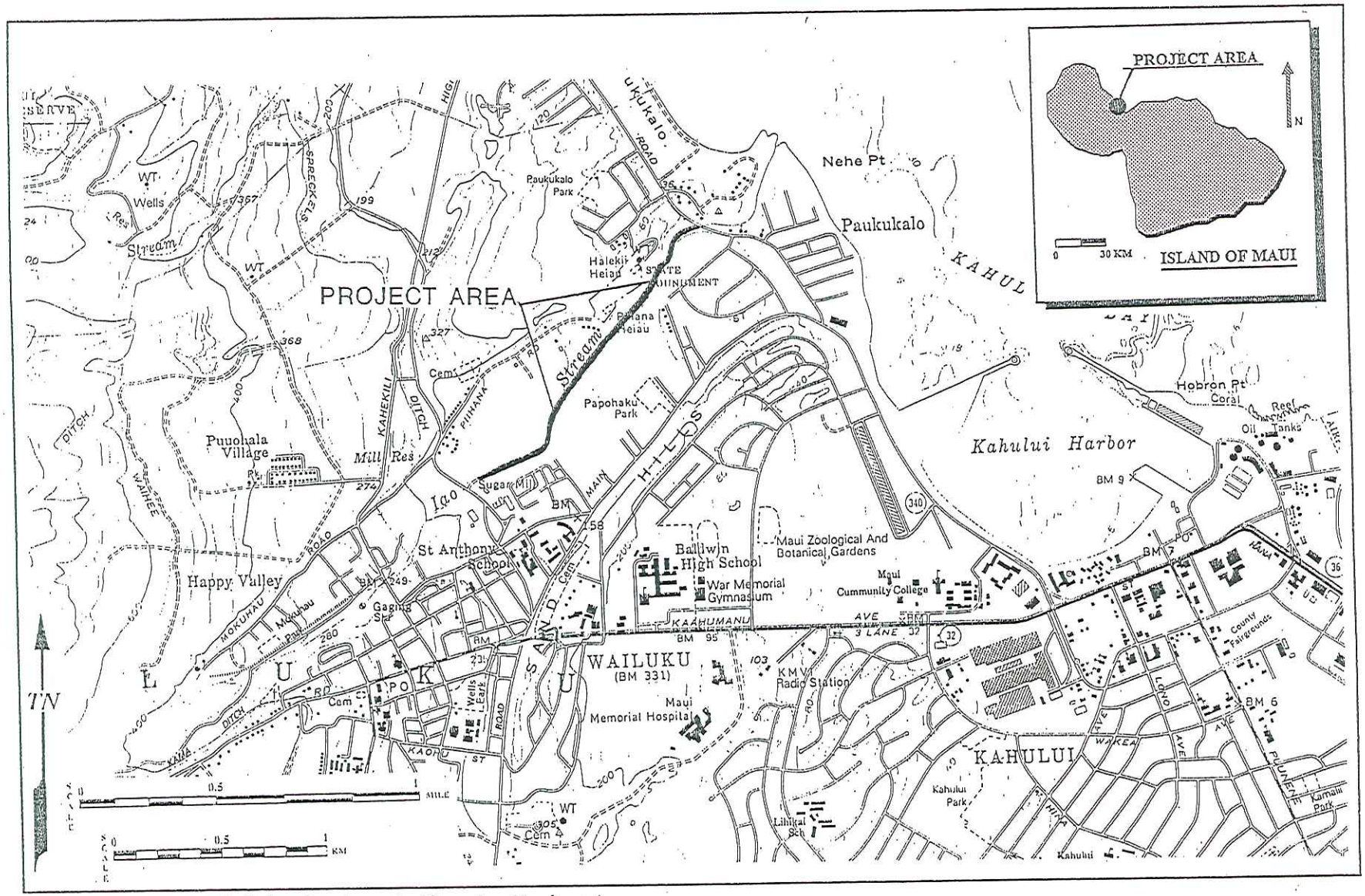


Figure 1: USGS Wailuku Quadrangle Showing Project Area.

Figure 2a: Maui Tax Key Map showing lower sections of the Iao Stream channel.

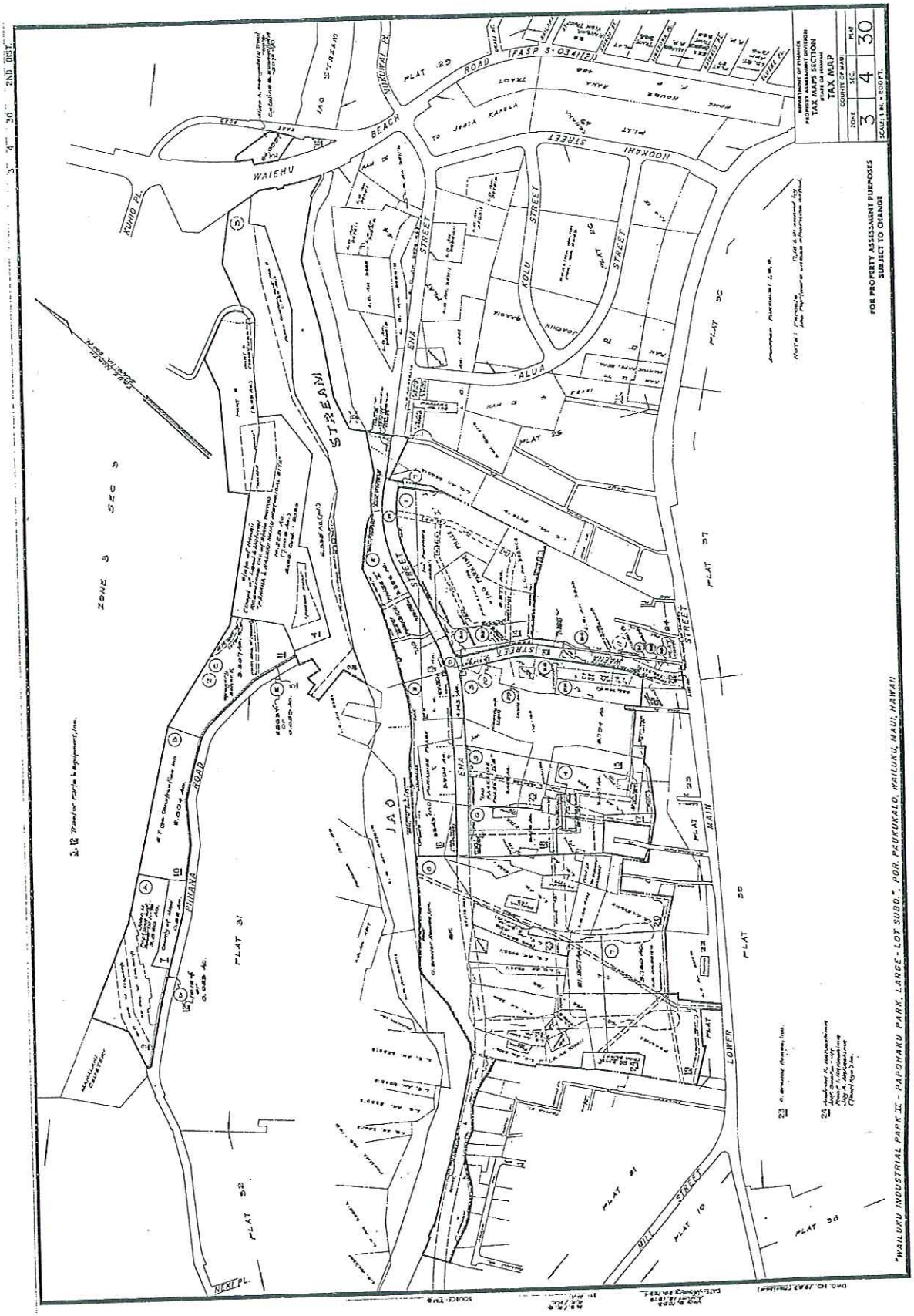


Figure 2b: Maui Tax Key Map showing lower sections of the Iao Stream channel.

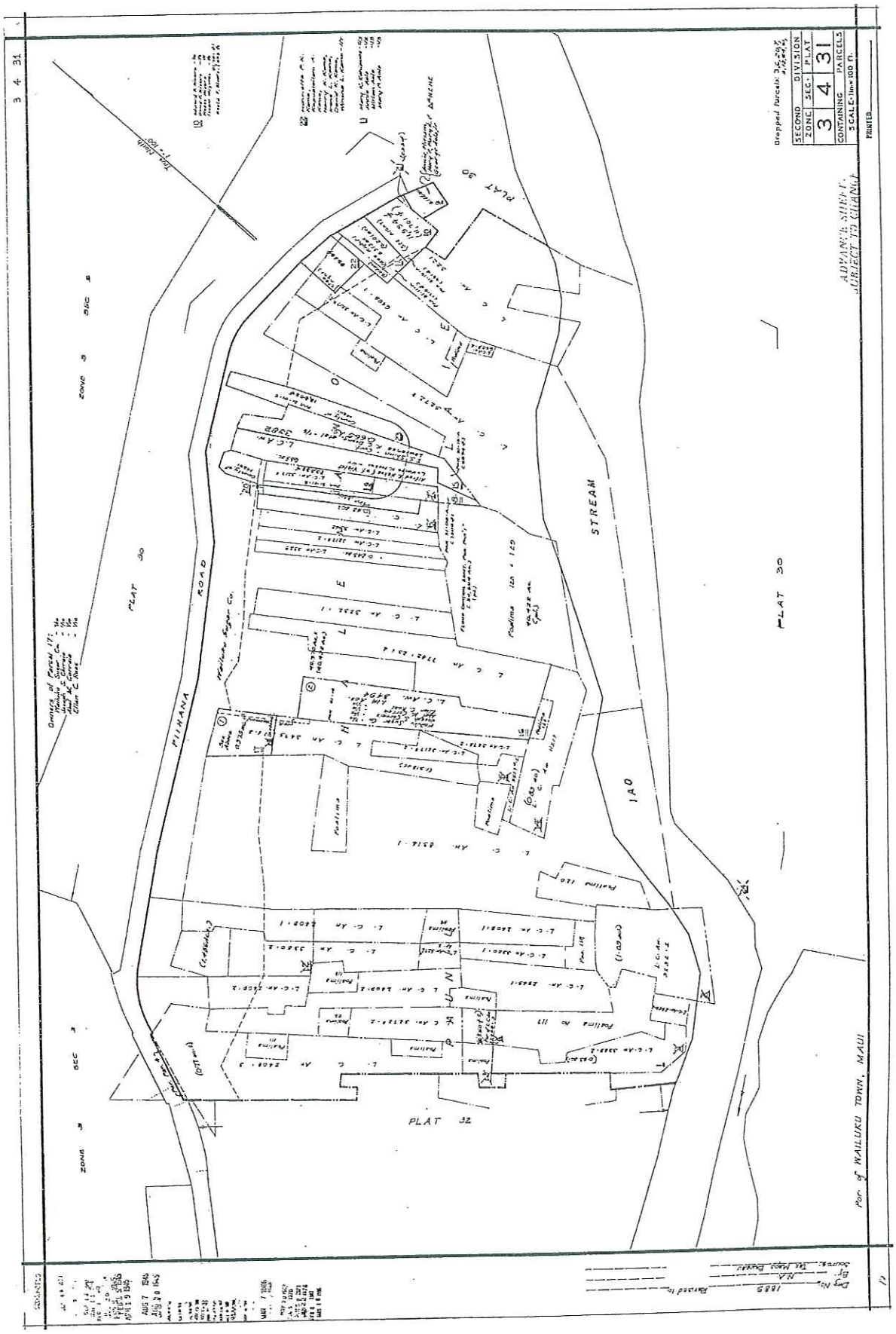
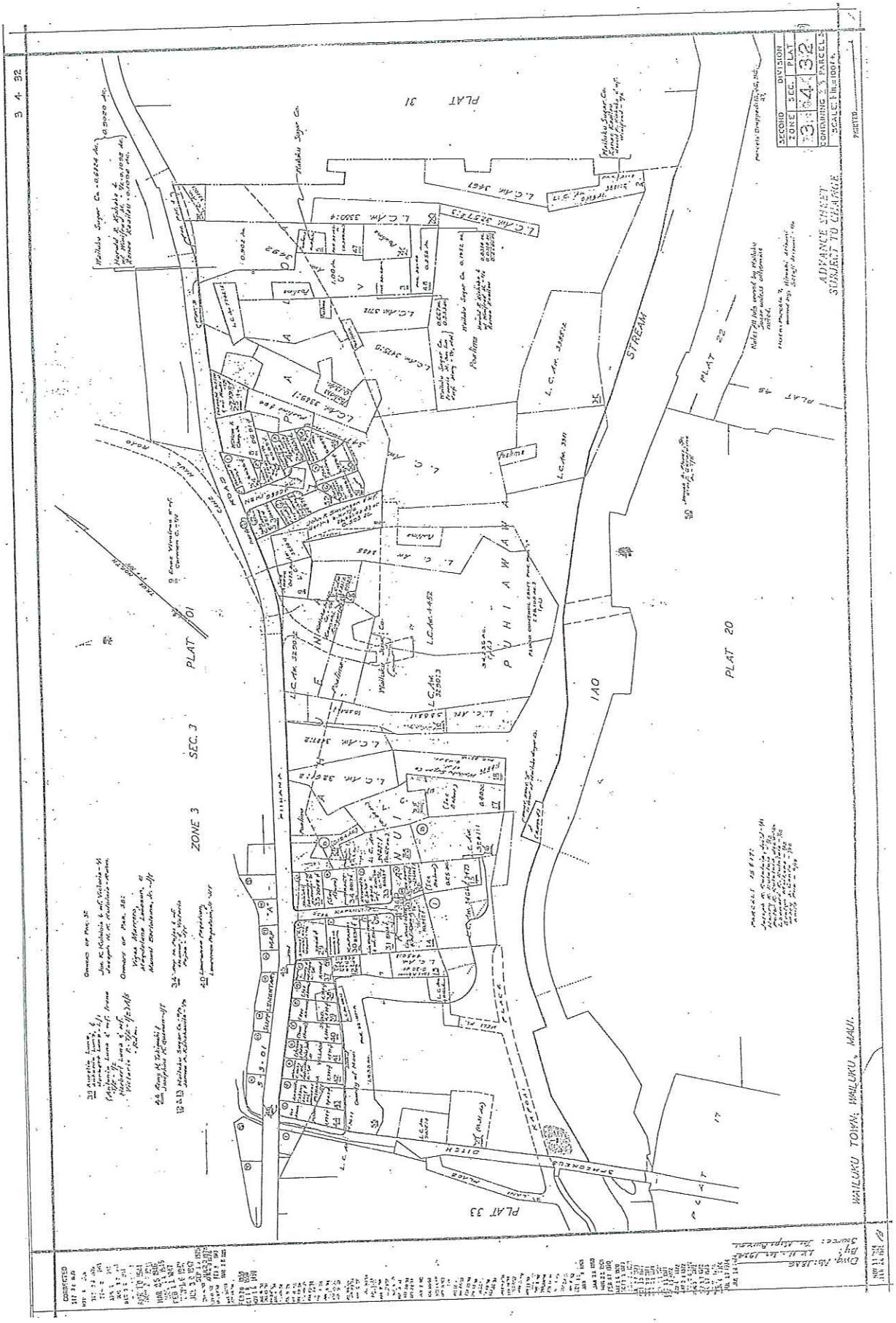
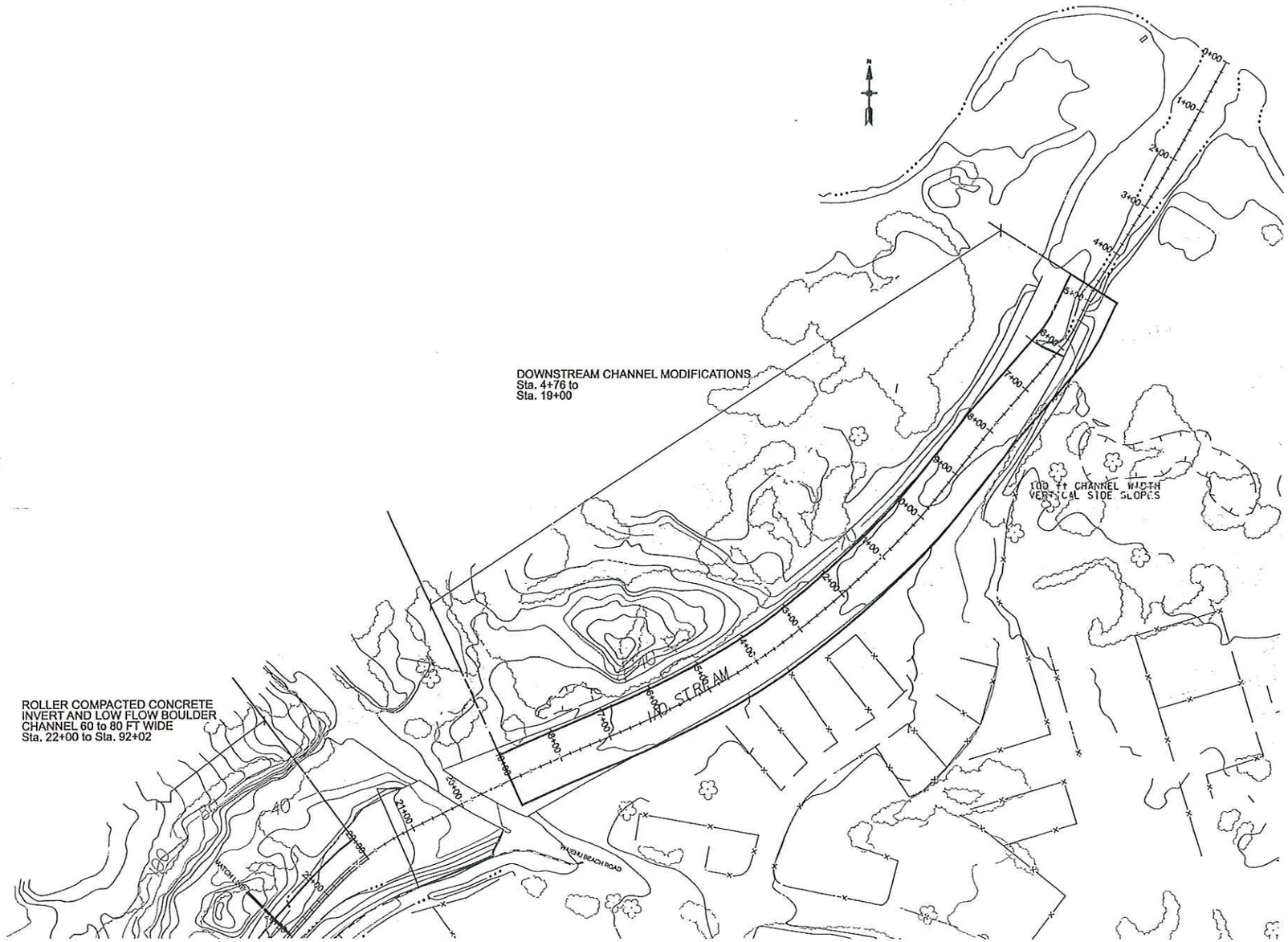


Figure 2c: Maui Tax Key Map showing lower sections of the Iao Stream channel.





FEASIBILITY STUDY
IAO STREAM FLOOD CONTROL
WAILUKU, MAUI, HAWAII

SITE PLAN
STA. 0+00 to STA 24+00

U.S. ARMY, CORPS OF ENGINEERS,
HONOLULU DISTRICT

FIGURE 3. Site Plan for Station 0+00 to Station 24+00.

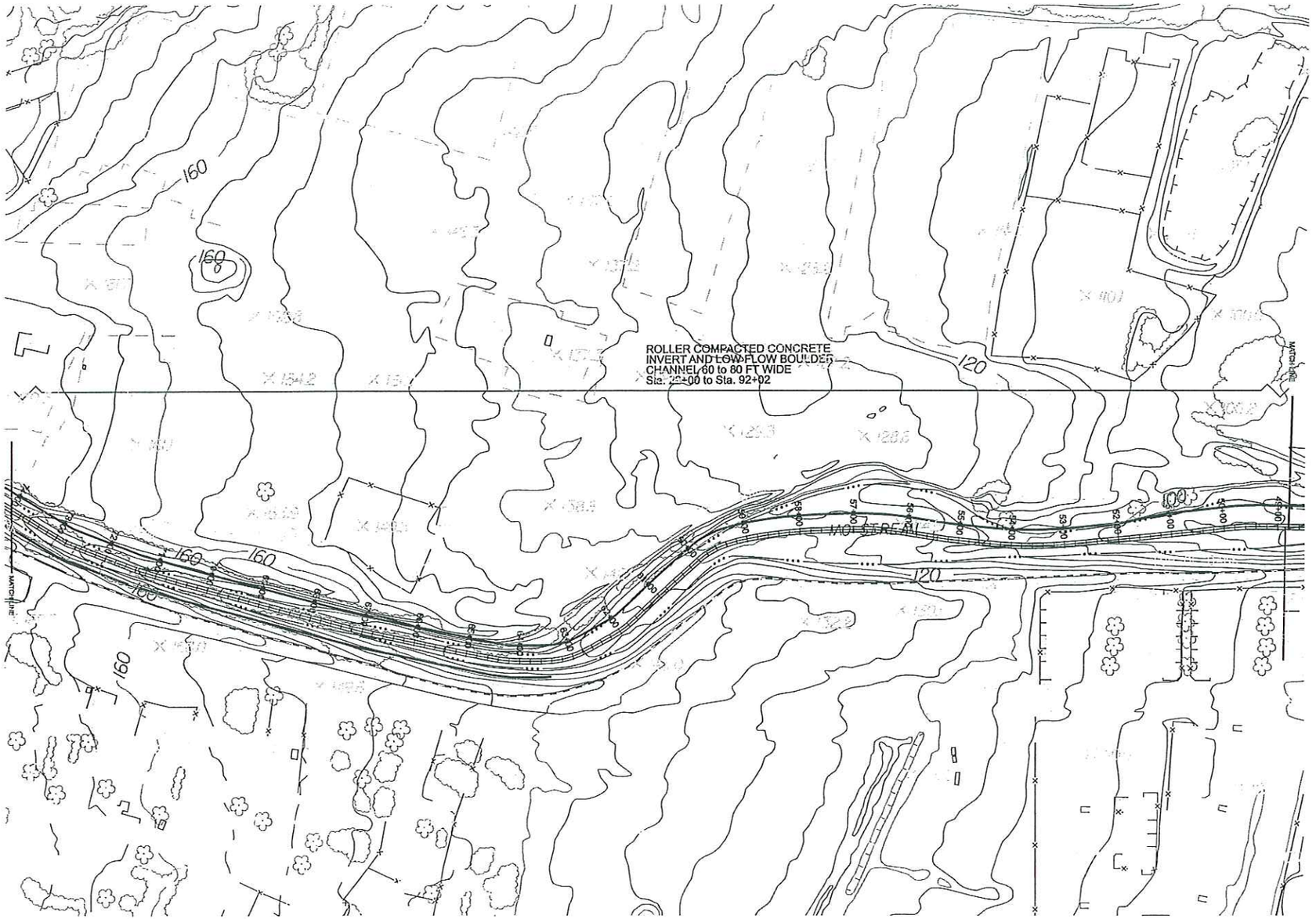


FEASIBILITY STUDY
IAO STREAM FLOOD CONTROL
WAILUKU, MAUI, HAWAII

SITE PLAN
STA. 24+00 to STA. 49+00

U.S. ARMY, CORPS OF ENGINEERS,
HONOLULU DISTRICT

FIGURE 4. Site Plan for Station 24+00 to Station 49+00.

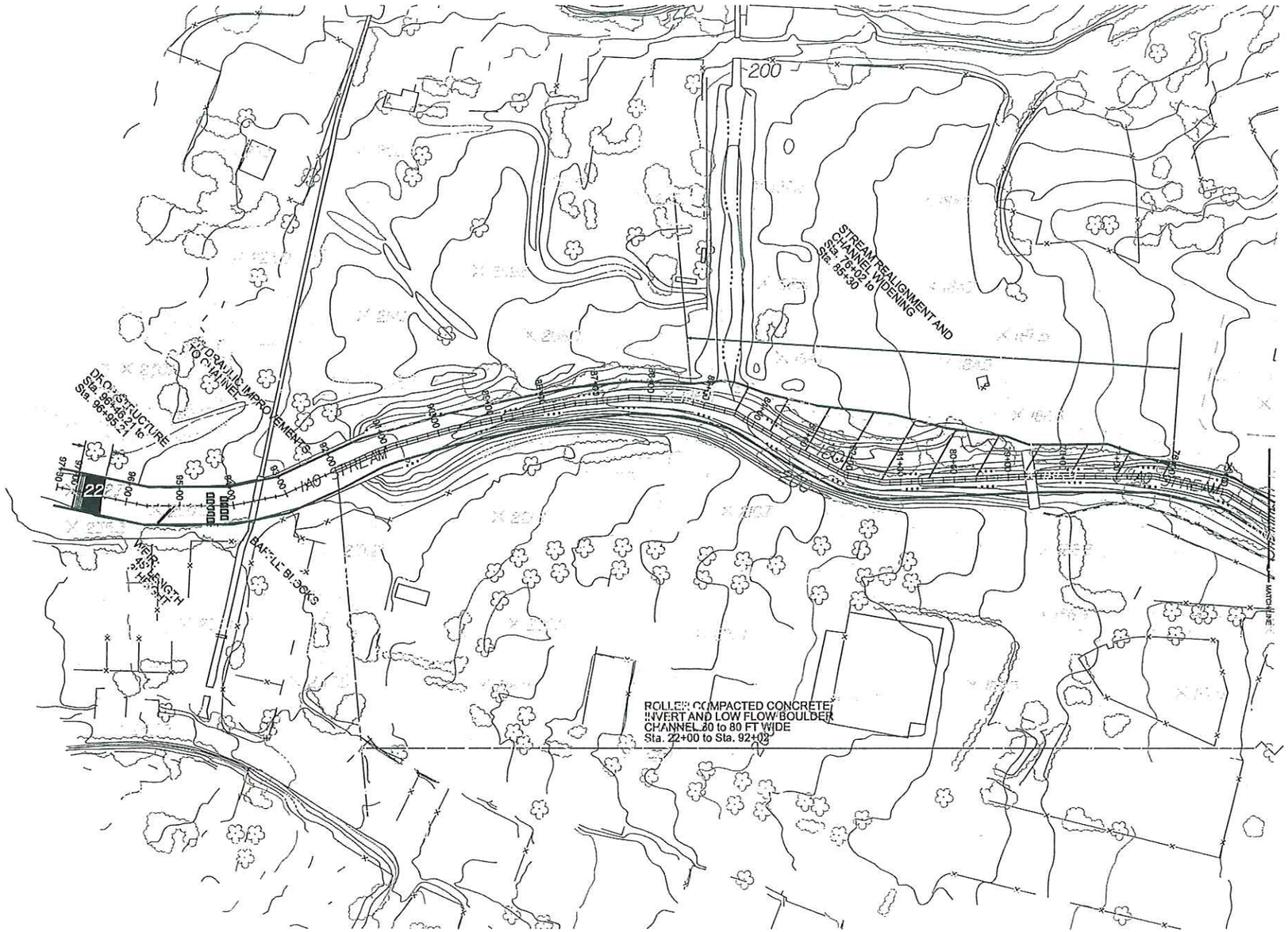


FEASIBILITY STUDY
IAO STREAM FLOOD CONTROL
WAILUKU, MAUI, HAWAII

SITE PLAN
STA. 49+00 to STA. 74+00

U.S. ARMY, CORPS OF ENGINEERS,
HONOLULU DISTRICT

FIGURE 5. Site Plan for Station 49+00 to Station 74+00.

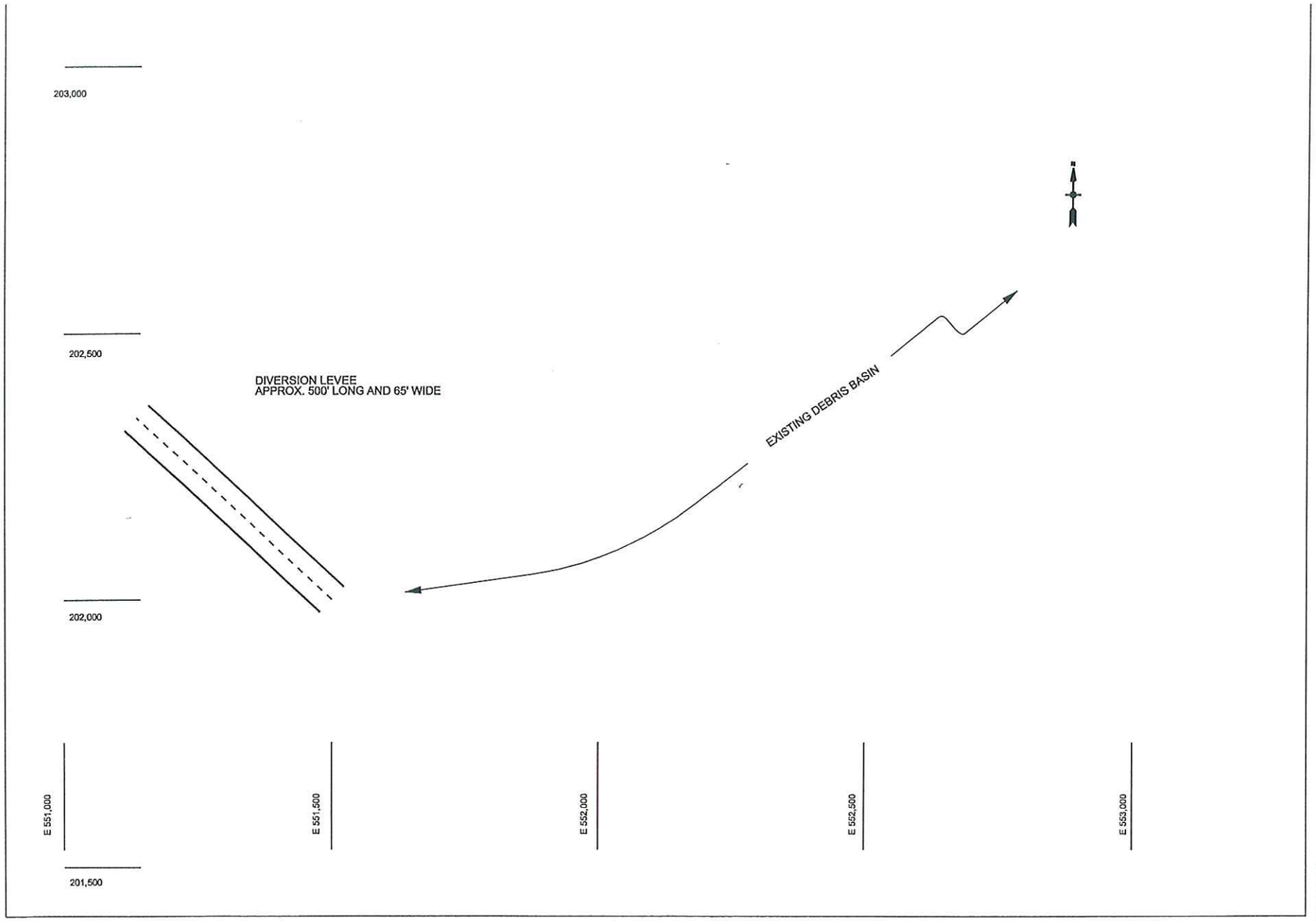


FEASIBILITY STUDY
IAO STREAM FLOOD CONTROL
WAILUKU, MAUI, HAWAII

SITE PLAN
STA. 74+00 to STA. 97+00

U.S. ARMY, CORPS OF ENGINEERS,
HONOLULU DISTRICT

FIGURE 6. Site Plan for Station 74+00 to Station 97+00.



FEASIBILITY STUDY
IAO STREAM FLOOD CONTROL
WAILUKU, MAUI, HAWAII

SITE PLAN
DIVERSION LEVEE

U.S. ARMY, CORPS OF ENGINEERS,
HONOLULU DISTRICT

FIGURE 7a. Site Plan – Diversion Levee



FIGURE 7b Site Plan - Diversion Levee

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

September 10, 2007

REPLY TO

Engineering and Construction Division

Mr. Clyde W. Namu'o
Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Namu'o:

The U.S. Army Engineer District, Honolulu (POH) is proposing to undertake a flood control project on the lower segments of Iao Stream (multiple TMK) in Wailuku, Maui Island (Figures 1, 2a, 2b, and 2c). The project area begins on the makai (east) end of Waiehu Beach Road The project was designed for Standard Project Flood (SPF) protection with a peak design discharge of 27,500 cubic feet/second (cfs) downstream at Station 22+00 and 26,000 cfs upstream at Station 92+02 (Figures 3-6). Five (5) alternatives are being considered for the flood control measures, and Alternative III has been proposed as the most viable based on engineering and cost benefits. A summary of the work under Alternative III is attached herein as Enclosure 1. Work proposed under Alternative III is an undertaking requiring consultation in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, pursuant to implementing regulations 36 CFR Part 800. The purpose of this letter is to initiate the Section 106 consultation process.

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We are also forwarding a copy of this letter to Mr. Stanley Solamilo, Maui County Cultural Resources Commission Minute, Maui County Planning Department, 250 S. High Street, Wailuku, Hawaii 96793. If you require any additional information, please contact Mr. Kanalei Shun at 438-7000.

Sincerely,

Todd C. Barnes, P.E.
Chief, Engineering and
Construction Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

October 5, 2007

REPLY TO
ATTENTION OF:

Engineering and Construction Division

Ms. Laura H. Thielen
Interim Chairman and State Historic Preservation Officer
Department of Land and Natural Resources
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

Dear Ms. Thielen:

Enclosed for your review and comment is a copy of the Cultural Impact Assessment (CIA) report that was compiled as part of the U.S. Army Engineer District, Honolulu (POH) Iao Stream Flood Control Project. The study was conducted by our Small Business contractor, Social Research Pacific, Inc., for the Environmental Assessment (EA) being prepared by POH for the project in compliance with the National Environmental Policy Act (NEPA). The CIA study was performed in accordance with Chapter 343 of the Hawaii Revised Statute and with the "Guidelines for Assessing Cultural Impacts" adopted in 1977 by the Environmental Council of the State of Hawaii.

In our 5 September 2007 letter to your office, POH initiated consultation for the project with your office in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, pursuant to implementing regulations 36 CFR Part 800. We await your response to our letter.

A copy of this report is also being forwarded to the Office of Hawaiian Affairs, the Maui County Cultural Resources Commission, the Central Maui Hawaiian Civic Club, and the President of the Association of Hawaiian Civic Clubs for review and comment. If you require any additional information, please contact Mr. Kanalei Shun at 438-7000.

Sincerely,

Curtis I. Yokoyama, S.E., P.E.
Chief, Engineering and
Construction Division

Enclosure

PHONE (808) 594-1888

FAX (808) 594-1865

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

HRD07/3219B

October 30, 2007

Curtis Yokoyama, Chief
Department of the Army
U.S. Army Engineer District
Fort Shafter, Hawai'i 96858-5440

RE: Cultural Impact Assesment for 'Iao Stream Flood Control Project, Maui, Hawai'i.

Dear Mr. Yokoyama,

The Office of Hawaiian Affairs (OHA) is in receipt of your request for written comments regarding the Cultural Impact Statement (CIS) for the 'Iao Stream flood control project on Maui. We have the following comments:

OHA requests that the TMK number for this project be given so that we can determine whether this project will impact any of our ceded lands.

This CIS was sent to us separate from the environmental assessment (EA) for which it is to be incorporated into. OHA recognizes that this was done in order to begin the consultation process; however, it is not particularly useful to do so. It is difficult to review a CIS out of context form its associated project. Further, OHA understands that the EA for this CIS will be released soon and we will review it at that time. That being said, OHA wishes to make clear that we are always pleased to see an applicant working on a CIS and as such are happy to assist with its preparation. However, the review of the CIS as a stand-alone document is not the intent of the environmental review process and, as said, a bit difficult.

OHA also notes that the invitation to comment mentions that a Section 106 consultation was initiated by the U.S. Army Engineer District on September 5, 2007. However, our agency has no record of receiving this document and as such, does not recognize the initiation of the 106 process as of now.

In terms of the CIS, OHA appreciates that a number of sources were consulted in preparation of this document including archival searches, field studies, oral histories from kūpuna in the area, public scoping meetings and surveys. However, there are numerous lo'i, heiau, and other culturally significant sites in the area as well as constitutionally protected Native Hawaiian rights being practiced in the area. As such, OHA both compliments the research done for the CIS, while reserving the right to further comment for the EA.

Thank you for the opportunity to comment. If you have any further questions or concerns please contact Grant Arnold at (808) 594-0239 or granta@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

C: Thelma Shimaoka, Community Resource Coordinator
Office of Hawaiian Affairs, Maui Office
140 Ho'ohana St., Ste. 206
Kahului, Hawai'i 96732

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

October 5, 2007

REPLY TO
ATTENTION OF:

Engineering and Construction Division

Mr. Clyde W. Namu'o
Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Namu'o:

Enclosed for your review and comment is a copy of the Cultural Impact Assessment (CIA) report that was compiled as part of the U.S. Army Engineer District, Honolulu (POH) Iao Stream Flood Control Project. The study was conducted by our Small Business contractor, Social Research Pacific, Inc., for the Environmental Assessment (EA) being prepared by POH for the project in compliance with the National Environmental Policy Act (NEPA). The CIA study was performed in accordance with Chapter 343 of the Hawaii Revised Statute and with the "Guidelines for Assessing Cultural Impacts" adopted by the Environmental Council of the State of Hawaii in 1997.

In our 5 September 2007 letter to your office, POH initiated consultation for the project with your office in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, pursuant to implementing regulations 36 CFR Part 800. We await your response to our letter.

A copy of this report is also being forwarded to the State of Hawaii Historic Preservation Office, the Maui County Cultural Resources Commission, the Central Maui Hawaiian Civic Club, and the President of the Association of Hawaiian Civic Clubs for their review and comment. If you require any additional information, please contact Mr. Kanalei Shun at 438-7000.

Sincerely,

Curtis I. Yokoyama, S.E., P.E.
Chief, Engineering and
Construction Division

Enclosure

K. Shun
CEPOH-EC-E

D. Nakamura
CEPOH-EC-E

E. Kozuma
CEPOH-EC-Z

C. Yokoyama
CEPOH-EC

Rtn to Onuma
CEPOH-EC-E
File/Distr

November 5, 2007

Engineering and Construction Division

Mr. Clyde W. Namu'o
Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Namu'o:

It has been brought to our notice that your office may not have received our letter dated September 10, 2007, with its attachment. We are re-sending a copy of this letter in case you had not as yet received it. If you have received the letter, then please disregard this one.

We would appreciate a response to our September 10, 2007 letter. If you have further questions, please contact Mr. Kanalei Shun, Environmental Branch at (808)438-7000 or electronically at kanalei.shun@poh01.usace.army.mil.

Sincerely,

Curtis I. Yokoyama, S.E., P.E.
Chief, Engineering and
Construction Division

Enclosures

INTERNAL REVIEW OFFICE	
OFFICE FILE NUMBERS	
FILE #	**DESCRIPTION**
1a	Office File Numbers
1c	Office Inspections and Surveys
1f	Office Organization Files
1q	Office Property Records
1x	Office Civilian Personnel Time and Attendance Files
1aa	Office Supervisory or Manager Employee Records
1hh	Office Temporary Duty Travel
1oo	Policies and Procedures
1-1e	Operating Budgets
1-201a	Inspection, Survey, and Staff Visit Coordination Files
11-2a	Internal Control Systems
11-7a	Internal Review and Audit Files
36-2c	AAA Audit Reporting Files

7004 2510 0005 7838 4589

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Sent To: Mr. V. R. Hinano Rodrigues
Street, Apt. No.; or PO Box No.: 130 Mahalani St
City, State, ZIP+4: Wailuku, HI 96793

PS Form 3800, June 2002 — See Reverse for Instructions

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. V. R. Hinano Roddrigues
130 Mahalani St.
Wailuku, HI 96793

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by *(Printed Name)*: Russell Sparks
C. Date of Delivery: 11/07/07

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number *(Transfer from service label)*: 7004 2510 0005 7838 4589

PS Form 3811, February 2004 — Domestic Return Receipt — 102595-02-M-1540

IAO SOLOMAN FLOOD CONTROL PROJECT

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. Clyde W. Namu'o
711 Kapiolani Blvd., Suite 500
Honolulu, HI 96813

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by (*Printed Name*) Ashton Saifoloi
C. Date of Delivery 11/8/07

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
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IAO STREAM FLOOD CONTROL PROJECT

Appendix I:

Trip Report, 3-4-2008 Site Walk

CEPOH-PP-C 31 March 2008

MEMORANDUM FOR RECORD

SUBJECT: IAO STREAM SITE VISIT, 4 MARCH 2008.

1. A site visit was held at Iao Stream on 4 March 2008 with representatives from US Fish and Wildlife Service, DLNR Division of Aquatic Resources, County of Maui, and the US Army Corps of Engineers. The following people attended:

Mike Dean	County of Maui	270-7745
Sonia Garcia	Environet, Inc (For COE)	833-2225
Jeffrey Herod	US Fish and Wildlife Service	792-0462
Wendy Kobashigawa	County of Maui	270-7745
Skippy Hau	DLNR Div of Aquatic Resources	243-5834
Jim Pennaz	Corps of Engineers	438-8599
Nani Shimabuku	Corps of Engineers	438-2940
Gordon Smith	US Fish and Wildlife Service	

2. The purpose of the site visit was to discuss potential project modifications which might facilitate migration of aquatic stream fauna in Iao Stream. The group observed Iao Stream from the ocean to just above the debris basin (Sta 0+00 to 120+00). A summary of these discussions is as follows:

a. Mouth of Iao Stream (Approximate Sta 0+00). At the bottom of the project, a large debris field of boulders has filled in the area between the channel invert and ocean. The original channel design had a drop of approximately three feet between the channel invert and estuary area. Boulders from channel erosion have now filled this area and created a more natural transition from the channel to the estuary area. No changes are proposed in this area.



b. Low Flow Channel Under Waiehu Beach Road Bridge (Approximate Sta 20+00). The low flow channel from the stream mouth to the Waiehu Beach Road bridge is a boulder concrete channel and is considered acceptable. However, the low flow channel under the bridge has been repaired and modified from its original shape by placement of concrete in the invert. Skippy Hau indicated that this channel is an important resting place for aquatic animals because of the shade provided by Waiehu Beach Road Bridge. He recommended that this portion of the low flow channel be modified to a five feet wide boulder concrete type channel with more roughness.





c. Proposed Low Flow Channel in Roller Compacted Concrete (RCC) Channel (Sta 22+00 to 94+00). The recommended design is a 20 ft wide boulder concrete low flow channel with a level invert. Gordon Smith recommended that this channel be modified to a width of 14 to 16 feet and be sloped towards one side. The channel depth should be at least 18 to 20 inches deep at its deepest point. The low flow channel should be placed along the left bank area unless more shade exists on the right bank. Purpose of the recommendation is to provide shaded areas.

d. Drop Structure (Sta 97+23). The existing 20 feet drop structure will be modified with a stair step type structure to improve overall channel safety. Recommendations from Gordon Smith and Skippy Hau are to continue the low flow channel from upstream along the right bank of the stair step structure. At the bottom of the structure, a new low flow channel will be formed along the toe of the new stair step structure connecting the right bank low flow channel to the existing left bank low flow channel.



e. Concrete Channel Upstream of Market Street Bridge (various locations). Recommendations here are to install small blocks in smooth portions of the low flow channel. The blocks should be doweled into the existing surface. Purpose of the small blocks would be to reduce flow velocities and provide resting areas for migrating animals.

f. Debris Basin Ground Water Recharge. The proposed plan will install a small dam at the debris dam outlets. The low dam will back water into the debris basin and allow more groundwater recharge. This proposed plan is based on community input at an earlier public meeting. Both Skippy Hau and Gordon Smith recommended against this plan because the backwater will create habitat for undesirable species, as well as, remove important low stream flows from the low flow channel. In addition, the small dam will make it more difficult for aquatic migration during low flows.



3. Items discussed during site visit will be discussed further in-house.

Nani Shimabuku
Project Manager

Appendix J:

Fish and Wildlife Revised Mitigation Recommendations Letter

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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

In Reply Refer To:
12200-2008-FA-0127

Lt. Colonel Charles H. Klinge
District Engineer, Honolulu
U.S. Army Corps of Engineers
Building 230
Ft. Shafter, HI 96858-5440

Subject: Revised Fish and Wildlife Coordination Act Mitigation Recommendations for the Iao Stream Flood Control Project, Wailuku, Maui, Hawaii

Dear Lieutenant Colonel Klinge:

The Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 *et seq.*; 48 Stat. 401], as amended (FWCA), was established to provide a framework for the consideration of fish and wildlife conservation measures to be incorporated into Federal and federally permitted or licensed water resources development projects. In January 2006, the U.S. Fish and Wildlife Service (Service) provided a Draft FWCA section 2(b) investigation report describing the significant fish and wildlife resources found within the proposed project area and recommendations for mitigation of unavoidable resource impacts anticipated to result from the proposed Iao Stream Flood Control Project. In coordination with U.S. Army Corps of Engineers (Corps) staff, we are providing the following *revised* mitigation recommendations for the proposed project. These recommendations were prepared under the authority of and in accordance with provisions of the FWCA and the Federal Clean Water Act of 1977 [33 U.S.C. 1251 *et seq.*; 62 stat. 1155], as amended (CWA). These comments are also consistent with the National Environmental Policy Act of 1969 [42 U.S.C. 4321 *et seq.*; 83 Stat. 852], as amended (NEPA), and other authorities mandating concern for environmental values.

The purpose of the proposed project is to increase the engineered flood protection capacity of the existing Iao Stream Flood Control and Related Improvements Project, which was constructed in 1979-1981. The existing project consists of a debris basin, an upper segment that is cement-lined and straightened (1,100 feet [ft] in length); a middle segment that is straightened, not lined with cement and bound by a levy on one side (7,200 ft in length); and a lower segment that is straightened, lined with cement and concrete-rubble masonry (CRM), and is 1,400 ft in length.

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Five alternatives are under consideration: Alternatives 1 and 2 call for straightening and installing a poured-cement lining over the un-lined middle segment of stream (7,200 ft). Alternative 3 also calls for a cement lining of the same middle segment of the stream. Under this alternative, the planned construction method would be via roller-compacted concrete (RCC), and a low-flow channel would be constructed using irregular boulder- and cobble-sized rock to form micro-habitat and refugia for fish and invertebrates and to facilitate upstream fish passage through the newly lined channel. The design specifications for Alternative 3 minimize, but do not completely eliminate, the anticipated environmental impacts of the proposed project. Alternative 4 calls for repair and reconstruction of damaged levee toes and would increase levee heights in key flood-prone areas. However, this alternative does not achieve the desired level of flood protection. Alternative 5 consists of complete removal of existing flood control infrastructure and includes installation of a flood warning system. This alternative was put forward in response to public support for restoration of natural ecosystem function in the Iao Stream watershed. However, in our review of flow characteristics and fluvial geomorphology of lower Iao Stream, this alternative is not viable without the addition of a property acquisition component to allow for a dedicated stream corridor to accommodate flooding and allow for natural meandering of the stream channel.

Because the proposed project is considered a modification of an existing project, the Corps plans to prepare an Environmental Assessment under NEPA. The extent of anticipated environmental impacts due to this modification, as envisioned for Alternatives 1, 2 or 3, will result in the cumulative loss of 9,700 linear ft of natural stream bottom habitat. This is far more than the habitat impacts attributed to the original flood control project, which resulted in loss of 2,500 ft of natural stream. From an environmental review standpoint, this presents an unusual situation in which the proposed modification will result in the elimination of almost four times more linear stream habitat than the original project. As stated in prior correspondence, if Alternatives 1, 2, or 3 are pursued to completion, the Iao Stream Flood Control Project will confine the lower reach of Iao Stream into the longest cement-lined stream channel on Maui, and create one of the longest cement channels in the State.

Regulatory Considerations

The Corps Regulatory Branch issues a CWA section 404 permit for any project that results in discharge of material into a waterbody that falls under their jurisdiction, and the project's environmental planning record must demonstrate that the Least Environmentally Damaging Practicable Alternative is chosen through a planning process that, among other considerations, *avoids* resource impacts wherever possible, *minimizes* unavoidable impacts, and *compensates* for all unavoidable resource losses. Recent guidance specifies that mitigation features designed to compensate for unavoidable impacts to jurisdictional waters are to be based on replacement of lost environmental functions, as considered in a watershed-wide context (Corps Regulatory Guidance Letter [RGL] 02-02). Mitigation planning that conforms to the CWA requirement for functional replacement is described in a variety of Corps and U.S. Environmental Protection Agency (EPA) administrative rules.

Although the Corps' Civil Works Branch is exempted from the requirements of CWA section 404 permits, the environmental protection requirements of section 404 still apply, and these requirements must be addressed in the project's NEPA disclosure documentation. The basis for this analysis is set forth in the CWA 404(b)(1) guidelines and the substantive elements of a

404(b)1 analysis must be included in a project's NEPA document. When avoidance and minimization of impacts to waters of the U.S. are not adequate to offset anticipated project-related natural resource impacts, compensatory mitigation is required as outlined in a 1990 Corps-EPA Memorandum of Understanding that describes the 404(b)(1) analysis requirements. A related requirement is the need for a 401(c) Water Quality Certification issued by the state water quality agency to assure that the project will not violate state-administered water quality standards.

In our opinion, and as described in our FWCA 2(b) report, the impacts anticipated to result from the Corps' preferred alternative (Alternative 3) cannot be avoided through minimization alone, unavoidable impacts must be addressed through compensatory actions. This alternative, which calls for roller-compacted concrete and grouted rip-rap throughout the project area, will result in an unavoidable and permanent **loss of 7,200 feet of pool/riffle stream habitat**.

Substantial guidance is available to develop compensatory mitigation adequate to offset this anticipated loss of aquatic resources in the mitigation plan requirements set forth in the Honolulu District Regulatory Branch Compensatory Mitigation and Monitoring Guidelines. This guidance was developed to conform to RGL 02–02. These planning requirements are further clarified by newly-adopted comprehensive Corps–EPA Regulations ("Compensatory Mitigation for Losses of Aquatic Resources" Federal Register 73:70 [Thursday, April 10, 2008] pg. 19593), which became effective earlier this month. Our mitigation recommendations for the Iao Stream Flood Control Project have been revised consistent with these regulatory considerations and are described below.

<u>Mitigation Recommendations</u>

The Iao Stream Flood Control Project has been reviewed by the Service at various stages since its inception in 1968. Because of its very high likelihood of success, the most frequently recommended method of compensatory mitigation was stream flow restoration. The suggestion to restore depleted flows date back to the early 1970s when the project was first reviewed. In 2006, our FWCA 2(b) report suggested pursuing the following mitigation scenario for the Corps' preferred alternative (Alternative 3):

> "1) creation and implementation of a flow restoration agreement between a number of partners including the Corps, DLNR–CWRM [Hawaii Department of Land and Natural Resources – Commission on Water Resource Management], the County of Maui, and private entities that hold licenses for diversion and out-of-stream consumptive use of Iao Stream water;
>
> 2) engineering and reconstruction of at least four existing diversion structures to allow managed minimum stream flows to remain in the stream and allow for passage of aquatic organisms; and
>
> 3) management in perpetuity of the flow restoration conditions to enhance support of aquatic organisms, including instream water volumes and in-channel riparian vegetation by the County as an integral element of the flood control project."

The goal of the recommended flow restoration was to provide for continuous stream flow to the sea 80 percent of the time.

Surface waters within the State of Hawaii are considered a public trust resource and the use of surface waters falls under State jurisdiction. Central Maui streams were recently designated as the State's first Surface Water Resource Management Area by the State of Hawaii Commission on Water Resource Management (COWRM) and this process is expected to lead to a re-allocation of offstream use of water resources. The deliberations to re-allocate water among competing uses, which include offstream agricultural use, native Hawaiian water claims, and environmental restoration, are proceeding under a quasi-judicial contested-case hearing format. This process will likely continue for several years before resolution of all water use claims are realized. In light of the uncertainty regarding water allocation in central Maui, and in coordination with Corps engineering and planning staff, alternative avenues to adequately develop a mitigation plan for the Iao Stream Flood Control Project were pursued.

Functional evaluation

For the purpose of evaluation of the freshwater aquatic habitats in Iao Stream, eight species of migratory native Hawaiian stream organisms known to occur in the stream were used as evaluation species. These organisms serve as biological indicators of stream function because they require cold, clean, high-quality flowing water and clean sandy or rocky substrate. This group of animals includes five species of fish and three species of invertebrates. All of these species require passage through the stream channel at two time-periods during the course of their life history, which takes place as follows: eggs are laid in the stream on clean rocky substrate, just-hatched larvae are carried by the stream to the sea, larvae develop and recruit to stream mouths and undergo metamorphosis, post-larvae undertake an upstream migration to inland reaches of streams. Because the pelvic fins of the fishes are modified to form a suction cup and the invertebrates can climb by clinging to substrate, several of these species are capable of ascending vertical or even overhanging waterfalls and can be found at high elevations in the watersheds as adults.

Under current conditions, a limited number of upstream migrating fish and invertebrates successfully ascend through the Iao Stream channel to reach middle and upper reaches where stream water quality, water quantity, and habitat conditions are sufficient to support native aquatic life. Recent observations by Service biologists indicated low numbers of *Awaos guamensis*, *Sicyopterus stimpsoni* and *Lentipes concolor* above the proposed project reach. Because the stream is severely de-watered, only exhibits continuous flow to the sea about 30% of the time, has 2,500 ft of cement channel, and has 7,200 ft of straightened channel, it is remarkable that any upstream migrants can ascend the stream to reach suitable habitat at all.

As an alternative to flow restoration, we recommend that structural features that enhance the upstream passage of migratory organisms be incorporated into the project as compensatory mitigation to offset unavoidable project impacts. Alternative 3 includes a low-flow channel and near-bank vegetation management to provide shade. In consultation with the Corps and County of Maui planning staff, the following additional mitigation actions are recommended:

1. Install a boulder- and cobble-lined, low-flow channel in the existing flat-bottomed cement channel extending from the upper end of the existing CRM channel under the Waiehu Beach Road bridge, upstream to the bottom of the proposed RCC low-flow channel (approximately 300 ft in length);

2. Design the new boulder- and cobble-lined, low-flow channel to meander within the proposed RCC channel to maximize exposure to shade created by steep banks. The low-flow channel will typically be adjacent to steeper, more heavily vegetated banks and will maximize the time period of either morning or evening shade;

3. Install a boulder- and cobble-lined, low-flow channel extending from the upper end of the RCC channel to the bottom of the drop-structure steps (approximately 350 ft in length);

4. Modify the 25-ft drop structure to form a stepped fish passage structure to facilitate upstream fish and invertebrate migration;

5. Modify the steepest areas of existing concrete channels with small irregularly-placed blocks to break up high-velocity flows and facilitate fish passage at five steep channel areas above the North Market Street Bridge;

6. Install and maintain a low-flow, boulder- and cobble-lined channel in natural substrate through the center of the debris basin (approximately 1200 ft): and

7. Commitment by the Corps and local sponsor to inform water resource regulatory agencies and water users that enhanced fish passage is an integral part of the project design and that flow restoration should be incorporated into management of the Iao watershed.

The construction and maintenance of these structural features will greatly improve the probability of successful upstream migration of native stream macrofauna in lower Iao Stream channel under both current and probable future flow regimes. We recommend that the above recommendations be incorporated into a Mitigation Plan developed to conform to Corps guidance. The plan should describe the construction details of the proposed structural features (low-flow channel widths and depths, construction boulder and cobble sizes, vegetation management regimes to be adopted by the local sponsor, and an aquatic resource monitoring plan that emphasizes before-and-after project documentation of upstream migration of fish and invertebrates). We are available to provide additional technical support for mitigation planning for the project.

We appreciate the opportunity to provide mitigation planning recommendations for the proposed project. If you have questions regarding these recommendations, please contact Fish and Wildlife Biologist Gordon Smith 808/792-9400.

Sincerely,

Patrick Leonard
Field Supervisor

cc: Dan Polhemus, HDAR
Skippy Hau, HDAR–Maui
Alec Wong, CWB
Wendy Wiltse, EPA
Gerry Davis, NMFS

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Dan Polhemus, Ph.D.
Division of Aquatic Resources
Hawaii Department of Land and Natural Resources
1151 Punchbowl Street, Room 330
Honolulu, HI 96813

Skippy Hau
Division of Aquatic Resources
Hawaii Department of Land and Natural Resources
130 Mahalani Street
Wailuku, Maui, HI 96793

Alec Wong, Branch Chief
Clean Water Branch
Hawaii Department of Health
919 Ala Moana Blvd., Room 301
Honolulu, HI 96814

Wendy Wiltse
Pacific Islands Contact Office
U.S. Environmental Protection Agency, Region IX
300 Ala Moana Blvd., Suite 5-152
Box 50003
Honolulu, HI 96850

Gerry Davis
Pacific Islands Regional Office
National Marine Fisheries Service
U.S. Department of Commerce
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814-4700

Appendix K:

Economic Update

Iao Stream Flood Control Project
Wailuku, Island of Maui, State of Hawaii
Economic Update
September 12, 2008

1. Background. The purpose of this economic analysis is to update the benefits and costs attributable to modifications to the Iao Stream Flood Control Project in the town of Wailuku on the island of Maui. Storms occurring in 1989 caused extensive damage to the project's levee system. In order to prevent potential failure of the flood control project during a storm event, modifications are imperative. Project failure will cause the resulting flood waters to inundate essentially the same area as if there was no project. The constructed project has instilled a sense of security in the Wailuku community and a project failure would result considerable property damage and possible loss of life.

In 1974, a General Design Memorandum was prepared which included an economic evaluation for the Iao Stream flood control project. At that time, there were 263 residential and commercial structures subject to flooding. The study area was surveyed again in August 1992 to take into account the changes that had occurred since 1974. The result of that survey and the subsequent economic analysis were incorporated into a report titled "Modifications to Completed Project Report for the Iao Stream Flood Control Project, Maui, Hawaii (March 28, 1995)". The report identified 510 residential and commercial structures in the 222-year Standard Project Flood (SPF) floodplain with a total depreciated value for structure of $38.9 million and total content value of $69.8 million at an October 1992 price level. Since 1992, a significant amount of development has taken place in the study area.

This update evaluates the economic bene[illegible]d costs of modifications to the Iao Stream Flood Control Project. These modifications are expected to reduce inundation damage to structures, contents and automobiles, the cost of emergency services, damages to yards and outside property, and the administrative costs of flood insurance. Although these modifications are also expected to reduce losses based on the value of motorists' and passengers' time lost due to road blockages and detours, these additional benefit categories have not been evaluated. In addition, this analysis addresses risk and uncertainty of both the engineering and economic data from which project benefits are derived.

2. General. This economic analysis compares the benefits and costs related to three of the five alternative plans proposed for Iao Stream Flood Control Project. Flood plain management, including flood control and prevention, contributes to the National Economic Development (NED) objective by improving the net productivity of flood-prone land resources. This occurs from an increase in the output of goods and services and/or by reducing the cost of using the land resources. These improvements in economic efficiency, or project benefits, are estimated by comparing the most likely future conditions without the project (the "without-project" condition) with the most likely future conditions resulting from the implementation of flood damage reduction measures (the "with-project" condition).

In this economic analysis, both costs and benefits are expressed at an estimated October 2007 price level. Costs and benefits occurring at different points in time are converted to an average annual equivalent basis over a 50-year period of analysis using the federal discount rate prescribed for water resources projects. This rate is currently set at 4.875 percent. The project base-year, or first year of project operation, is FY2013. The 50-year period of analysis is from FY2013 through FY2062, inclusive.

The objective of this economic analysis is to determine the alternative that will reasonably maximize net NED benefits. This is accomplished by comparing the average annual benefits and costs of the alternatives being considered. The alternative with a benefit-cost ratio greater than one and the highest net benefits will be designated as the NED alternative.

3. Alternatives. The five alternatives initially considered in the Engineering Documentation Report (main report) are described briefly below in Table 1. Detailed descriptions of the various alternatives are provided in the main report. Of these, only the performance of Alternative 3 was evaluated in detail using the Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) computer program. Alternatives 1 and 2 are assumed to provide the same benefits as Alternative 3 when designed for the same degree of protection.

Table 1. Iao Stream Alternative Plans

	Description
Alternative 1	Trapezoidal Concrete-Lined Channel
Alternative 2	Rectangular and Compound Channel
Alternative 3	Roller Compacted Concrete and Boulder Invert Channel along Existing Alignment
Alternative 4	Levee Reconstruction
Alternative 5	Removal of Flood Control Improvements

Alternative 4, levee reconstruction, is not considered a viable solution since it does not address erosion and undermining of levees. It is therefore not included in the NED analysis.

Alternative 5, removal of the existing flood control improvements and the restoration of the stream to its original natural condition, will remove all existing project flood control features for flooding events of all frequencies. Although for the purposes of this comparison it is assumed to have zero NED benefits, it is likely to have negative benefits to the extent that flooding events with a return period of less than 25-years are likely to cause damage in excess of the without project condition. Consequently it will not be analyzed in this NED analysis.

4. Methodology. Inundation damages are computed by combining an inventory of structures in the floodplain with the anticipated extent and effects of the flooding from various storms in the without-project alternative and with-project alternatives. Flooding

associated with 1-year, 10-year, 25-year, 20-year, 50-year, 100-year, and 222-year events were estimated using the Corps of Engineers' HEC-RAS computer software. The areas of flooding and the flooding depths associated with the different events were computed as discussed in the main report.

This analysis assumes that in the without-project condition the existing levees along the right bank of Iao Stream will fail in a flood event of 25-year of greater return period but not in the case of smaller events. This is expected to cause flooding along the entire length of the over-bank as a result of levee and bank failure in one or two places. In order to represent this condition, levees were specified in the HEC-FDA model to represent both levees and river banks, with levee heights artificially set halfway between the 20-year and 25-year flood stages.

For the with-project condition, levee heights were set to reflect the levee and river bank elevations of Alternative 3, which are the same as those now existing along Iao Stream. A list of levee heights specified in the HEC-FDA model for the without-project and with-project conditions is provided in Table 2.

Table 2. Levee Heights as Specified in the HEC-FDA Model

	Without-Project Levee Height (feet)	**With-Project Levee Height (feet)**
Reach 1	14.39	20.15
Reach 2	41.03	52.80
Reach 3	61.22	72.80
Reach 4	88.43	95.80
Reach 5	111.83	118.63
Reach 6	139.50	144.87
Reach 7	147.63	154.80
Reach 8	179.60	186.20

In order to determine the economic effects of flooding on structures in the floodplain, structure values, content values, first floor elevations, depth-damage curves, and the estimated water surface profiles for different frequency events were entered into the Corps' Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) computer program. HEC-FDA compares the flood heights for different events with the first floor elevations for each structure in the flood plain. This determines the height of the flood waters at each structure for any given flood event. HEC-FDA analyzes the percent damages to each structure and its contents associated with each level of flooding. The percent damages are multiplied by the structure or content value to arrive at dollar damages. This procedure is performed for every structure in the flood plain, with results consolidated by reach and integrated over the range of probabilities that flooding of different intensities will occur.

The HEC-FDA program also explicitly takes into consideration the uncertainty of the variables involved in calculating flood damages. The hydrologic, hydraulic, and economic data used in flood damage analysis are not known with certainty. To model these uncertainties, the probability distributions of the pertinent variables are input into the HEC-FDA program. The program then applies Monte Carlo simulation techniques to the data using discharge-probability, stage-discharge, and stage-damage functions containing these distributions. By conducting a large number of iterations, the program computes the expected value of damages while specifically accounting for the uncertainties in the underlying data. The expected average annual damages for each alternative are calculated by first summing damages by reach and by damage category, and then aggregating damages.

5. Structure Inventory. The structure inventory for this economic update is composed of all residential and commercial buildings in the SPF floodplain. Structures were identified by the use of a geographical information system (GIS) map with layers for county tax map key (TMK) parcels, the SPF floodplain, an aerial survey topographic map with 5-foot contour lines, and aerial photographs of the project area. The residential category includes single-family residences, and also multi-unit low-rise condominium and apartment buildings. The commercial structures category includes buildings serving commercial, industrial, and public purposes.

The study area is located in Wailuku along Iao Stream on the north coast of the island of Maui. Structures in the SPF-year floodplain are located within an area approximately bounded by Iao Stream to the Northwest, Lower Main Street and Mill Street to the Southeast, Imi Kala Street to the Southwest, and Kahului Bay to the Northeast. The ground elevations range from about 186 feet above Mean Sea Level (MSL) at the upstream end of the study area to about eight feet above MSL near Kahului Bay. There are about 362 single family residential structures (SFRs) in the 222-year floodplain. The average age of SFRs is about 31 years, and about a third were built since 2000. In addition to the SFRs, 45 multi-unit residential structures containing 464 condominium units were built between 1993 and 2002. The total replacement cost less depreciation value of residential structures in the 222-year floodplain is about $111 million and total contents value is about $43 million. The total replacement costs less depreciation of commercial structures in the 222-year floodplain is about $83 million and the total commercial contents value is about $121 million. The residential and commercial structures together have a replacement cost less depreciation value of about $194 million and damageable contents worth about $164 million.

For the purposes of this analysis, the flood plain was divided into eight reaches, all on the right bank of Iao Stream. The location of each reach along Iao Stream and a description of structure type types are shown in Table 3. Figure 1 illustrates the location of reaches within the floodplain. Figure 2 shows the location of structures in the SPF floodplain.

Table 3. Damage Reaches

	Location	Structure Inventory in Reach
Reach 1	shoreline to Sta. 16+75 (downstream of Waiehu Beach Road)	Mostly older SFRs
Reach 2	Sta. 16+75 to 33+08 at Momi Lane	Mostly commercial and industrial structures
Reach 3	Sta 33+08 to 38+97	Largely residential, contains both SFRs and multi-unit residential structures
Reach 4	Sta. 38+97 and 49+03	Largely residential, contains both SFRs and multi-unit residential structures
Reach 5	Sta. 49+03 to 59+03	Some multi-unit residential structures and many newer SFRs
Reach 6	Sta. 59+03 to 65+03	Some multi-unit residential structures and many newer SFRs
Reach 7	Sta. 65+03 to 73+01	Three SFRs
Reach 8	Sta. 73+01 to 80+12	One SFR

Both residential and commercial areas of the floodplain are fully built out, with little room available for construction of new structures without demolition of existing structures. This study therefore assumes that no significant changes will occur to the structure inventories or other assets on which damage categories are based, and that future conditions will be the same as present conditions for the purposes of calculating damages or costs.

In order to estimate flood damages to structures and their contents, it was necessary to identify the following information for each structure in the floodplain:

- The location or river station of each structure along the length of the stream;
- The first floor elevation of each structure;
- The depreciated replacement value of each structure;
- Depth-damage relationships for each type of structure that describe the effect of flooding at various depths on the structure and its contents.

The river station of each structure was calculated using a GIS map showing the location of structures and the floodplain cross sections with their associated river stations. The GIS measurement tool was used to interpolate the approximate river station for each structure using the river stations assigned to the nearest upstream and downstream cross sections.

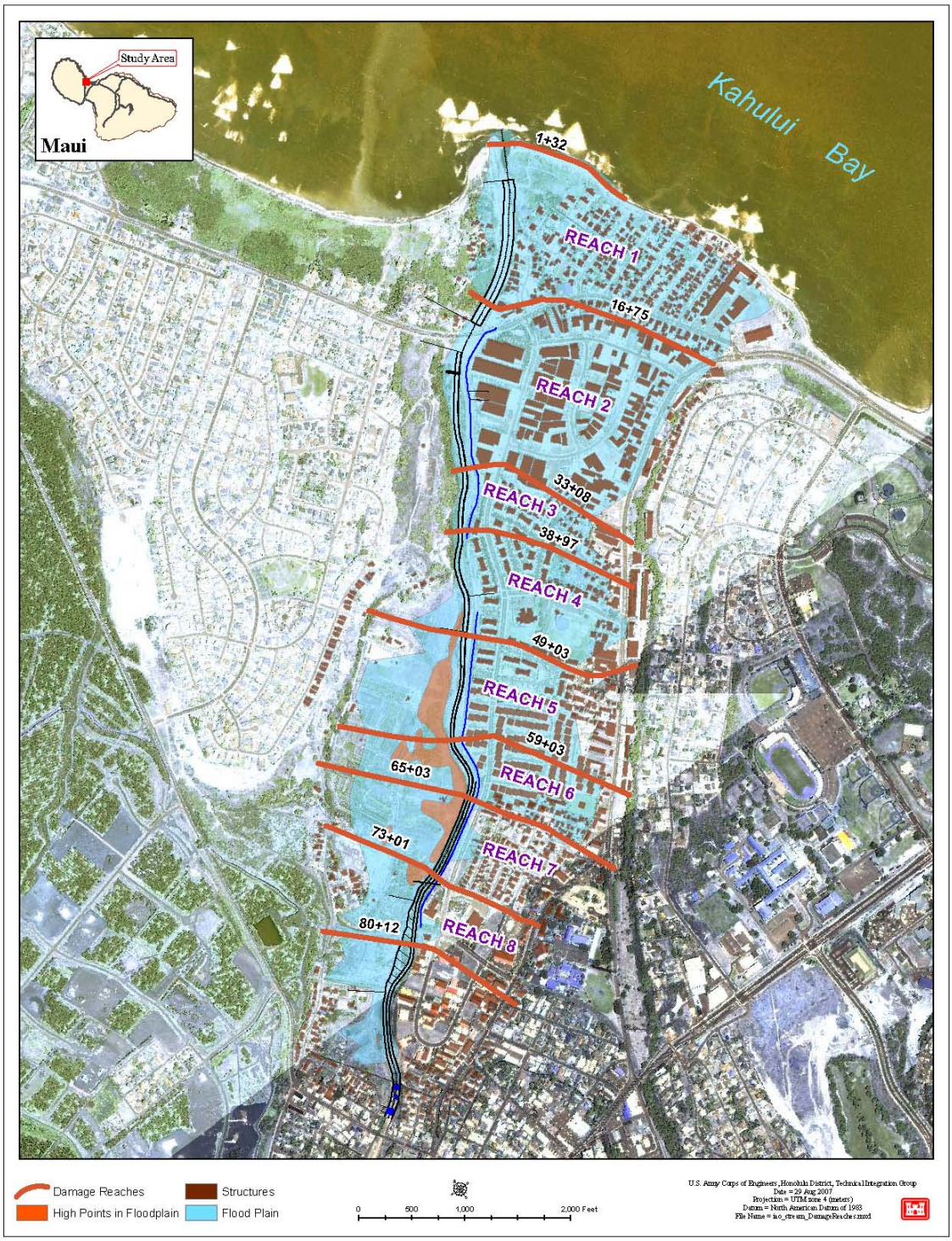

Figure 1. Damage Reaches.

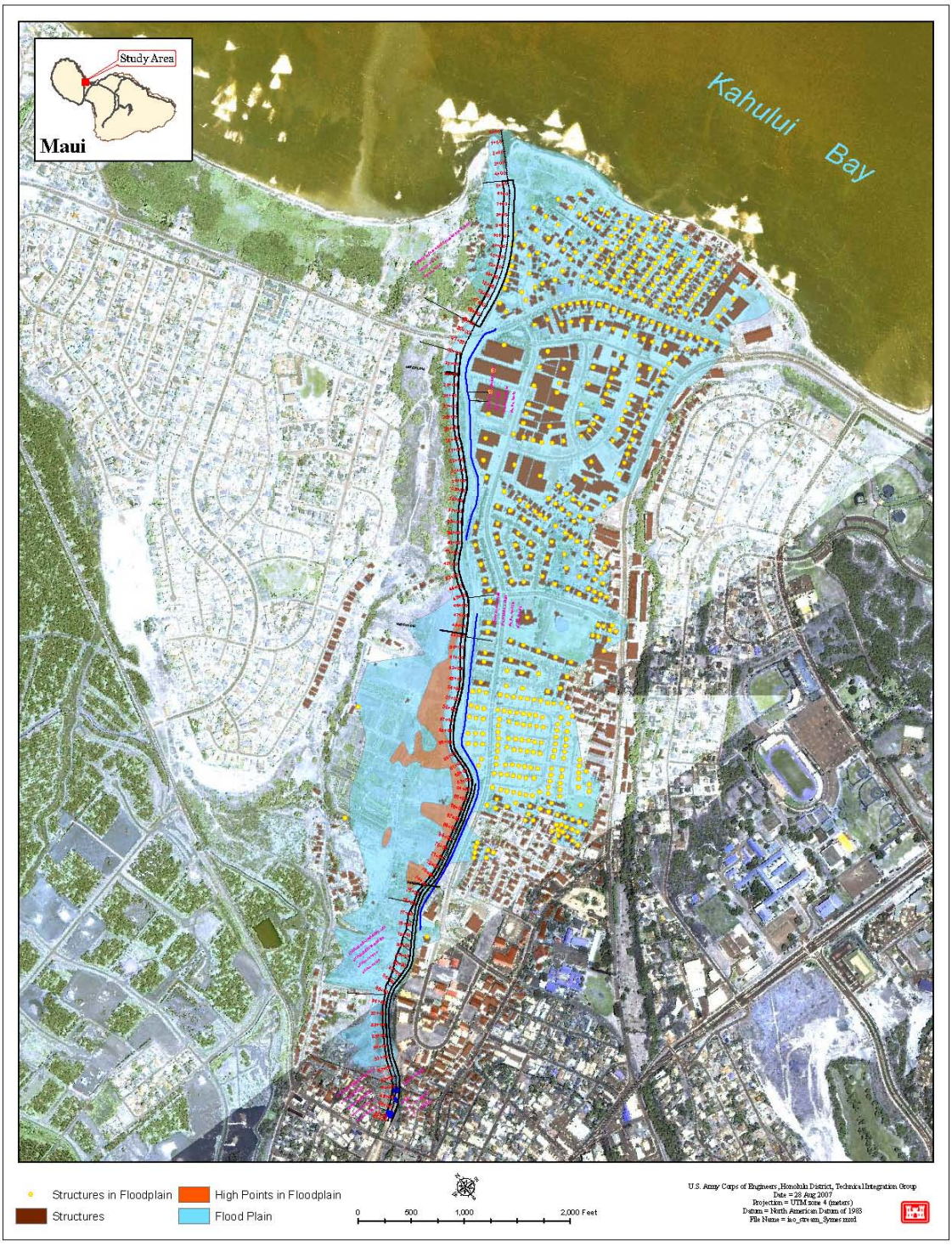

Figure 2. Location of structures in the Standard Project Flood (222-year) Floodplain.

Where appropriate, structure data gathered for the 1995 study was used for structures in existence at that time. For example, first floor elevation data gathered for the 1995 study was used in this analysis. Ground elevation of new structures not in place during the 1995 study was estimated using aerial contour maps. Height of first floor above ground for new structures was determined during a site visit in January 2004.

Structure values are based on 2008 property tax assessed values. According to "Procedural Guidelines for Estimating Residential and Business Structure Value for Use in Flood Damage Estimations (IWR 95-R-9, April 1995, page 43)," tax assessment data can be used as a proxy for depreciated replacement value when the assessment (1) has been performed recently, (2) gives consideration to effective age, remaining life, etc., (3) assesses land and improvements separately, and (4) when the economic depreciation is negligible. Telephone discussions in 2004 with Mr. Scott Teruya of the Maui County Real Property Tax Division confirmed that Maui tax assessments meet these conditions[1].

5.1 Single Family Residential Structure Values. In order to test the validity of using tax assessment values for SFRs in the Iao Stream floodplain, depreciated replacement values (DRVs) of a random sample of 38 properties were calculated using Marshall and Swift Residential Estimator (RE7) software. The following details of each property were obtained from property tax databases downloaded from the County of Maui web site[2]:

Year built
Living area (square feet)
Number of stories
Framing (Masonry, Double Wall, Wood/Single Wall, etc.)
Foundation Type (Concrete, Wood Piers, Hollow Tile)
Exterior Siding or Finish
Roof Material
Installed Air Conditioning
Number of Plumbing Fixtures

In order to calculate DRVs, RE7 also requires estimates of the quality and condition of each structure, and its effective age. Based on site visits, construction quality was assumed to be "fair" for older single-wall wooden homes, "average" for double-wall and masonry homes constructed more than 20 years ago, and "good" for homes less than 20 years. With the exception of homes built within the last 10 years, the condition was assumed to be average. All homes built less than 10 years ago are located along Iao Loop and adjacent streets, and appear to be in very good condition. Effective age was estimated using Tables 7, 8, and 9 from IWR 95-R-9 based on building age, framing type, quality and condition.

[1] See exception noted below for multi-unit condominium structures.
[2] http://webmail.co.maui.hi.us/com/webload/Extracts.htm as of 6/24/07.

For the 37 structures in the sample the standard deviation of the percent difference between tax assessment values and DRVs calculated using RE7 was 11.5%, which was used as the uncertainty value for SFR structure value in HEC-FDA.

Based on the methodology described above, the total depreciated replacement value (DRV) of single-family residence structures in the SPF floodplain is about $56,680,200, and the total value of contents of single-family residences is about $22,672,080. The average DRV of individual single-family residential structures is about $157,000 and the average value of contents per structure is about $63,000. Table 4 presents the number of single-family residential structures and total DRV and contents value for each reach, as well as average DRV and contents value for structures within each reach.

Table 4. Single Family Residences – Count and Values by Reach

	Single-Family Residential Structures (no.)	Depreciated Replacement Value ($)	Average Depreciated Replacement Value ($)	Contents Value ($)	Average Contents Value ($)
Reach 1	155	21,953,800	141,637	8,781,520	56,655
Reach 2	8	1,114,300	139,288	445,720	55,715
Reach 3	32	2,796,700	87,397	1,118,680	34,959
Reach 4	19	1,916,100	100,847	766,440	40,339
Reach 5	69	14,792,500	214,384	5,917,000	85,754
Reach 6	75	13,257,900	176,772	5,303,160	70,709
Reach 7	3	463,300	154,433	185,320	61,773
Reach 8	1	385,600	385,600	154,240	154,240
Total/ Average	**362**	56,680,200	156,575	22,672,080	62,630

5.2 Multi-Unit Residential Structure Values. Forty-five of the newer structures in SPF floodplain are two-story multi-unit structures with eight or twelve condominium units each. These structures were built between 1993 and 2002 and are two-story, wood frame structures with plywood sheathing. The average living space per structure is 8045 square feet. Using this data, the new replacement cost per square foot was calculated as $154.77 in October 2007 dollars using Marshall and Swift Commercial Estimator software (CE7). Tax assessment data was not used because the Maui County Real Property Tax Division does not attempt to accurately parse the overall assessed value of condominiums between land and improvements, although they do report values in both these categories[3].

[3] Phone conversation between Douglas Symes, Regional Economist, Honolulu District, U.S. Army Corps of Engineers and Mr. Wes Yoshioka, Appraiser, Maui County Real Property Tax Division, 12:50pm, 7/27/2007.

These buildings have been well maintained, and properties on the Island of Maui have appreciated rapidly in recent years. Using Marshall and Swift's methodology, the effective age was calculated to be 3 years for structures built in 2002 and 8 years for structures built in 1993 through 1996. The equivalent depreciation is 1% and 3% respectively for structures of good construction quality with an expected life of 55 years, which indicates DRVs of $153.22 per square foot for structures built in 2002 and $150.13 per square foot for structures built between 1993 and 1996.

The value of these buildings also depends on the condition of the condominiums within each building. However, the condition of individual condominiums is unknown. In order to estimate the uncertainty of the DRVs for these structures, the effective age was allowed to randomly vary between zero (indicating all newly remodeled units) and 14 years (the actual age of a structure built in 1993). This is equivalent to depreciation between 0% and 7%. The standard deviation of the difference between DRVs using Marshall and Swift's methodology and the alternative methodology of randomly varying depreciation between zero and 7% was 2.12%, based on thirty iterations using the Excel software (formula =rand()*.07) for the amount of depreciation applied to each structure in the alternative method.

The total DRV of multi-unit residential structures in the SPF floodplain is about $54,451,845, with an average DRV of about $1,210,041 and average contents of about $447,715. Table 5 presents the number of multi-unit residential structures and total DRV and contents values for each reach as well as average DRV and average contents value for structures within each reach.

Table 5. Multi-Unit Residential Structures – Count and Values by Reach

	Multi-unit Residential Structures (no.)	Depreciated Replacement Value ($)	Average Depreciated Replacement Value ($)	Contents Value ($)	Average Contents Value ($)
Reach 1	0	0	0	0	0
Reach 2	0	0	0	0	0
Reach 3	9	9,755,696	1,083,966	3,609,608	401,068
Reach 4	23	27,187,081	1,182,047	10,059,220	437,357
Reach 5	13	17,509,068	1,346,851	6,478,355	498,335
Reach 6	0	0	0	0	0
Reach 7	0	0	0	0	0
Reach 8	0	0	0	0	0
Average			1,210,041		447,715
Total	**45**	54,451,845		20,147,183	

5.3 Commercial Structure Values. The 222-year flood plain contains 103 tax parcels with one or more commercial structures. Commercial structures were assigned to the categories of depth-damage function developed by the New Orleans District of the

U.S. Army Corps of Engineers (MVN), as listed in Table 6 below. Where multiple structures existed on one tax parcel, the predominate usage was assigned to all structures on the parcel. Structure and first floor elevation data gathered for the 1995 study was used for structures in existence at that time. New structures were added to the inventory during a site visit in January 2004.

Table 6. Occupancy Types

Occupancy Type	HEC/FDA Name
Eating and recreation	EAT
Grocery and gas stations	GROC
Professional businesses	PROF
Public and semi-public	PUBL
Repairs and home use	REPA
Retail and personal services	RETA
Warehouse/contractor services	WARE

As with SFRs, 2008 property tax data was used to estimate the depreciated replacement values of commercial structures on each tax parcel. Table 7 presents the number of tax parcels per reach with commercial structures, the total and average depreciated replacement costs of structures per parcel within each reach, and the total and average value of contents. The total DRV of commercial structures in the 222-year floodplain was calculated to be about $84 million, and the total value of commercial contents was estimated to be about $120 million.

Table 7. Commercial Structures and Contents by Reach

	Tax Parcels with Commercial Structures (no.)	Depreciated Replacement Value of Structures By Reach ($)	Average Depreciated Replacement Value of Structures per Parcel ($)	Contents Value By Reach ($)	Average Contents Value per Parcel ($)
Reach 1	17	10,066,600	592,153	14,116,410	830,377
Reach 2	77	64,894,500	842,786	93,377,905	1,212,700
Reach 3	4	5,459,500	1,364,875	9,117,308	2,279,327
Reach 4	4	3,230,400	807,600	4,287,993	1,071,998
Reach 5	0	0	0	0	
Reach 6	1	1,300	1,300	1,482	1,482
Reach 7	0	0	0	0	
Reach 8	0	0	0	0	
Average			812,158		1,173,797
Total	103	83,652,300		120,901,098	

In order to estimate the uncertainty of the using tax assessment data for commercial structures, a random sample of twenty tax parcels was evaluated using CE7 and the resulting DRVs were compared with the tax assessments of buildings on each parcel. The standard deviation of the percent difference between these paired values was 20.08%.

6. Depth-Damage Functions for Structures and Contents.

6.1 Residential Depth-Damage Functions. The effects of flooding on the structures in the various reaches were estimated using depth-damage relationships. These depth-damage "curves" relate the depth of flooding to the damage likely to be caused to the structure and its contents, expressed as a percentage of the structure value. The curves used in this study for SFRs are from the Economic Guidance Memorandum 04-01, "Generic Depth-Damage Relationships for Residential Structures with Basements (Institute for Water Resources (IWR), 2004)". They are based on data from approximately one thousand homes flooded between 1996 and 1998 in major flooding events in different parts of the country. Structure and contents damage curves for one-story residences without basements were used for the majority of residential structures in this study. Different curves are provided for two-or-more-story residences and split-level residences.

The generic depth damage curves supplied by IWR include depth-damage relationships for residential contents. These curves provide mean values for the contents damaged as a percent of structure value, and the associated standard deviations for the three types of single family residential structures that were used in this study.

Because the multi-unit residential structures in the Iao Stream floodplain are similar in structure to large two story residential homes (although somewhat larger), the IWR depth damage curves for SFR structures with two or more stories without basements were used to estimate structure and content damages.

6.2 Depth Damage Functions for Commercial Structures and Contents. Depth damage functions for commercial structures and contents developed for the New Orleans District of the Corps of Engineers were used to evaluate damages to commercial structures and contents[4].

7.0 Inundation Damage to Residential and Commercial Structures and Contents. HEC-FDA software was used to evaluate structure and content damages to residential and commercial structures. Average annual damages by reach to residential structures and contents are presented in Table 8. In the without-project condition, the total expected annual structure and content damage is about $923,000. If Alternative 3 is constructed, total expected annual damages are about $4,000. Total Damages prevented for

[4] GEC, "Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSVRs) in Support of the Jefferson and Orleans Flood Control Feasibility Studies," Baton Rouge, Louisiana, June 1996.

residential structures and contents are the difference between without-project and with-project expected annual damages, or about $919,000.

Table 8. Inundation Damage to Residential Structures and Contents.

	Without-Project Damages ($)	With-Project Damages (Alternative 3) ($)	Damages Prevented ($)
Reach 1	218,640	3,500	215,140
Reach 2	30,810	0	30,810
Reach 3	14,150	0	14,150
Reach 4	118,120	0	118,120
Reach 5	233,060	10	233,050
Reach 6	304,730	750	303,980
Reach 7	160	10	150
Reach 8	3,120	0	3,120
Total	922,790	4,270	918,520
Rounded	**923,000**	**4,000**	**919,000**

Damages by reach to commercial structures and contents are presented in Table 9. In the without-project condition, the total expected annual structure and content damage is about $1,438,000. If Alternative 3 is constructed, total expected annual damages are $2,000. The benefits are the difference between without-project and with-project expected annual damages, or about 1,436,000.

Table 9. Inundation Damage to Commercial Structures and Contents.

	Without-Project Damages ($)	With-Project Damages (Alternative 3) ($)	Damages Prevented ($)
Reach 1	133,110	1,780	131,330
Reach 2	1,250,000	0	1,250,000
Reach 3	0	0	0
Reach 4	54,680	0	54,680
Reach 5	0	0	0
Reach 6	0	0	0
Reach 7	0	0	0
Reach 8	0	0	0
Total	1,437,790	1,780	1,436,010
Rounded	**1,438,000**	**2,000**	**1,436,000**

8. Damages to Motor Vehicles. In addition to structural and content damages to residential and commercial structures, flooding also causes damages to motor vehicles. In order to estimate the damages to a vehicle in the flood plain, the analyst must know four things: the parked elevation of the vehicle, the height of floodwaters at the vehicle's location, the value of the vehicle, and the appropriate depth-damage curve to describe the percent of vehicle damage likely to be caused by flooding. To aggregate vehicle damages over the flood plain, the number of vehicles at each location must also be estimated.

8.1 Vehicle Elevation. The parking elevation for vehicles associated with residential structures was measured with a hand level relative to the first floor elevation for the 48% of residential structures surveyed. For the remaining 52% of structures, the first floor elevations were known with a maximum standard deviation of 0.102 feet, so parking elevations were estimated by subtracting the average difference between structure first floor elevations and parking elevations for the surveyed structures in the same reach. The standard error of these estimated elevations was calculated for each reach as the square root of the sum of (1) the variance associated with the techniques used to measure the parking elevations which were directly measured, (2) the variance of the difference between first floor elevations and measured parking elevations in the reach, and (3) the variance associated with measurement of first floor elevations using an automatic level.

8.2 Height of Floodwaters at Vehicle Location. The HEC-FDA program calculates flooding depth by comparing the elevation of a structure (in this case, a motor vehicle) with the height of floodwater for a given frequency event at the location along the stream station where the structure is located. In this analysis, vehicles associated with a particular building were assigned the same location as the building. Because only residential vehicles are considered in this damage category, and the majority of homes have parking either in an attached garage or carport, the assumption is a reasonable one. Elevation of parked cars associated with residential structures is assumed to be the same as the first floor elevation of the associated structure. Since carports, garages, and street parking all tend to be at a lower elevation than the first floor of the typical residence, this assumption is conservative and may tend to understate damage to vehicles.

8.3 Vehicle Depth-Damage Function. This analysis uses depth damage curves and associated probability distribution functions[5] developed by the New Orleans District of the U.S. Army Corps of Engineers (MVN) to estimate the effects of flooding on parked cars. A panel of experts with experience dealing with flood damaged vehicles, in this case two car-dealership operators, was asked to estimate vehicle values and percent damage at various flooding depths for new or nearly new compact, mid-sized, and full-sized cars. The six resulting damage estimates was averaged for flood levels between 0.5 feet and 3 feet to give the depth-damage relationship described in Table 10:

[5] GCE, Inc., "Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSRVs) in Support of the Jefferson and Orleans Flood Control Feasibility Studies," Baton Rouge, Louisiana, June 1996.

Table 10. MVN Vehicle Depth Damage Function.

Flood Level (feet above road surface)	Damage (Percent of Value)
0.5	2.3%
1.0	22.8%
1.5	54.2%
2.0	95.8%
3.0	100%

This analysis assumes that the MVN depth-damage relationships identified above are representative of the effects of flooding on vehicles in the Iao Stream floodplain. A discussion of the uncertainty of these estimates is provided in Section 16.2.3.

8.4 Number of Vehicles at Residential Locations. According to data from the 2000 Census, there are about 1.6 vehicles per occupied housing unit in Census Tract 309.02, which is largely the same as the study area. However, since people drive to work, shop, take children to school, and perform many other driving activities which take them away from home, the average number of vehicles likely to be at the typical housing unit at any given time will be less that the average number of vehicles owned by household residents. About 41% of the residents of the study area are aged 16 or older, employed, do not work at home, and travel to work by car or other private vehicle. However, because about 19% of these workers carpool with one or more other commuters, each worker commuting by car represents 0.90 vehicles. Applying these proportions to the average household of 2.83 persons in the Iao Stream study area, the average number of vehicles per household used for commuting equals:

2.83 persons per household x 41% commuting x 0.90 carpooling factor = 1.04 vehicles per household used to commute to work.

Also according to the 2000 Census, the average time spent traveling to work is about half an hour. Assuming that, on average, workers will work eight hours per day, five days per week, and will take an extra hour shopping or completing other errands as part of their daily commute, each vehicle used to commute to work will be away from its home parking location in the Iao Stream study area 50 hours per week or about 30% of the time.

Because households use automobiles for many other activities besides commuting to work, this analysis makes a simplifying assumption in the absence of data that all vehicles in the study area are away from their home parking locations about 66 hours per week, or about 40% of the time. Therefore the average number of vehicles that will be parked at a residence at any given time is:

1.6 vehicles per occupied household x ((1 – 40 % time away from home) = 0.96 vehicles, or about one vehicle per household at any given time.

8.5 Estimating the Average Value of Vehicles. The average price of all used vehicles sold in the U.S. is reported in the 2006 Used Car Market Report (UCMR) by Manheim Auctions. The UCMR reports that the average price of used vehicles in 2005 was $8,315, and the average price of new vehicles was $24,275. Updating these values to FY 2008 using CPI-U for used and new vehicles respectively gives average prices of $8,324 for used vehicles and $24,192 for new vehicles at a 2008 price level.

According to the Bureau of Transportation Statistics, U.S. households owned a total of 247 million motor vehicles in 2005. Of these, the 2006 UCMR reports that 17 million or about 6.9% were purchased new in 2005.

This analysis assumes that (1) vehicles in the Iao Stream floodplain have the same distribution of value as vehicles in the U.S. as a whole, (2) the average value of used vehicles owned by U.S. households is equal to the average price of used vehicles reported by Manheim, and (3) that at any given time, the average value of the new vehicles purchased during the preceding 12 months is 90% of the average 2005 price of new vehicles reported by Manheim. Taking the weighted average of the value of used vehicles and vehicles purchased new during the preceding 12 months gives an average value for all vehicles of ($8,324 x 93.1%) + ($24,192 x 90% x 6.9%) = $9,251, or about $9,300.

Using the estimated one vehicle per household present at any given time, the average value of vehicles present at each single family residential structure or individual condominium is $9,251 or about $9,300.

8.6 Number of Vehicles at Commercial Locations. Vehicles at commercial establishments were not included in this analysis. Although it is likely that some vehicles parked at commercial establishments will also be damaged during a flooding event, it is not possible to estimate the number of vehicles parked at commercial establishments without additional field surveys, which are beyond the resources available for this project. Estimates of vehicle damages may therefore be considered conservative.

8.7 Inundation Damage to Vehicles. Vehicle damages under the without-project and with-project conditions and damages prevented were evaluated with the HEC-FDA computer program and are presented in Table 11.

Table 11. Inundation Damage to Vehicles.

	Without-Project Damages ($)	With-Project Damages (Alternative 3) ($)	Damages Prevented ($)
Reach 1	21,710	380	21,330
Reach 2	2,720	0	2,720
Reach 3	2,090	0	2,090
Reach 4	21,360	0	21,360
Reach 5	19,960	0	19,960
Reach 6	20,330	600	19,730
Reach 7	10	0	10
Reach 8	130	0	130
Total	88,310	980	87,330
Rounded	**88,000**	**1,000**	**87,000**

9.0 Yard and Outside Property Damage for Residences. Besides damages to automobiles, structures, and contents, the residents of the Iao Stream area will also suffer damages to their yards and other outside property after a major flooding event. This is especially true for those yards inundated by mud as well as water. A Corps survey of residents in Niu Valley on the Island of Oahu soon after the 1988 New Year's Eve flood revealed that out of a total of 171 homes in the flood plain, 149 of them suffered yard damages. Owners of 144 homes (97 percent) reported mud in their yards. A more recent survey asked Niu Valley homeowners about the cost, in both dollars and time spent, involved in rehabilitating their yards and other outside property. Responses put the average expenditures to repair damages at about $4,040 at an October 1987 price level. The length of time spent repairing yards and other property averaged 110 hours.

Because without-project flooding along Iao Stream is only expected in a 25-year or larger event which will also involve levee failure, residents may experience damage to yards and outside property similar to that experienced by residents of Niu Valley. Consequently, the average cost and time spent to repair yards and other property from Niu Valley are used in this analysis.

Damages to yards were determined by comparing flood heights with first floor elevations using the HEC-FDA software. The Niu Valley survey taken right after the 8 1988 flood indicated that mud was deposited on yards with flood waters as low as four inches. It is assumed that this phenomenon will also occur in the Iao Stream floodplain during the various events, and that lots which experience flooding over the first floor structure elevation will also sustain damages to their yards and other outside property.

The total cost for repairing flood damage is the monetary expenditure plus the value of time spent by the resident. The average monetary expenditure by homeowners in Niu

Valley who suffered damage to their yards was $4,040 at an October 1987 price level. The average time spent on clean up and repair was 110 hours. Landscaping and grounds-keeping workers in Hawaii made about $13.68 per hour as of May 2007[6]. Using this hourly rate, 110 hours spent in yard clean up and repair amount to 110 hours x $12.51 per hour = $1,505. Before these two expenditure figures can be summed, they must be adjusted to a common price level using the Honolulu Consumer Price Index. Using the 90.9% increase in Honolulu CPI-U between the second half of 1987 and the second half of 2007, the $4,040 average costs for repairing yard damages was updated to $4,040 x 1.909 = $7,712 at approximately the October 2007 price level. The total expenditure per lot is then $7,712 + $1,505 = $9,217, or about $9,200.

Although only the mean value of yard damage which occurred in the 1988 Niu Valley flood is know, it seems likely that damages varied considerably from one yard to another. In the absence of data, this analysis assumes that the uncertainty of damages may be characterized by a symmetrical triangular distribution with a most likely value equal to the updated average damages from the Niu Valley flood, a minimum value of zero, and a maximum value equal to 200% of the average damages.

Without-project and with-project yard and outside property damages for each reach were calculated by the HEC-FDA program, and are presented in Table 12. Total without-project average annual damage to yards and outside property is $72,630, or about $73,000 and with-project damage is $360, or about $0 (rounded) with the project in place. Benefits, or the reduction in damages and cleanup costs, are about $72,000.

Table 12. Yards and Outside Property Damage.

	Without-Project DamagesDamages ($)	**With-Project Damages (Alternative 3) ($)**	**Damages Prevented ($)**
Reach 1	25,310	310	25,000
Reach 2	2,480	0	2,480
Reach 3	2,620	0	2,620
Reach 4	7,980	0	7,980
Reach 5	15,660	0	15,660
Reach 6	18,400	50	18,350
Reach 7	30	0	30
Reach 8	150	0	150
Total	72,630	360	72,270
Rounded	**73,000**	**0**	**72,000**

[6] Bureau of Labor Statistics, http://www.bls.gov/oes/current/oes_1500001.htm#b37-0000, as of 8/13/08.

10. Emergency Costs. In the event of flooding, some residents of the Iao Stream floodplain may require emergency assistance, during or after the event. There is no emergency assistance data for previous flooding events at Iao Stream, so the emergency costs for the 1988 New Year's flood in Niu Valley on the Island of Oahu have been generalized to Iao Stream for this study.

Emergency assistance to the residents of Niu Valley included Red Cross assistance, Federal Emergency Management Administration grants, and Armed Forces and church group donations of their manpower and supplies. These costs totaled $264,000 for the relief effort in 1988.

To determine the cost per structure using this figure, it was necessary to estimate the number of Niu Valley homes flooded in the 1988 storm. According to the records collected after the flood, 108 homes in Niu Valley had water over the first floor. Dividing the total cost of these emergency relief services by the estimated number of homes with water over the first floor gives an average per structure emergency assistance cost of about $2,400 at an October 1987 price level. This figure was updated to about $4,600 at approximately an October 2007 price level, using the Honolulu Consumer Price Index[7].

This analysis assumes that residents in the Iao Stream floodplain whose homes are inundated by flood waters above the first floor level will, on average, require $4,400 emergency assistance. A depth damage function for the HEC-FDA program was developed which assigned zero damages to a flooding depth of zero inches above the first floor elevation and $4,600 to any flooding depth one inch or more above the first floor elevation. The uncertainty of first floor elevations is the same as described above for residential structure first floor elevations.

Although no data was available for this analysis with respect to the variability of emergency costs which occurred in the 1988 Niu Valley flood, it seems likely that emergency costs varied considerably. In the absence of data, this analysis assumes that the uncertainty of damages may be characterized by a symmetrical triangular distribution with a most likely value equal to the updated average damages from the Niu Valley flood, a minimum value of zero, and a maximum value equal to 200% of the average damages.

The expected annual emergency costs under without-project and with-project conditions were calculated by the HEC-FDA model as described earlier and are listed in Table 13 below by damage reach. Total average annual without-project emergency costs are about $38,000, and total with-project emergency costs are $170, or about $0 when rounded. The difference between these, the total average annual benefits, are about $38,000.

[7] CPI/U-HON (1987/second half) = 116.5; CPI/U-HON (2007/second half) = 222.39.

Table 13. Emergency Costs.

	Without-Project Costs ($)	With-Project Costs (Alternative 3) ($)	Costs Prevented ($)
Reach 1	13,410	150	13,260
Reach 2	1,260	0	1,260
Reach 3	1,390	0	1,390
Reach 4	4,080	0	4,080
Reach 5	8,200	0	8,200
Reach 6	9,430	20	9,410
Reach 7	10	0	20
Reach 8	80	0	80
Total	37,860	180	37,680
Rounded	**38,000**	**0**	**38,000**

11. Flood Insurance Operating Costs. A reduction in the operating cost of the National Flood Insurance Program (NFIP) can be claimed as a benefit for certain flood control projects. Benefits are attributed to those projects that have at least a 90 percent chance of containing the 100-year event. This will reduce the number of homes requiring insurance policies for flood damages and hence the operating costs necessary to process those policies. According to Economic Guidance Memorandum 06-04, the (latest guidance on flood insurance operating costs), the NFIP's average operating costs per policy was $192 for FY2006.

Every time the HEC-FDA program computes stage damage relationships, it writes an output file that can be used to identify structures which are flooded at or above the first floor level. In the without-project condition the output file indicates that 200 homes would be flooded above the first floor by a 100-year event, while in the with-project condition tyhere are no residential damages in any reach for a 100-year event. The reduction in flooding therefore affects 200 residential structures. However, typically only about 49% of homes in a 100 year flood plain carry a flood insurance policy[8], implying

[8] Dixon, Lloyd et al, "The National Flood Insurance Program's Market Penetration Rate: Estimates and Policy Implications," Rand Corporation, Santa Monica, CA 2006: 14-20. The 95% confidence interval of the 49% estimate of nationwide market penetration is 42% to 56%, which implies that the Standard deviation is about 3.5% (one quarter the range of the 95% confidence interval).

According to the 2000 Census, about 55% of the housing units in census districts 3.01 and 3.02 of Honolulu County have mortgages or other secured loans (Table HCT72. MORTGAGE STATUS, Census 2000 Summary File 4 (SF 4) - Sample Data). This analysis therefore assumes that 55% of the houses in the floodplain are mortgaged and subject to mandatory purchase of flood insurance, enforced by the lender.

A study released by the U.S. Federal Emergency Management Agency (FEMA) in 2000 found an overall compliance rate of 90 percent for mandatory flood insurance, based on a sample with a disproportionate number of coastal communities. (FEMA, Office of the Inspector General, "Opportunities to Enhance Compliance with Homeowner Flood Insurance Purchase Requirements," Washington DC, 2000).

that the number of policies held by homeowners in the Iao Stream floodplain is about 200 structures x 49% = 98 flood insurance policies.

The annual without-project NFIP operating costs are therefore 200 structures x 49% x $192 per policy = $18,816, or about $19,000. With-project NFIP costs are zero. Benefits, or the savings in with-project National Flood Insurance Program operating cost are therefore about $19,000.

12. Benefits Summary. Table 14 summarizes the without-project and Alternative 3 with- project damage and the resulting benefits. Total without-project damages are about $2,579,000. With-project damages are about $7,000. The total benefit for these damage categories is about $2,572,000. As noted earlier, Alternatives 1 through 4 are assumed to have identical benefits.

Table 14. Benefit Summary.

	Without Project Damages/Costs ($)	**With Project Damages/Costs ($)**	**Benefits (Damages or Costs Prevented) ($)**
Residential structures and contents	923,000	4,000	919,000
Commercial structures and contents	1,438,000	2,000	1,436,000
Vehicles	88,000	1,000	87,000
Yard and Outside Property Damage	73,000	0	73,000
Emergency Assistance Costs	38,000	0	38,000
Flood Insurance Operating Costs	19,000	0	19,000
Total	2,579,000	7,000	2,572,000

13. Project Costs. Table 15 lists the various costs involved in constructing and maintaining the improvements to the Iao Flood Control Project and changes in annual operating and maintenance costs associated with each alternative.

Combining this proportion with the 55% of housing units subject to mandatory flood insurance purchase gives a flood insurance coverage rate of 49.5%., which is very close to Lloyd et al above.

Table 15. Project Costs

	Alternatives		
	1	**2**	**3**
Project First Cost[1]	$40,641,882	$55,187,961	$30,809,128
Months of Construction	30	30	22
Interest During Construction (months, 4.875%, EOY)	$1,607,371	$2,208,762	$691,982
Investment Cost	$42,249,253	$57,396,723	$31,501,110
Amortized Investment Cost	$2,269,726	$3,083,483	$1,692,312
Difference in Annual O&M[2]	-$61,175	$0	$122,352
Total Average Annual Cost	$2,208,551	$3,083,483	$1,814,664
Total Average Annual Cost (Rounded)	$2,209,000	$3,083,000	$1,815,000

[1]Includes PED, S&A, EDC, and LERRD.
[2]The difference between without-project O&M of $152,939 per year and O&M for with-project alternatives.

The project first cost of each alternative includes the costs of all materials and services that will go into fixing the project. The interest during construction is based on the project first cost and is calculated using the prescribed discount rate of 4.875%, the estimated construction period, and end-of-year compounding. The investment cost is equal to the project first costs plus interest during construction. Investment cost is then amortized at the prescribed interest rate of 4.875% over the 50-year period of analysis. Annual operation and maintenance cost is then added to the amortized investment cost to get the total average annual cost of each alternative.

14. Benefit-Cost Ratios and Net Benefits. As noted in the Section 2 at the beginning of this economic update, two criteria are applied in order to choose the plan that reasonably maximizes NED benefits: the plan must have a benefit-to-cost ration greater than one, and must also have the greatest net benefits. Table 16 shows the average annual benefits, the average annual costs, the benefit-cost ratios and the net benefits of the three alternatives considered in the analysis (Alternative 4 was eliminated from consideration because itdoes not meet project objectives, and Alternative 5 was not analyzed because it is assumed to have a benefit/cost ratio of zero or less).

Table 16. Benefit-Cost Ratio and Net Benefits of Alternatives

	Alternatives		
	1	**2**	**3**
Average Annual Benefits	**2,572,000**	**2,572,000**	**2,572,000**
Average Annual Costs	$2,209,000	$3,083,000	$1,815,000
Benefit/Cost Ratio	1.2	0.8	1.4
Net Benefits (rounded)	$363,450	($511,480)	$757,340

15. National Economic Development (NED) Plan. According to the information in Table 16, Alternative 3 has a benefit-cost ratio greater than 1 and the highest net benefits. Therefore, the recommended plan is Alternative 3, with a benefit-cost ratio of 1.3.

16. Risk and Uncertainty. As noted above, the HEC-FDA software program explicitly takes into consideration the uncertainties related to the variables involved in calculating flood damages. The hydrologic, hydraulic, and economic data used in the flood damage analysis are not known with certainty. To take this into consideration, the probability distributions of the pertinent variables are input into the HEC-FDA program. The program applies Monte Carlo simulation techniques to sample from the quantified uncertainty in the applicable discharge-probability, stage-discharge, and stage-damage functions. By conducting a large number of iterations, the program computes expected values of damages while specifically accounting for the uncertainties in the underlying data. The expected average annual damages for each reach are then calculated using these figures.

16. 1 Structure, Vehicle, and Ground Elevations. First floor elevations were estimated using an aerial survey topographical map with five foot contours. According to "Risk-based Analysis for Flood-damage-reduction Studies" (EM 1110-2-1619, USACE, Washington, DC, August 1996), the standard deviation of the measurement error for such a map is 0.60 feet.

16.2 Depth-Damage Functions.

16.2.1 Residential Depth-Damage Functions. This analysis uses generic depth-damage functions with associated uncertainty parameters described in the U.S. Army Corps of Engineers Economic Guidance Memorandum (EGM) 04-01, "Generic Depth-Damage Relationships for Residential Structures with Basements." The EGM also list depth-damage relationships for structures without basements, which were used in this analysis. Three types of structures without basements are described: one-story structures, two or more story structures, and split level structures. The standard deviation of measure error is listed for each level of flooding in the damage schedules.

16.2.2 Commercial Depth-Damage Functions. This analysis uses depth damage curves developed for the New Orleans District of the U.S. Army Corps of Engineers (MVN) to estimate the effects of flooding on commercial structures and contents. A panel of experts composed of one general contractor, one insurance adjuster, and one certified restorer was asked to estimate damages to three types of commercial structure construction at various flooding depths. Of the three types (metal frame walls, masonry walls, and wood or steel frame), the damage function for masonry walls under freshwater conditions were used in this study as best representing the commercial structures in the Iao Stream floodplain.

For each depth of flooding, the panel produced a maximum, minimum, and mean value of damage for the sample structure they were asked to evaluate. These values, expressed as a percent of structure value, were entered into the HEC-FDA program for each depth of flooding to produce a series of triangular distributions for structure damage. The MVN contractor also used a panel of experts to estimate depth-damage functions for commercial contents using similar methodology, with a triangular distribution of error based on minimum, mean, and maximum estimated of damage at different levels of flooding.

MVN's contractor interviewed nine managers and/or owners from each of eight different categories of commercial businesses concerning the value of commercial contents and the value of the structure in which the building was located. The value of the structures was also evaluated with Marshall and Swift software. The interviews were used to derive Content to Structure Value Ratios (VRCSVRs) for each category of business, as well as the variability of those CSVRs, expressed as standard deviations.

The reader is referred to the contractor's report for comprehensive explanations of methodologies used to derive commercial depth-damage functions for structures and contents, and associated risk and uncertainty values. Table 17 presents depth-damage functions with uncertainty parameters for all structure types, as used in the HEC-FDA model to evaluate Iao Stream.

16.2.3 Vehicle Depth-Damage Functions. This analysis uses depth damage curves[18] developed by a contractor for the New Orleans District of the U.S. Army Corps of Engineers (MVN) to estimate the effects of flooding on parked cars. A panel of experts with experience dealing with flood damaged vehicles, in this case two car-dealership operators, was asked to estimate vehicle values and percent damage at various flooding depths for new or nearly new compact, mid-sized, and full-sized cars. The six resulting damage estimates were averaged for flood levels between 0.5 feet and 3 feet, and the minimum and maximum estimates at each damage level were used as the minimum and maximum values of a triangular error distribution. Above 3 feet, all members of the panel estimated damage at 100%.

16.2.4 Yard and Outside Property Damage. Damages to yards were determined by comparing flood heights with ground elevations using the HEC-FDA software. The Niu Valley survey taken right after the 1987 flood indicates that mud was deposited on yards with flood waters as low as four inches. It is assumed that this phenomenon will also occur in the Iao Stream floodplain during the various events, and that lots which experience flooding of a foot over ground level or higher will also sustain damages to their yards and other outside property.

Although only the mean value of yard damage which occurred in the 1988 Niu Valley flood is known, it seems likely that damages varied considerably from one yard to another. In the absence of data, this analysis assumes that the uncertainty of damages may be characterized by a symmetrical triangular distribution with a most likely value

equal to the updated average damages from the Niu Valley flood or about $9,200, a minimum value of zero, and a maximum value equal to 200% of the average damages.

16.2.5 Emergency Cost. This analysis assumes that residents of the Iao Stream floodplain whose homes are inundated by flood waters above the first floor level will, on average, require $4,600 of emergency assistance, based on similar flooding during the 1988 Niu Valley flood. A depth damage function for the HEC-FDA program was developed which assigned zero damages to a flooding depth of zero inches above the first floor elevation and $4,600 to any flooding depth over one inch above the first floor elevation. The uncertainty of first floor elevations is the same as described above for residential structure first floor elevations.

Although no data was available for this analysis with respect to the variability of emergency costs which occurred in the 1987 Niu Valley flood, it seems likely that emergency costs varied considerably. In the absence of data, this analysis assumes that the uncertainty of damages may be characterized by a symmetrical triangular distribution with a most likely value equal to the updated average damages from the Niu Valley flood or about $4,600, a minimum value of zero, and a maximum value equal to 200% of the average damages.

Table 17. Depth-damage functions from HEC-FDA model.

Occ_Name	Occ_Description	Cat_Name	Parameter	Start_Data																	
RETA	Retail and Personal Services	COM	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RETA			S	0	0	0.2	7.6	8.3	11.4	15	15.8	15.8	15.8	22.2	26.6	28.7	28.7	28.7	32.4	39.7	41.2
RETA			STL	0	0	0.1	5.7	6.2	8.6	12.8	13.4	13.4	13.4	18.9	22.6	24.4	27.3	27.3	30.1	37.7	39.1
RETA			STU	0	0	0.3	9.5	10.4	14.2	17.2	18.2	18.2	18.2	25.5	30.1	30.1	30.1	30.1	34	41.7	43.3
RETA			C	0	0	0	35.3	48.2	54.1	54.3	54.8	54.8	54.8	54.8	54.8	98.9	99.9	100	100	100	100
RETA			CTL	0	0	0	15.3	28.2	34.1	34.3	34.8	34.8	34.8	34.8	34.8	78.9	79.9	80	80	80	80
RETA			CTU	0	0	0	55.3	68.2	74.1	74.3	74.8	74.8	74.8	74.8	74.8	100	100	100	100	100	100
RETA			Struct	N		0.6		N		20.08		N	142	93.2			-901				
EAT	Eating and Recreation	COM	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EAT			S	0	0	0.2	7.6	8.3	11.4	15	15.8	15.8	15.8	22.2	26.6	28.7	28.7	28.7	32.4	39.7	41.2
EAT			STL	0	0	0.1	5.7	6.2	8.6	12.8	13.4	13.4	13.4	18.9	22.6	24.4	27.3	27.3	30.1	37.7	39.1
EAT			STU	0	0	0.3	9.5	10.4	14.2	17.2	18.2	18.2	18.2	25.5	30.1	30.1	30.1	30.1	34	41.7	43.3
EAT			C	0	0	0	27.5	60.8	81	88.6	89.5	92	92	97.8	97.8	97.8	97.8	97.8	97.8	97.8	97.8
EAT			CTL	0	0	0	17.5	50.8	71	78.6	79.5	82	82	87.8	87.8	87.8	87.8	87.8	87.8	87.8	87.8
EAT			CTU	0	0	0	37.5	70.8	91	98.6	99.5	100	100	100	100	100	100	100	100	100	100
EAT			Struct	N		0.6		N		20.08		N	114	48.2			-901				
GROC	Groceries and Gas Stations	COM	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
GROC			S	0	0	0.2	7.6	8.3	11.4	15	15.8	15.8	15.8	22.2	26.6	28.7	28.7	28.7	32.4	39.7	41.2
GROC			STL	0	0	0.1	5.7	6.2	8.6	12.8	13.4	13.4	13.4	18.9	22.6	24.4	27.3	27.3	30.1	37.7	39.1
GROC			STU	0	0	0.3	9.5	10.4	14.2	17.2	18.2	18.2	18.2	25.5	30.1	30.1	30.1	30.1	34	41.7	43.3
GROC			C	0	0	0	33	73.6	81.4	84.8	87.6	96.3	96.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3
GROC			CTL	0	0	0	28	68.6	76.4	79.8	82.6	91.3	91.3	93.3	93.3	93.3	93.3	93.3	93.3	93.3	93.3
GROC			CTU	0	0	0	38	78.6	86.4	89.8	92.6	100	100	100	100	100	100	100	100	100	100
GROC			Struct	N		0.6		N		20.08		N	127	48.2			-901				
WARE	Warehouses and Contractor Services	COM	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
WARE			S	0	0	0.2	7.6	8.3	11.4	15	15.8	15.8	15.8	22.2	26.6	28.7	28.7	28.7	32.4	39.7	41.2
WARE			STL	0	0	0.1	5.7	6.2	8.6	12.8	13.4	13.4	13.4	18.9	22.6	24.4	27.3	27.3	30.1	37.7	39.1
WARE			STU	0	0	0.3	9.5	10.4	14.2	17.2	18.2	18.2	18.2	25.5	30.1	30.1	30.1	30.1	34	41.7	43.3
WARE			C	0	0	0	19.2	30.7	39.7	44.5	48.8	54.1	58.3	62.6	71.6	71.6	71.6	71.6	71.6	71.6	71.6
WARE			CTL	0	0	0	9.2	20.7	29.7	34.5	38.8	44.1	48.3	52.6	61.6	61.6	61.6	61.6	61.6	61.6	61.6
WARE			CTU	0	0	0	49.2	60.7	69.7	74.5	78.8	84.1	88.3	92.6	100	100	100	100	100	100	100
WARE			Struct	N		0.6		N		20.08		N	168	98.3			-901				
1ST-NB	1 story, no basement	RES	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1ST-NB			S	0	2.5	13.4	23.3	32.1	40.1	47.1	53.2	58.6	63.2	67.2	70.5	73.2	75.4	77.2	78.5	79.5	80.2
1ST-NB			SN	0	2.7	2	1.6	1.6	1.8	1.9	2	2.1	2.2	2.3	2.4	2.7	3	3.3	3.7	4.1	4.5
1ST-NB			C	0	2.4	8.1	13.3	17.9	22	25.7	28.8	31.5	33.8	35.7	37.2	38.4	39.2	39.7	40	40	40
1ST-NB			CN	0	2.1	1.5	1.2	1.2	1.4	1.5	1.6	1.6	1.7	1.8	1.9	2.1	2.3	2.6	2.9	3.2	3.5
1ST-NB			Struct	N		0.6		N		11.53		N	100				-901				
AUTO		AUTO	Stage	0	0.5	1	1.5	2	3												
AUTO			S	0	2.3	22.8	54.2	95.8	100												
AUTO			STL	0	1.7	17.1	40.7	71.9	100												
AUTO			STU	0	2.9	28.5	67.8	100	100												
AUTO			Struct	N		0.6		T		22	260		0				-901				
2ST-NB	2 or more stories, no basement	RES	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2ST-NB			S	0	3	9.3	15.2	20.9	26.3	31.4	36.2	40.7	44.9	48.8	52.4	55.7	58.7	61.4	63.8	65.9	67.7
2ST-NB			SN	0	4.1	3.4	3	2.8	2.9	3.2	3.4	3.7	3.9	4	4.1	4.2	4.2	4.2	4.2	4.3	4.6
2ST-NB			C	0	1	5	8.7	12.2	15.5	18.5	21.3	23.9	26.3	28.4	30.3	32	33.4	34.7	35.6	36.4	36.9
2ST-NB			CN	0	3.5	2.9	2.6	2.5	2.5	2.7	3	3.2	3.3	3.4	3.5	3.5	3.5	3.5	3.5	3.6	3.8
2ST-NB			Struct	N		0.6		N		11.53		N	100				-901				
PROF	Professional Business	COM	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PROF			S	0	0	0.2	7.6	8.3	11.4	15	15.8	15.8	15.8	22.2	26.6	28.7	28.7	28.7	32.4	39.7	41.2
PROF			STL	0	0	0.1	5.7	6.2	8.6	12.8	13.4	13.4	13.4	18.9	22.6	24.4	27.3	27.3	30.1	37.7	39.1
PROF			STU	0	0	0.3	9.5	10.4	14.2	17.2	18.2	18.2	18.2	25.5	30.1	30.1	30.1	30.1	34	41.7	43.3
PROF			C	0	0	0	25.8	45.7	94.1	96.9	99.3	99.3	99.3	99.3	99.3	99.3	99.3	99.3	99.3	99.3	99.3
PROF			CTL	0	0	0	13.3	33.2	81.6	84.4	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8
PROF			CTU	0	0	0	38.3	58.2	100	100	100	100	100	100	100	100	100	100	100	100	100
PROF			Struct	N		0.6		N		20.08		N	43	13.8			-901				
REPA	Repairs and Home Use	COM	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
REPA			S	0	0	0.2	7.6	8.3	11.4	15	15.8	15.8	15.8	22.2	26.6	28.7	28.7	28.7	32.4	39.7	41.2
REPA			STL	0	0	0.1	5.7	6.2	8.6	12.8	13.4	13.4	13.4	18.9	22.6	24.4	27.3	27.3	30.1	37.7	39.1
REPA			STU	0	0	0.3	9.5	10.4	14.2	17.2	18.2	18.2	18.2	25.5	30.1	30.1	30.1	30.1	34	41.7	43.3
REPA			C	0	0	0	17	44.6	59.6	64.8	86	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8
REPA			CTL	0	0	0	7	34.6	49.6	54.8	76	83.8	83.8	83.8	83.8	83.8	83.8	83.8	83.8	83.8	83.8
REPA			CTU	0	0	0	27	54.6	69.6	74.8	96	100	100	100	100	100	100	100	100	100	100
REPA			Struct	N		0.6		N		20.08		N	206	102			-901				
MULT	Apartments 5 units and over	RES	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MULT			S	0	0	0.2	7.6	8.3	11.4	15	15.8	15.8	15.8	22.2	26.6	28.7	28.7	28.7	32.4	39.7	41.2
MULT			STL	0	0	0.1	5.7	6.2	8.6	12.8	13.4	13.4	13.4	18.9	22.6	24.4	27.3	27.3	30.1	37.7	39.1
MULT			STU	0	0	0.3	9.5	10.4	14.2	17.2	18.2	18.2	18.2	25.5	30.1	30.1	30.1	30.1	34	41.7	43.3
MULT			C	0	0	0	19.8	37.8	42.6	45.6	50	50	50	50	50	50	69.8	87.8	92.6	95.6	100
MULT			CTL	0	0	0	14.8	32.8	37.6	40.6	45	45	45	45	45	45	64.8	82.8	87.6	90.6	95
MULT			CTU	0	0	0	24.8	42.8	47.6	50.6	100	100	100	100	100	100	100	100	100	100	100
MULT			Struct	N		1.1		N		20.08		N	37	14.3			-901				
PUBL	public properties	COM	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PUBL			S	0	0	0.2	7.6	8.3	11.4	15	15.8	15.8	15.8	22.2	26.6	28.7	28.7	28.7	32.4	39.7	41.2
PUBL			STL	0	0	0.1	5.7	6.2	8.6	12.8	13.4	13.4	13.4	18.9	22.6	24.4	27.3	27.3	30.1	37.7	39.1
PUBL			STU	0	0	0.3	9.5	10.4	14.2	17.2	18.2	18.2	18.2	25.5	30.1	30.1	30.1	30.1	34	41.7	43.3
PUBL			C	0	0	0	5.1	17.5	49.8	50.1	51.8	57.6	57.6	57.6	57.6	57.8	59.4	69.2	69.6	69.7	78.9
PUBL			CTL	0	0	0	0	5	37.3	37.6	39.3	45.1	45.1	45.1	45.1	45.3	46.9	56.7	57.1	57.2	66.4

PUBL			CTU	0	0	0	17.6	30	62.3	62.6	64.3	70.1	70.1	70.1	70.1	70.3	71.9	81.7	82.1	82.2	91.4
PUBL			Struct	N		0.6		N		20.08		N	114	71.5			-901				
CONDO	Same as 2ST_NB	RES	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CONDO			S	0	3	9.3	15.2	20.9	26.3	31.4	36.2	40.7	44.9	48.8	52.4	55.7	58.7	61.4	63.8	65.9	67.7
CONDO			SN	0	4.1	3.4	3	2.8	2.9	3.2	3.4	3.7	3.9	4	4.1	4.2	4.2	4.2	4.2	4.3	4.6
CONDO			C	0	1	5	8.7	12.2	15.5	18.5	21.3	23.9	26.3	28.4	30.3	32	33.4	34.7	35.6	36.4	36.9
CONDO			CN	0	3.5	2.9	2.6	2.5	2.5	2.7	3	3.2	3.3	3.4	3.5	3.5	3.5	3.5	3.5	3.6	3.8
CONDO			Struct	N		0.6		N		2.12		N	100	19.3			-901				
RES-E	emergency services	RES_E	Stage	0	0.1	2	3														
RES-E			S	0	100	100	100														
RES-E			STL	0	0	0	0														
RES-E			STU	0	200	200	200														
RES-E			Struct	N		0.6							-901				-901				
RES-Y	yard damage	RES_Y	Stage	0	0.5	2	3														
RES-Y			S	0	100	100	100														
RES-Y			STL	0	0	0	0														
RES-Y			STU	0	200	200	200														
RES-Y			Struct	N		0.6							-901				-901				

Table 17 (continued)

17. Risk and Uncertainty Parameters for Frequency/Discharge and Stage/Discharge Functions in HEC-FDA. The frequency/discharge function was entered using the "Graphical from WSP" command with years of record set at 20 years.

For the without-project condition, the Stage discharge function was entered using the "Retrieve from WSP" command with normal distribution of uncertainty and standard deviation entered as zero for zero flow, 0.6 feet standard deviation of error for discharges from 25-year and greater events and 0.1 for discharges below 25-year events (based on WSPs). The uncertainty of discharges below 25-year events was set low because the levees are not expected to fail in these circumstances. As noted in section above, the without-project condition is a simplified analysis, with the assumption that levees will fail in an event with a 25-year or greater return period.

In section 2.1.5 of the main report, the design criteria for levee heights is described as the greater of the existing bank or levee heights or the 222-year with-project Water Surface Profile (WSP) plus 3.2 feet. The 3.2 feet is based on waves about 2 feet high plus two 0.6 foot standard deviations of measurement error. Ideally, the effect of waves would be analyzed using a separate wave analysis function. However, although HEC-FDA documentation describes a wave height analysis function that is accessed via the Levee Features screen, the function does not work. Consequently, POH engineers increased the standard deviation of the with-project Stage-Discharg function to 1.6 feet for all discharge values greater than zero to allow for the additional uncertainty of waves.

18. Project Performance – Exceedance Probability and Long Term Risk. For flood damage analysis of streams with levees, HEC-FDA calculates the probability that the elevation of water in the channel will exceed the height of the levee (or river bank) during different probability events for each reach. The program also calculates the cumulative long term risk that water will exceed these "target stages" over periods of ten, twenty-five, and fifty years.

Table 18 below presents the calculated target stage and three kinds of exceedance probabilities for each reach under Alternative 3: the median and expected probabilities that the target stage will be exceeded in any given year; the long term risk, i.e., cumulative probability, that the target stage will be exceeded over a ten, twenty-five, or fifty-year period, and the conditional probability that the target stage will be exceeded should various frequency events occur.

Table 18. Probability Exceedance and Long-Term Risk

Plan	Reach Name	Target Stage	Target Stage Annual Exceedance Probability		Long-Term Risk (years)			Conditional Non-Exceedance Probability by Events					
			Median	Expected	10	25	50	10%	4%	2%	1%	0.4%	0.2%
Alternative 3	Reach 1	levee	0.001	0.0000	0.0019	0.0046	0.0092	0.9999	0.9999	0.9996	0.9965	0.9811	0.9613
	Reach 2	levee	0.001	0.0010	0.0097	0.0242	0.0477	0.9999	1.0000	1.0000	0.9999	0.9991	0.9985
	Reach 3	levee	0.001	0.0010	0.0097	0.0242	0.0477	0.9999	0.9999	1.0000	0.9998	0.9991	0.9984
	Reach 4	levee	0.001	0.0010	0.0097	0.0242	0.0477	0.9999	0.9999	0.9999	0.9998	0.9991	0.9984
	Reach 5	levee	0.001	0.0010	0.0097	0.0242	0.0478	0.9998	0.9999	0.9999	0.9999	0.9991	0.9984
	Reach 6	levee	0.001	0.0000	0.0012	0.0030	0.0060	0.9999	0.9999	0.9999	0.9994	0.9932	0.9866
	Reach 7	levee	0.001	0.0000	0.0010	0.0025	0.0051	1.0000	1.0000	1.0000	0.9999	0.9982	0.9961
	Reach 8	levee	0.001	0.0000	0.0010	0.0024	0.0049	0.9999	1.0000	1.0000	1.0000	0.9992	0.9984

Appendix L:

Real Estate Planning Report

REAL ESTATE PLANNING REPORT

FOR

IAO STREAM
FLOOD CONTROL PROJECT MODIFICATION

ISLAND OF MAUI
STATE OF HAWAII

PREPARED BY
JIM V. DOING
NORTHWESTERN DIVISION
16 November 2007

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EXECUTIVE SUMMARY

Authorized under Section 203 of the Flood Control Act of 1968 (Public Law 90-483), construction of the original Iao Stream Flood Control Project, including a debris basin, levees, a channel, and stream realignment was completed in 1981. Flooding between 1981 and 1989 caused damage to the original construction. A reconnaissance Study for the Iao Stream Flood Control Project Modification was approved by HQ USACE in December 1995.

Iao Stream is approximately 16 miles long and is located in the State of Hawaii, on the northwestern portion of the Island of Maui, and in the County of Maui. The modification project is located in Wailuku Village at the lower end of the stream, downstream of North Market Street.

Iao Stream is not a navigable watercourse. Construction of this modification project is to prevent flooding, not induce it. There is no necessity for relocation of public utilities. No relocations under PL 91-646 are anticipated. There are no known surface or subsurface minerals that would affect the construction, operation and maintenance of this modification project. The non-Federal sponsor, Maui County, has been assessed as to its capabilities to acquire the necessary land, easements, right-of-way, relocations, and disposal (LERRD) interests and is considered fully capable of acquiring the necessary interests. Also, Maui County has been notified in writing of the risks of acquiring the LERRD before the execution of the Project Cooperation Agreement (PCA) and the Government's formal notice to proceed with the acquisition. Zoning is agricultural, residential, and industrial and there are no changes required for the project. Environmental Impacts are addressed in other sections of the Engineering Documentation Report. Landowner's attitudes indicated adversity to this project.

The modification project will require 4.78 acres of permanent channel improvement easements, 0.32 acre of perpetual joint use road easements, and 2.06 acres of temporary work area easements. The non-Federal sponsor has approved the Government's standard easement estates for the necessary easements. There are multiple owners involved. The baseline cost estimate for real estate includes $118,400 for the easements, a 30% contingency in the amount of $35,500 and $240,000 for administrative costs, totaling $394,000. A detailed schedule of all land acquisition milestones, approved by the Project Manager and the non-Federal sponsor, is also included in the report.

The information provided in this report meets the requirements of ER 405-1-12, Chapter 12, Section 12-16c.

1. AUTHORITY/PURPOSE

The initial Iao Stream Flood Control Project was authorized by the Flood Control Act of 1968 (PL 90-483). In compliance with Section 221 of the Flood Control Act of 1970, a local cooperation agreement was executed with the non-Federal sponsor, the County of Maui, on 23 May 1976. The construction of a debris basin, a channel, levees along the right bank, and stream realignment was completed in 1981.

Between 1981 and 1989 flood damage caused erosion that compromised channel stability and weakened portions of the existing levees. The Corps of Engineers conducted a Reconnaissance Study on modifying the existing flood control project. The study was approved by HQ USACE in December 1995.

This Real Estate Planning Report is for the proposed Iao Stream Flood Control Project Modification. This REPR will be included as a part of the Engineering Documentation Report.

2. DESCRIPTION

Iao Stream is located in the Village of Wailuku, Island of Maui, State of Hawaii. It is about 16 miles long and falls from an elevation of 5,788 feet to sea level. The subject modification area is located at the lower end of the stream, downstream of North Market Street to approximately the mouth. The right side of the stream is elevated above the flood way and is developed with industrial, residential and offices. The left side of the stream is flood way/flood plain and is mostly undeveloped. It is largely grown up in weeds and brush but with a few agricultural areas.

The proposed modification project will follow the existing alignment of the stream between stations 22+00 and 94+00 and will contain a 10 year flood within the structural improvements. The floodplain would remain on the left bank. The design is for a roller-compacted concrete and boulder invert channel with 60 to 80 foot bottoms. The channel lining and retaining wall will be raised because of the increased flow and higher flood levels.

The tracts required for the project modification perpetual channel improvement easements are as follows:

TMK	**Owner**	**Area in Square Feet**
234033029	A & B Hawaii, Inc.	1,997.4
233001003	Tracy, Mark W. & Carla	798.0
234032001	C. Brewer Homes	127,890.8
234033050	Maui Hostel LLC	2,469.2
234029030	Mary H. Amaral	1,223.8
234029036	Richard J. Hoehn	4,665.3
234033014	Wailuku Sugar	19,596.3
234033024	A & B Hawaii, Inc	1,880.7
233001025	Casey J. Del Dotto	1,008.6
234031001	Noenoe Lindsey	46,375.3
Total		207,905.4

In addition to these tracts, the project requires approximately 14,000 square feet of perpetual road access easement at a location to be determined during design. It also requires 2 temporary work area easements approximating 90,000 square feet, also at locations to be determined during design. This is also at an undetermined location. The total for all tracts is 311,905.4 square feet.

3. SPONSOR'S REAL ESTATE INTERESTS

The sponsor acquired the lands for the original project construction, therefore, those lands are not considered in this modification project. It has been determined that the estates acquired in the original project are sufficient for use in the modification project needs but credit will not be allowed for lands previously acquired for the original project.

4. ESTATES TO BE ACQUIRED

ROAD EASEMENT:

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tract Nos. __, __ and __.) for the location, construction, operation, maintenance alteration and replacement of (a) road(s) and appurtenances thereto; together with the right to trim, cut, fell and remove there from all tress, underbrush, obstructions and other vegetation, structures, or obstacles within the limits of the right-of-way; (reserving, however, to the owners, their heirs and assigns, the right to cross over or under the right-of-way as access to their adjoining land at the locations indicated in Schedule B); subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

TEMPORARY WORK AREA EASEMENT:

A temporary easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos., and), for a period not to exceed_____, beginning with date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a (borrow area) (work area), including the right to borrow and/or deposit fill, spoil and waste material thereon). (move, store and remove equipment and supplies, and erect and. remove temporary * structures on the land and to perform any other work necessary and incident to the construction of the Project, together with the right to trim, cut, fell and remove, therefore all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

CHANNEL IMPROVEMENT EASEMENTS

A perpetual and assignable right and easement to construct, operate, and maintain channel improvement works on, over and across (the land described in Schedule A) (Tract Nos. __, __, and __.) for the purposes as authorized by the Act of Congress approved _____, including the right to clear, cut, fell, remove and dispose of any and all timber, trees, underbrush, buildings, improvements and/or other obstructions therefore; to excavate dredge, cut away, and remove any or all of said land and to place thereon dredge or spoil material; and for such other purposes as may be required in connection with said work of improvement; reserving, however, to the owners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and Pipelines.

5. FEDERAL PROJECTS/OWNERSHIP

The original Iao Stream Flood Control Project was a cost-shared project between the United States and a non-Federal sponsor, Maui County. The County still owns the interest acquired. There are no federal owned lands within the project requirement areas.

6. NAVIGATION SERVITUDE

Iao Stream is not considered a navigable river and the Navigation Servitude does not apply.

7. MAPS

Maps depicting the State of Hawaii and Island of Maui, the project area, the easements acquired for the original project and the required easements for the modification project are attached in the addendum.

8. FLOODING

The stream is a natural floodway and flood waters rise quickly with heavy rains on the mountain. Proposed construction, operation and maintenance of this project is to control flooding, and prevent loss of life and property damages. The design is intended to contain the 10 year flood within the structural improvements and the standard project flood within the designated floodplain and existing levees.

9. BASELINE COST ESTIMATE FOR REAL ESTATE

Fee Title……..$ 0

Perpetual Channel Improvement Easement……$ 106,160

Perpetual Joint Use Road Easement……$ 4,000

Temporary Work Area Easement……$ 8,240

Improvements……..$ 0

Hazard Removals…….$ 0

Mineral Rights…….$ 0

Damages……..$ 0

Contingencies……..$ 35,500

Relocations……..$ 0

Uniform Relocation Assistance (PL 91-646)……..$ 0

Acquisition Administrative Costs……$ 240,000

TOTAL COST…….$ 394,000

10. PL 91-646 RELOCATION BENEFITS

No PL 91-646 benefits are anticipated for the project.

11. MINERALS

There are no surface of subsurface minerals known that would impact the project or acquisition.

12. ASSESSMENT OF SPONSOR'S ACQUISITION CAPABILITY

An assessment of the sponsor's acquisition capabilities to acquire the land necessary for this project is attached as an exhibit. Maui County is fully capable.

13. ZONING

The subject properties have four zoning classifications:

Agriculture- This is the primary zoning found on the tracts. It primarily applies to those properties located along the west (left) bank of the stream. Although zoned agriculture, very little of the property is used for crops, but it does have agricultural potential.

Conservation- This applies to one property.

Residential/Interim- This zoning applies to 5 parcels.

14. MILESTONES

The sponsor will begin preliminary acquisition work approximately 6 months prior to PCA execution as follows:

Survey/Maps/Title	90 Days	01 Oct 2009	01 Jan 2010
Legal Descriptions	30 Days	01 Jan 2010	01 Feb 2010
Appraisals	90 Days	01 Feb 2010	01 May 2010

Execution of the PCA is anticipated on or around 1 May 2010. The sponsor will complete acquisition of LERRD within 180 days after the PCA execution as follows:

Documentation	120 Days	01 May 2010	01 Sep 2010
Negotiations	60 Days	01 July 2010	01-Sep 2010
Final Subdivision	60 Days	01 Sep 2010	01 Nov 2010
Payments	90 Days	01 Sep 2010	01 Dec 2010
LERRD certification	21 Days	1 Dec 2010	22 Dec 2010

15. PUBLIC UTILITIES RELOCATIONS

There are no anticipated public utility relocations for this project.

16. ENVIRONMENTAL IMPACTS

Environmental impacts, if any, are discussed in other sections of the Engineering Documentation Report.

17. ATTITUDES OF LANDOWNWERS

During a public meeting held 12 August 2003, many members of the public opposed the project due to a disbelief of potential future flooding and potential damages to cultural resources and wildlife habitats.

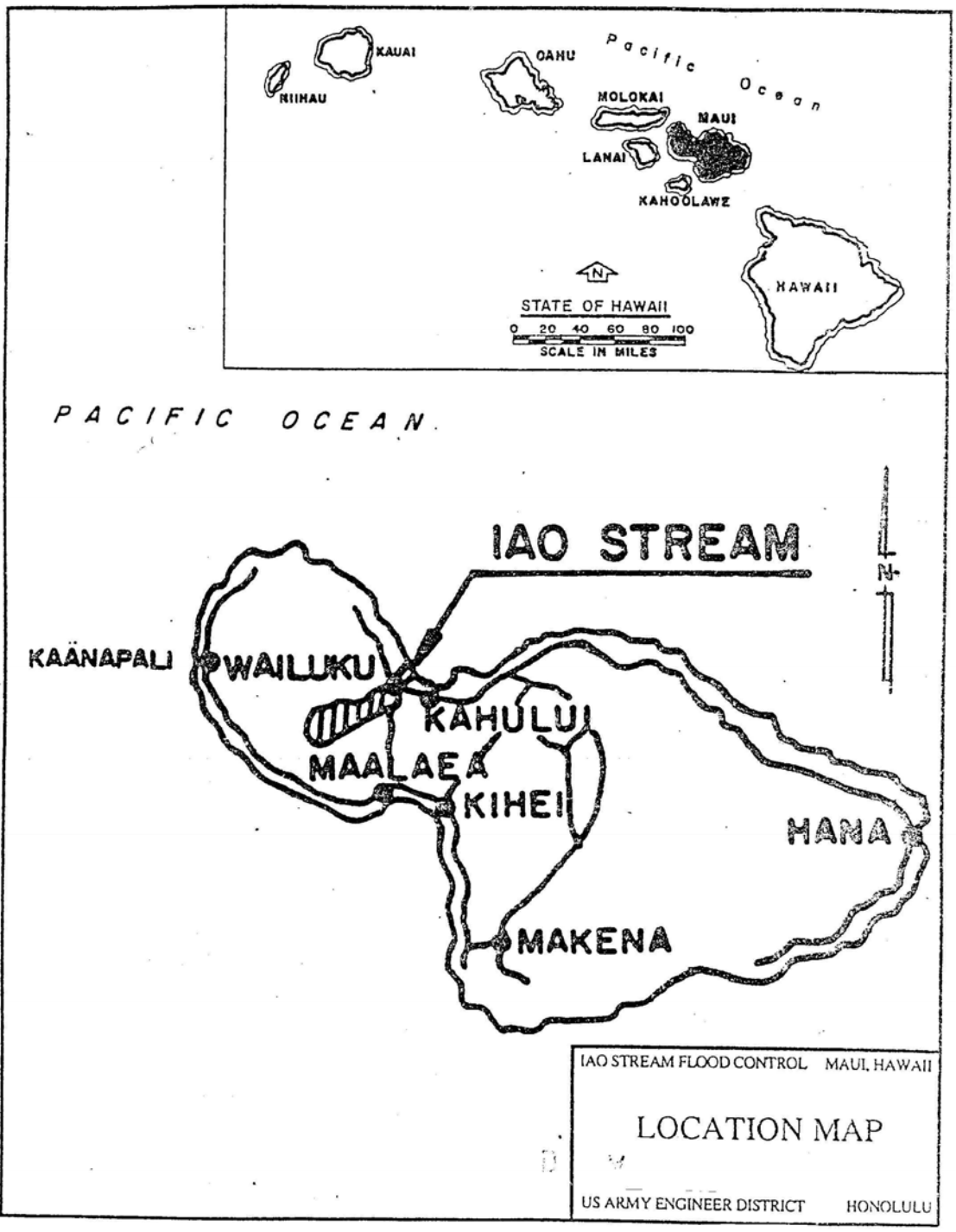
18. NOTIFICATION TO SPONSOR

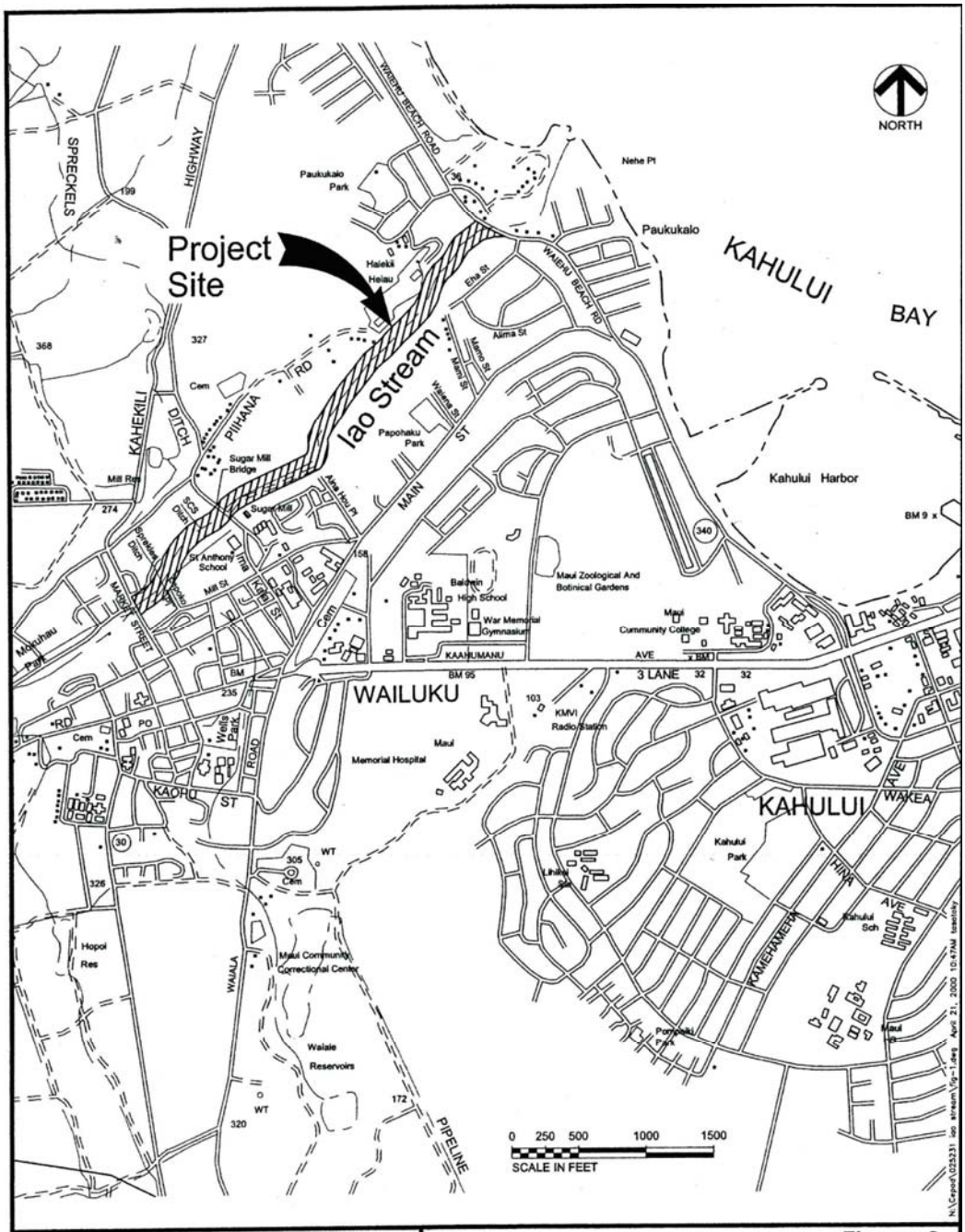
The non-Federal sponsor, Maui County, as been notified in writing about the risks of acquiring the LERRD for the project prior to the PCA execution and the Government's formal notice to proceed. The written notification is attached as an exhibit.

ADDENDUM

State Map
Area Map
Tract Map
Assessment of Sponsor Capability
Letter to Sponsor

STATE MAP


KAUAI
NIIHAU
OAHU
Pacific Ocean
MOLOKAI
MAUI
LANAI
KAHOOLAWE
HAWAII
N
STATE OF HAWAII
0 20 40 60 80 100
SCALE IN MILES
PACIFIC OCEAN
IAO STREAM
N
KAANAPALI
WAILUKU
KAHULUI
MAALAEA
KIHEI
HANA
MAKENA
IAO STREAM FLOOD CONTROL MAUI, HAWAII
LOCATION MAP
US ARMY ENGINEER DISTRICT HONOLULU

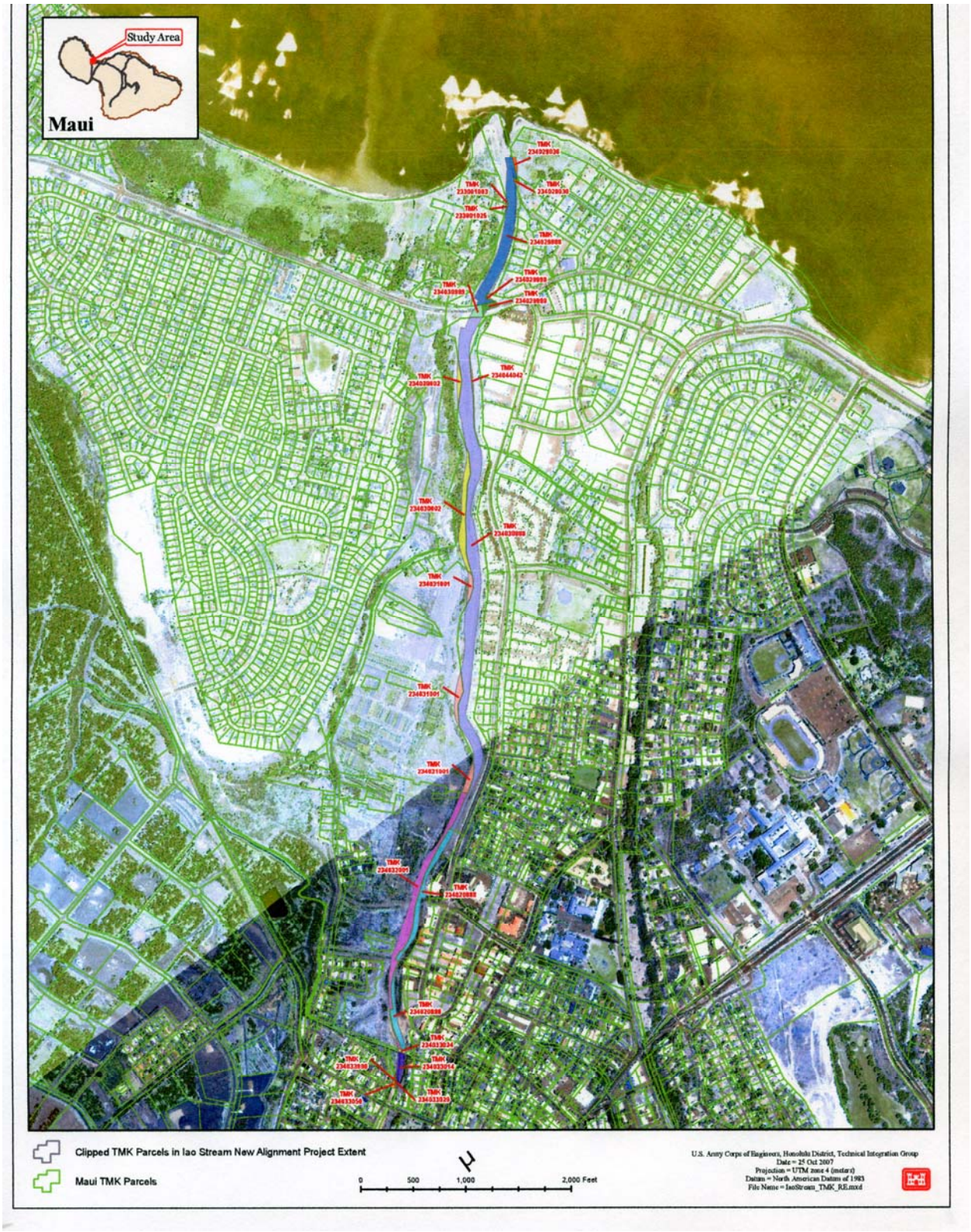


Source:

M&E Pacific, Inc.
ENGINEERS & ARCHITECTS
SUITE 500, PAUAHI TOWER · 1001 BISHOP ST., HONOLULU, HAWAII 96813

Figure 2
PROJECT SITE MAP
Iao Stream Hydraulic Design
Wailuku, Maui, Hawaii

Prepared By: M&E Pacific, Inc.
December 2000


Study Area
Maui
Clipped TMK Parcels in Iao Stream New Alignment Project Extent
Maui TMK Parcels
0
500
1,000
2,000 Feet
U.S. Army Corps of Engineers, Honolulu District, Technical Integration Group
Date = 25 Oct 2007
Projection = UTM zone 4 (meter)
Datum = North American Datum of 1983
File Name = IaoStream_TMK_RE.mxd

Maui, HI

ASSESSMENT OF NON FEDERAL SPONSOR'S
REAL ESTATE ACQUISITION CAPABILITY
FOR
IAO STREAM MODIFICATION PROJECT

YES	NO	
✓		a. Does the non-Federal Sponsor have legal authority to acquire and hold title to real property for project purposes? Cite statutory authority: Hawaii Revised Statutes, Chapter 46
✓		b. Does the non-Federal sponsor have the power of eminent domain for this project? Cite statutory authority: Hawaii Revised Statutes, Chapter 101
	✓	c. Does the non-Federal sponsor have "quick-take" authority for this project? Cite statutory authority:
	✓	d. Are there any lands/interests in land required for the project that are located outside the non-Federal sponsor's political boundary?
	✓	e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? (If "yes", provide description on attached sheets.)

ASSESSMENT OF NON-FEDERAL SPONSOR'S
REAL ESTATE ACQUISITION CAPABILITY

YES	NO	
	✓	a. Will the sponsor's in-house staff require training to become familiar with real estate requirements of Federal projects including P. L. 91-646, as amended?
		b. If the answer to (a) above is "yes", has a reasonable plan been developed to provide such training? (If "yes", provide description on attached sheets.)
✓		c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project?
✓		d. Is the sponsor's projected in-house staffing level sufficient considering it's other workload?
✓		e. Can the sponsor obtain contractor support, if required, in a timely fashion?
	✓	f. Will the sponsor likely request USACE assistance, if available, in acquiring real estate?
✓		g. Will the sponsor's staff be located within reasonable proximity to the project site?
✓		h. Is the sponsor confident it can provide real estate in time to meet contract-advertising dates for the project? If "no", provide explanation on an attached sheet.

ASSESSMENT OF NON-FEDERAL SPONSOR'S REAL ESTATE ACQUISITION CAPABILITY

With regard to this project, the sponsor is anticipated to be (check one):

Highly Capable

Fully Capable ✓

Moderately Capable

Marginally Capable

Insufficiently Capable (provide explanation on an attached sheet)

YES	NO	N/A	
✓			a. Has the sponsor performed satisfactorily on other USACE projects?
✓			b. Has the assessment been coordinated with the sponsor?
✓			c. Does the sponsor concur with this assessment? (If "no", provide explanation on attached sheet.)

PREPARED BY:

Cindy Y. Young

Cindy Y. Young,
Deputy Corporation Counsel
County of Maui
200 South High Street
Wailuku, Maui Hawaii 96793
Telephone: (808) 270-7740
Date: OCT 0 1 2004

REVIEWED AND APPROVED:

Randall K. Tsuneyoshi
Chief, Real Estate Division
Honolulu District, Corps of Engineers

Date: OCT 1 2 2004

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF:

Real Estate Division

22 September 2004

Ms. Cary Yamashita
Chief, Engineering Division
County of Maui, DPW & Environmental Management
200 South High Street
Wailuku, Maui, Hawaii 96793

Dear Ms. Yamashita:

Reference the Iao Stream Flood Control Project Modification, where the County of Maui, as the non-Federal Sponsor, is responsible for ensuring that it possesses the authority to acquire and holds title for all real property required for the proposed project. Non-Federal sponsors shall provide 100 percent of the lands, easements, rights-of way, utility or public facility relocations, and dredge or excavated material disposal areas (LERRDs), and operation, maintenance, repair, rehabilitation and replacement.

We wish to advise you that there are risks associated with the acquisition of land prior to the execution of the Project Cooperation Agreement (PCA). The County of Maui will assume full and sole responsibility for any and all costs, responsibility or liability arising out of the acquisition effort. These risks generally include but may not be limited to the following:

a. Congress may not appropriate funds to construct the proposed project.

b. The proposed project may otherwise not be funded or approved for construction.

c. A PCA mutually agreeable to the non-Federal sponsor and the Government may not be executed and implemented.

d. The non-Federal sponsor may incur liability and expense by virtue of its ownership of contaminated lands, or interests therein, whether such liability should arise out of local, state, or Federal laws or regulations including liability arising out of CERCLA, as amended.

e. The non-Federal sponsor may acquire interests or estates that are later determined by the Government to be inappropriate, insufficient, or otherwise not required for the project.

f. The non-Federal sponsor may initially acquire insufficient or excessive real property acreage which may result in additional negotiations and/or benefit payments under P.L. 91-646 as well as the payment of additional fair market value to affected landowners which could have

been avoided delaying the acquisition until after the PCA execution and the Government's notice to commence acquisition and performance of LERRD.

g. The non-Federal sponsor may incur costs or expenses in connection with its decision to acquire or perform LERRD in advance of the executed PCA and the Government's notice to proceed which may not be creditable under the provisions of Public Law 99-662 or the PCA.

If you have any questions, please contact Cindy Luciano at phone number 438-1306 or by email at Cindy.L.Luciano@poh01.usace.army.mil.

Sincerely,

Signed

Randall K. Tsuneyoshi
Chief, Real Estate Division

Appendix B*:*

Comment Letters and Responses

Summary of Public Comments
Draft Environmental Assessment
Modification to the ʻĪao Stream Flood Control Project
Wailuku, Maui, Hawaiʻi
Comment Period: June 23, 2015-July 23, 2015

Name	Affiliation	Source	Date	Summary of Comment	Response to Comments
Chris Sugidono, Staff Writer / Photographer	The Maui News	Email	6/24/2015	My understanding is that one of the main points of the project is to reconnect the main channel to the overflow channel, or floodplain. Why was the main channel not connected to the overflow channel? Was it connected in the past, and that's why it's being "reconnected?" What is the overflow channel? Is it a bunch of farmland or an open area? Any other information you have would be helpful and thank you for your time.	The ʻĪao Stream Flood Control Project, constructed in 1981 by the U.S. Army Corps of Engineers, includes channel improvements in the upper and lower reaches of the stream, levees, and designated floodplain along the left bank. The middle reach of the stream remained unlined. The Project is designed so that when stream flows exceed the 25-year flood frequency, water is diverted to the designated floodplain on the left bank to prevent the remaining flows in the stream from overtopping the stream banks and flooding the Wailuku area. The use of the floodplain during high stream flow conditions is an integral part of the overall function of the Project. Over the years, the channel invert (bottom) and right bank levee toe has deepened and eroded significantly as a result of high velocity flows and steep slopes. The designated floodplain is restricted to agricultural purposes. As such, structures are not permitted within the floodplain. The purpose of the overflow channel, described in the Project modification, diverts flows to the floodplain more frequently, thus reducing damaging flows within the channel and to the right bank levees. The overflow channel is being built by lowering the left bank. Storm water will temporarily be detained in the floodplain

Summary of Public Comments
Draft Environmental Assessment
Modification to the ʻĪao Stream Flood Control Project
Wailuku, Maui, Hawaiʻi
Comment Period: June 23, 2015-July 23, 2015

Name	Affiliation	Source	Date	Summary of Comment	Response to Comments
					before re-entering downstream. (Response provided by Joseph Bonfiglio, Chief of Public Affairs USACE Honolulu District)
Tom Clark	Landowner	Email	6/30/2015	Would the project affect my property, which can be described as a long, skinny parcel located parallel to the right bank by Wili Pa Loop.	Parcel TMK: 3-4-020: 080, owner Tom Clark, is located adjacent to the stream and several other properties. Parcels just downstream, TMK: 3-4-020: 044, 045, and 046 will be impacted. However, this property is not identified as being affected by the proposed changes on the right bank.
Douglas Murdock, Comptroller	State of Hawaii Department of Accounting and General Services	Letter	7/1/2015	No comments to offer at this time.	Comment acknowledged. Thank you for your response.
Ford N. Fuchigami, Director of Transportation	State of Hawaii Department of Transportation	Letter	7/2/2015	Obtain a permit from Department of Transportation (DOT) Highways Division, Maui District Office for the transport of oversized and/or overweight materials and equipment on State highway facilities.	Comment acknowledged. Required permits will be obtained for the transport of oversized and/or overweight materials and equipment on State highway facilities during the construction of the Proposed Action. Thank you for your response.
John V. Duey, President	Hui O Na Wai Eha	Email	7/5/2015	1. Do not do anything in the low flow channel above Hawaiian Commercial Sugar Co (HC&S) intake; it has been basically closed per agreement on April 14, 2014. 2. Remove the existing cement in the Wailuku river bed as suggested back in 2009 at the public meeting.	1. The Proposed Action does not include any actions within the subject area. 2. Removing the existing cement in the stream would not meet the project objective of reducing flood risks and preventing further erosion of the existing levee and stream bank.
Arthur J. Logan, Major General	State of Hawaii Department of	Letter	7/6/2015	No comments to offer at this time.	Comment acknowledged. Thank you for your response.

Summary of Public Comments
Draft Environmental Assessment
Modification to the ʻĪao Stream Flood Control Project
Wailuku, Maui, Hawaiʻi
Comment Period: June 23, 2015-July 23, 2015

Name	Affiliation	Source	Date	Summary of Comment	Response to Comments
Hawaii National Guard Adjutant General	Defense				
Alec Wong, P.E., Chief, Clean Water Branch	State of Hawaii Department of Health (DOH) Clean Water Branch (CWB)	Letter	7/7/2015	1. Project must meet criteria: antidegradation policy, designated uses, water quality criteria. 2. May be required to obtain NPDES permit. 3. If project involves work in, over, or under waters of the United States, contact the USACE Regulatory Branch regarding their permitting requirements. A Section 401 Water Quality Certification (WQC) may be required. 4. All discharges related to project construction or operation activities must comply with the State's Water Quality Standards. 5. Ensure project planning follows: reduce, reuse, and recycle to protect, restore, and sustain water quality and beneficial uses of State waters.	1. The Proposed Action will ensure that its potential impacts to State waters meet the stated criteria. 2. An NPDES permit will be obtained prior to the start of the proposed construction activities. The permit application process would be initiated during the design phase of the project. 3. A Section 404(b)(1) analysis (Appendix B of the EA) has been prepared for the Proposed Action since it would involve work in a stream that could potentially result in discharge of fill and/or dredge material into an aquatic ecosystem. Since the proposed project may generate discharges to State waters during construction, a Section 401 WQC would be required. DOH, the state approving agency, would only issue a conditional WQC during the design phase. The final WQC would be issued to the contractor, upon receipt of acceptable BMPs. The application would be filed with the Clean Water Branch of the DOH at least 180 days before the date the WQC is needed (i.e., start of construction). 4. Concur. All discharges related to the Proposed Action will comply with the State's Water Quality Standards.

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					5. Concur. Project planning will ensure that the said policies/criteria are met.
David C. Goode, Director of Public Works	County of Maui Department of Public Works	Letter	7/8/2015	We reviewed the subject application and have no comments.	Comment acknowledged. Thank you for your response.
Scott Nakasone, Assistant Division Administrator	State of Hawaii Department of Human Services	Letter	7/8/2015	There is a child care facility at the Maui Family Support Services Childcare Center (1844 Wili Pa Loop). May need to contact the facility directly to discuss if there will be an impact.	USACE will ensure that best management practices (BMPs) are implemented during construction activities to minimize potential impacts to the surrounding neighborhood/facilities. Any facilities that may be impacted during construction activities will be contacted prior to the start of construction.
John V. Duey, President	Hui O Na Wai Eha	Letter	7/15/2015	1. Iao Stream has officially been changed back to Wailuku River as of May 27, 2015 by the Hawaii Board of Geographic Names. It is being brought up on the Federal level in the next couple of months. 2. Still believe that the "no action alternative" is the right thing. 3. Still believe Alternative B would be the proper way to go; not to remove all concrete just the cement in the channel. 4. Do something about the 22' drop so that stream life can have a better chance to migrate up-river.	1. Comment acknowledged. The EA has been revised accordingly. 2. The no action alternative would not address the project objective of reducing flood risks and preventing further erosion of the existing levee and stream bank. 3. Although Alternative B may increase the potential for groundwater recharge and possibly restore habitats within the stream, it does not alleviate the increased flood risk in areas surrounding the stream/river. 4. The project objective is to reduce flood risk and is not to restore the ecological function of the stream. USACE is not authorized to conduct ecosystem restoration. Funding to address concerns over the 22' vertical structure may be

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				5. Page 2-12 O&M; clear the weir every year instead of every 5 years. 6. Page 3-64; cannot understand the statement "agriculture land would not be significantly impacted." That is an untrue statement. 7. Make available a place that Hawaii Commission on Water Resource Management (CWRM) can install a stream gauge as required by the settlement agreement of April 2014.	available through the Continuing Authorities Program (CAP) Section 1135 that allows for environmental restoration of an existing Corps project particularly if matching funds were made available from a local sponsor. 5. The assumption of clearing the weir every 5 years was made for cost estimating purposes; following project completion, County of Maui will be responsible for clearing the weir as required to maintain the low-flow within the diversion weir. 6. The county obtained a perpetual flowage easement from Wailuku Sugar Company on 6 October 1980 on the land parcels located within the left bank floodplain. This easement was acquired for the flood control project to allow flood water to occasionally inundate this area when flows exceed the channel capacity. The current proposed modification does not change the original intent or function of the project with respect to flooding of this land. 7. It is outside of USACE's area of responsibility to install a stream gauge as required by the settlement agreement of April 2014; CWRM will determine the location of the stream gauge and coordinate with USACE/County of Maui as needed. Adequate space will be available to install the stream gauge as

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					the Proposed Action does not require substantial use of land/space within or adjacent to the stream.
Patti Kitkowski, District Environmental Health Program Chief	State of Hawaii Department of Health Maui District Health Office	Letter	7/16/2015	1. NPDES permit coverage may be required for the project. 2. A Section 401 WQC may be required.	1. An NPDES permit will be obtained prior to the start of the proposed construction activities. The permit application process would be initiated during the design phase of the project. 2. Since the proposed project may generate discharges to State waters during construction, a Section 401 WQC would be required. DOH, the state approving agency, would only issue a conditional WQC during the design phase. The final WQC would be issued to the contractor, upon receipt of acceptable BMPs. The application would be filed with the Clean Water Branch of the DOH at least 180 days before the date the WQC is needed (i.e., start of construction).
Kyle K. Ginoza, P.E. Director of Environmental Management	County of Maui Department of Environmental Management	Letter	7/20/2015	Solid Waste Division has no comments. Wastewater Reclamation Division (WWRD) comments: 1. Access to all existing sewer improvements will need to be provided for maintenance. 2. Any manhole within anticipated flood areas will need to be sealed to the satisfaction of the WWRD in order to prevent water infiltration. 3. Any sewer facility affected by the project shall be protected or relocated with approval by the	1. Concur. Access to all existing sewer improvements, if any within the affected area, will be provided for maintenance as required. 2. Concur. Any manhole within anticipated flood areas, if any within the affected area, will be sealed to the satisfaction of the WWRD in order to prevent water infiltration. 3. Existing sewer utilities would not be impacted by the Proposed Action.

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				Wastewater Reclamation Division.	
Skippy Hau, Aquatic Biologist	State of Hawaii Department of Land and Natural Resources (Division of Aquatic Resources)	Letter	7/20/2015	**Draft EA:** 1. Will kalo farming and lo'i be given priority in restoring the inundation area along with kuleana ditches? There appears to be historical information that with over a hundred years of diversions for sugar cane production, land use has changed. For example, farming banana and other crops could absorb water but water would not be expected to return to the stream. The irrigation system used for Waiheʻe should be replicated. The terracing and natural flow for lo'i adjoining the stream is outstanding. Will Commission on Water Resources Management (CWRM) appurtenant permit holders be involved? 2. [Page 3-35] Hihiwai (*Neritina granosa*) were collected from the Iao Stream mouth from 2000 to 2006. Hihiwai recruitment stopped because of below average rainfall from 2007-2013. Hihiwai have returned in May 2015 possible due to the restored continuous flow. **Appendix B Section 404(B)(1) Evaluation:** 3. Water measurements should be conducted during stream flow and not be repeating that low flow and/or dry conditions persist 90% of the year. Please gather some useful water quality information and make stream flow estimates for that location.	1. Installing an irrigation system for farming is outside of the objective of the project. The intent of the Proposed Action is not to divert the stream permanently but to construct a overflow channel that would allow stream waters to be diverted to the floodplain on the left bank during large storm events. Under normal conditions, the stream waters will remain within the main channel. 2. Comment noted. Section 3.5, *Biological Resources* of the EA has been revised to include conditions following flow restoration and the presence of Hihiwai in the stream indicating that the stream flow has been more consistent following implementation of the IIFS in October 2014. 3. The Section 404(B)(1) Evaluation has been updated to reflect the current flow conditions of the stream. Water quality measurements were gathered during the water quality and biological surveys conducted in April 2012 and November 2016. However, these measurements were collected to characterize existing aquatic environments and not to establish compliance with water quality standards. The criteria for turbidity, total suspended solids, and nutrient

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				4. [Suspended Particulate/Turbidity Determination] No data presented. 5. [Page 11] Oʻopu nakea (Awaous) has been revised back to *Awaous stamineus* and all five fishes are endemic. **Appendix F Water Quality and Biological Survey:** 6. [Figure 3] The two 2-inch channel irons have provided limited flow but has never been shown to provide amphidromous passage. It should be labeled as a passage channel. 7. [Figure 4A] I asked the low-flow channel be corrected for continuous stream flow. The low-flow channel changes to the other side downstream. Instead of a plunge pool or staging area to climb the waterfall, there is a shallow concrete bottom with no hiding areas.	measurements require making comparisons with geometric mean values; a minimum of three separate sampling events per location would be required to generate a proper statistic for comparison with a criterion. Ideally, multiple samplings would encompass a "typical" range of conditions for the location. If required, these standards will be used, together with "baseline" data collected from a series of preconstruction sampling events, to develop decision rules as part of the data quality objectives (DQO) process in an applicable monitoring and assessment program developed in accordance with a Clean Water Act Section 401 Water Quality Certification. 4. See response above. 5. The section has been revised as stated. 6. The water quality and biological survey has been updated accordingly. 7. The project objective is to reduce flood risk and is not to restore the ecological function of the stream. USACE is not authorized to conduct ecosystem restoration. Funding to address concerns over the continuity of low-flow channel may be available through the Continuing Authorities Program (CAP) Section 1135 that allows for environmental restoration of an

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				8. Stenogobius and Eleotris have been found upstream. As post larvae, they were transported with the other oʻopu collected by the Waiehu Bridge. 9. Honu (*Chelonia mydas*) have been present in coastal waters and nesting has increased over time.	existing Corps project particularly if matching funds were made available from a local sponsor. 8. Comment acknowledged. An updated biological survey was conducted in November 2016 following restoration of the stream flow. Findings of the updated survey has been included in the Final EA. 9. Comment acknowledged. As discussed in the EA (Section 3.5.5), the Proposed Action is anticipated to have positive impacts on the green sea turtles since it would result in improved water quality in the coastal zone in the vicinity of the stream mouth.
Darren T. Lerner, PhD Interim Director	University of Hawaii Water Resources Research Center	Letter	7/20/2015	The Water Resources Research Center does not have the capacity to review the EA at this time due to faculty position vacancy. The Center will exclude itself from commentary on the EA.	Comment acknowledged. Thank you for your response.
Leo R. Asuncion, Acting Director	Office of Planning State of Hawaii	Letter	7/21/2015	1. The Draft EA should consider and evaluate the Proposed Action based upon the statewide planning system in HRS Chapter 226, the Hawaii State Plan and should include an analysis that addresses whether the proposed project conforms or is in conflict with goals, objectives, policies, and priority guidelines listed in the Hawaii State Plan. 2. The Draft EA provides a synopsis of the Coastal Zone Management Act and an acknowledgement that the project will need to be consistent with the Hawaii Coastal Zone	1. Analysis based on the goals, objectives, policies, and priority guidelines listed in the Hawaii State Plan has been included in the Final EA. 2. Discussion on how the proposed project conforms to the CZM objectives and its supporting policies has been included in the Final EA.

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				Management (CZM) program. The Draft EA, however, does not address the project's conformity with the enforceable policies of the Hawaii CZM program found in HRS § 205A-2. The Final EA should include an assessment on how the proposed project conforms to the CZM objectives and its supporting policies. 3. The Proposed Action will need an evaluation on Federal Consistency requirements.	3. USACE will ensure that Federal Consistency requirements are met prior to implementing the Proposed Action.
Alan K. Bernaldo, CPA	Landowner	Email	7/22/2015	Major concern with "right bank armoring and repair to existing revetments". My office building and other business owners have had the land eroded to a point dangerously close to the building structures. The stream's present lining ends downstream of the eroded hillside. Armoring on the right bank is crucial to prevent further catastrophic erosion along the bank supporting affected buildings. Timeline to address this issue sooner than mid-2018 should be considered.	Thank you for your comment. USACE is aware of this issue and plans to implement the Proposed Action, which includes armoring of the subject right bank, pending receipt of funding.
Russell Y. Tsuji, Land Administrator	State of Hawaii Department of Land and Natural Resources (DLNR) Land Division	Letter	7/22/2015	DLNR Land Division distributed the Draft EA to DLNR Divisions for their review and comments. Following are comments from the Engineering Division.	
Carty S. Chang, Chief Engineer	DLNR Engineering Division	Letter	7/21/2015	Please take note that part of the project site, according to the Flood Insurance Rate Map (FIRM), are located in Flood zones AE, AEF, XS, and X. The National Flood Insurance Program (NFIP) regulates developments within Flood Zones AE, AEF, and XS, but not Flood Zone X.	Comment acknowledged. USACE will ensure that the Proposed Action complies with the rules and regulations of the NFIP presented in Title 44 of the CFR.

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				The project must comply with the rules and regulations of the NFIP presented in Title 44 of the Code of Federal Regulations (CFR), whenever development within a Special Flood Hazard Area is undertaken.	
Ashley Lindsey	Landowner	Email	7/23/2015	My family owns parcels TMK: 2340300020000 and 2340310010000 which both abut the Iao Stream/Wailuku River. It is important to us that we put back this agricultural property into active farming, more specifically Hawaiian farming of kalo or taro. With the O&M road and the building of the berm that exists on the plan, it might preclude us or create such financial hardship that would prevent us from farming. The O&M road stretches from the lower portion of TMK 340300010000 through the upper portion of TMK 340300020000 and the berm will be located at the upper portion of TMK 340300020000. Please take into consideration with designing the specifics of the plan.	The O&M road and the raised berm will be designed to minimize impacts to the use of the surrounding land parcels.
Clayton I. Yoshida, AICP, Planning Program Administrator for William R. Spence, Planning Director	County of Maui Department of Planning	Letter	7/23/2015	1. The project is within the areas covered by the Maui Island Plan and Wailuku-Kahului Community Plan. We do not find that the Draft EA listed the land use designations for the project area from those two plans. 2. The project could impact the feasibility of the development of Project District 2 of the Wailuku-Kahului Community Plan as envisioned within the Community Plan. 3. The Wailuku-Kahului Community Plan includes the following objectives and policies which are supported by the project: Objectives and Policies No.3 - “Protect shoreline wetland	1. The EA has been revised to include a list of land use designations of the affected area defined in the Maui Island Plan and Wailuku-Kahului Community plan. 2. USACE has verified that the Proposed Action is not in conflict with the development of Project District 2 of the Wailuku-Kahului Community Plan. 3. Comment acknowledged.

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				resources and flood plain areas as valuable natural systems and open spaces resources"; and Objectives and Policies No.4 - "Ensure that storm water run-off and siltation will not adversely affect the marine environment and nearshore and offshore water quality."	
Rhiannon T. Chandler-ʻĪao D. Kapuaʻala Sproat Isaac H. Moriwake	EARTHJUSTICE	Letter (via email)	7/23/2015	**Impacts to Native Stream Life, Habitat, and Migration** 1. The Draft EA (DEA) provides few details on what impact the Proposed Action will have on native amphidromous species migration in light of the restoration of stream flows and uses vague language that does not provide the level of transparency necessary to facilitate meaningful public comment in the environmental review process.	1. An updated biological survey of the project area was conducted in November 2016 following restoration of stream flow. The EA has been revised to include the updated results of the biological survey and also includes discussion of potential impacts of the Proposed Action on the native amphidromous species. Observations made during the biological survey conducted in 2016 and recent observations made by DAR indicate the presence of species in the stream, including the native amphidromous species, that are indicative of a more consistent stream flow. The number of these species are expected to increase over time as the stream continues to experience more frequent continuous flow to the ocean. The Proposed Action would not impact the ability for an interim instream flow standard (IIFS) of greater than 5 million gallons per day (mgd) to remain in the channel through the project area and downstream to the stream mouth, and has been designed to facilitate fish

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				2. The DEA does not provide any clear illustrations and diagrams that would enable laypeople in the public to readily understand how the proposed structures will look and operate in their specific environmental settings. 3. The DEA does not make clear how much instream flow the diversion wall will accommodate. 4. Stream habitat should be improved to facilitate species migration. 5. The DEA does not contain sufficient information to describe the existing challenges for species migrating upstream. 6. USACE could add features to the Proposed Action to facilitate species migration. The USACE's lack of alternatives that would improve habitat for species migration, coupled with a finding that the current action would not have a significant impact on these same amphidromous species, disregards the requirements of the cumulative impact analysis. **Impacts to Groundwater Recharge, Coastal Springs, and Nearshore Resources** 7. The DEA does not provide discussion of alternatives that would mitigate the project's impacts on groundwater recharge and coastal spring flow.	passage by incorporating a 15-ft wide opening in the diversion weir. The Proposed Action would not result in impediment of the continuous flow or the biological connectivity of the stream; therefore, is not anticipated to have any negative impacts on the native amphidromous species migration. 2. Additional diagrams have been added to the final EA to help the public more easily understand the proposed action. 3. The diversion wall will accommodate up to a 10-year frequency flood event. Response to comments #4, 5, & 6: The project objective is to reduce flood risk and is not to restore the ecological function of the stream. USACE is not authorized to conduct ecosystem restoration. Funding to address concerns over the 22' vertical structure may be available through the Continuing Authorities Program (CAP) Section 1135 that allows for environmental restoration of an existing Corps project particularly if matching funds were made available from a local sponsor. 7. The objective of the current project is to reduce flood risks and not to address impacts from past actions.

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				8. EA does not provide the full range of alternatives that the law requires; consider alternatives that would expose the base of the channel (leaving the concrete walls and other flood control measures within the channel in place) and facilitate aquifer recharge. 9. Consider the non-economic value of a healthy, functioning stream system from mauka to makai. The loss of and estimated1mgd of groundwater recharge is economically quantifiable and staggering over the thirty year life of the project. 10. The Hui shares NOAA's concern, expressed at the September 17, 2014 interagency meeting, regarding the possibility that sediment from the floodplain area will reenter the main channel near the river mouth, impairing nearshore waters. **Impacts to Archaeological Resources and Cultural Practices** 11. An Archaeological Monitoring Plan (AMP) is warranted and should be produced in conjunction with the Proposed Action. The DEA (i.e., the archaeological impacts section) needs details on the extent of ground disturbance activities; given the extent of ground disturbance activities being proposed, a qualified archaeologist must be on hand to monitor ground disturbing activities in addition to implementation of an AMP.	8. Section 2 of the EA includes description of the alternatives considered in accordance with the National Environmental Policy Act (NEPA) and Hawaii Revised Statues (HRS) Chapter 343 as a result of agency and internal scoping input and how they were compared/screened to select the preferred alternative. Exposing the base of the channel would result in erosion of the stream bottom and subsequent increase in risk of levee failure. 9. Comment acknowledged. 10. As discussed in Section 3.5.5 of the EA, following concerns expressed by NOAA regarding the possibility of sediment reentering the main channel, the sedimentation study was revised to include the rate of sediment loss originating from within the overflow channel area and floodplain during a standard project flood (SPF) event. It was concluded that although diversion of flood waters would result in transport of sediment from the floodplain into the main channel to some extent, implementation of the Proposed Action would result in overall reduction in sediment load downstream of the proposed project area. 11. An AMP will be prepared and archaeological monitoring will be

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				12. The Hui urges that the Proposed Action incorporate modifications to address community concerns over the ecosystem functionality for amphidromous species, aquifer recharge, and upwelling of coastal springs, which have been negatively impact by USACE's past mistakes (i.e., channel hardening). If these issues are not addressed, the Proposed Action continues long-standing impacts to traditional and cultural practices.	conducted during all ground disturbing activities. The AMP will be reviewed by the State Historic Preservation Division (SHPD) prior to the start of construction activities. The EA has been revised to include this statement. 12. The project objective is to reduce flood risk and is not to restore the ecological function of the stream. USACE is not authorized to conduct ecosystem restoration. Funding to address concerns over the ecosystem functionality for amphidromous species, aquifer recharge, and upwelling of coastal springs may be available through the Continuing Authorities Program (CAP) Section 1135 that allows for environmental restoration of an existing Corps project particularly if matching funds were made available from a local sponsor. During the environmental analysis of the Proposed Action, USACE has conducted consultation with Native Hawaiian groups to ensure that there are no significant impacts to traditional and cultural practices within the project area.
Jessica E. Wooley, Director	State of Hawaii Department of Health Office of Environmental Quality Control	Letter	7/23/2015	1. Include a list of all permits and approvals required into the body of the EA pursuant to Section 11-200-10, Hawaii Administrative Rules (HAR). 2. The anticipated determination and the findings	1. Concur. The EA has been revised to include a list of all permits and approvals required. 2. Concur. The referenced document has been corrected as indicated and included

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				& reasons supporting the agency's anticipated determination, which was submitted to our Office as a stand-alone document, is a required content of the EA and must be included within the body of the EA. Further, the referenced document must be corrected to state that the Department of Public Works is the proposing/determining agency. 3. Include graphic material or additional figures that are easier to comprehend than Figure 1-3. 4. Withdraw the 2009 Draft EA to alleviate confusion.	within the body of the EA. 3. Additional diagrams that are easier to comprehend has been added in the EA. 4. Do not concur. The 2009 Draft EA needs to be kept on record since the current Draft EA references the 2009 Draft EA as well as information that are only found in the 2009 Draft EA. As stated in the EA, because of public and agency concerns over potential significant impacts under the alternative that was recommended in the 2009 Draft EA, the USACE decided to prepare an Environmental Impact Statement (EIS). During the EIS alternative screening process, a new alternative measure (Alternative F; the Proposed Action in the current EA) that addressed the project purpose and need, and did not require significant disturbance or modification to the existing stream alignment, was identified. Since this new alternative (i.e., the Proposed Action) was anticipated to have minimal impacts to the existing condition of the stream and the environment surrounding the stream, in 2013, the USACE decided to re-scope the project from an EIS to an EA. A Withdrawal of Notice of Intent (NOI) to prepare an EIS will be issued following issuance of the Final EA/Finding of No Significant Impact (FONSI) under the current Proposed

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					Action.
Kamanaʻopono M. Crabbe, Ph.D. Ka Pouhana, Chief Executive Officer	State of Hawaii Office of Hawaiian Affairs (OHA)	Letter	7/23/2015	1. Given the level of ground disturbance and location of the project, the USACE should commit to archaeological and cultural monitoring during ground disturbing activities. The DEA discusses monitoring with ambiguity. 2. OHA has yet to receive correspondence from the USACE initiating consultation for the Proposed Action. 3. OHA strongly urges the USACE to reincorporate project elements that will mitigate the impact of channelization ma uka and ma kai of the current project boundaries and improve the overall habitability of Iao Stream. There is no reasonable basis under NEPA for segmenting review of the new work and excluding earlier impacts (from past stream modifications). 4. The USACE and COM are encouraged to incorporate Hawaiian (indigenous and Polynesian-introduced) plants into its landscaping for this project.	1. The EA has been revised to include language that commits to archaeological and cultural monitoring during ground disturbing activities. 2. A formal letter initiating consultation for the Proposed Action was sent to OHA on December 5, 2016. 3. The project objective is to reduce flood risk and is not to restore the ecological function of the stream. USACE is not authorized to conduct ecosystem restoration. Funding to address concerns over the overall habitability of Iao Stream may be available through the Continuing Authorities Program (CAP) Section 1135 that allows for environmental restoration of an existing Corps project particularly if matching funds were made available from a local sponsor. 4. No landscaping is anticipated under the Proposed Action.
Steve & Michele Haller	Landowners	Letter	7/23/2015	The proposed project would have negative impacts on our property (TMK 2-3-4-031-001 and TMK 2-3-4-030-002) which is and has been in active agricultural use for the last ten years. Although portions of our parcels have designated flood level zones, deliberate flooding was never anticipated. If the proposed project goes through, it will be a negative impact to us and to the group of farmers that have been farming with us for the	The county obtained a perpetual flowage easement from Wailuku Sugar Company on 6 October 1980 on TMK parcel 2-3-4-031-001. This easement was acquired for the flood control project to allow flood water to occasionally inundate this area when flows exceed the channel capacity. The current proposed modification does not change the original intent or function of the project

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				last ten years.	with respects to flooding of this land.
Kristi Young, Acting Field Supervisor	U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office	Letter	8/12/2015	1. The Service concurs with the conclusions reached in the Draft EA that the Proposed Action will be more beneficial than other alternatives previously considered, particularly in regard to the nearshore marine environment at the mouth of the stream. 2. The Service still recommends that mitigating measures be undertaken due to 1) long-term permanent losses of aquatic habitat already resulting from earlier project phases; 2) the relationship of the proposed alternative to earlier work (the current proposal was developed to correct deficiencies in the earlier construction); 3) because of existing and future watershed -level impacts that could be rectified to conserve stream function to support native stream fauna; and 4) because a recent 2014 decision by the State of Hawaii Commission on Water Resource Management (CWRM) has now established an Interim Instream Flow Standard (IIFS) of 10 million gallons per day (mgd) near Kepaniwai Park, and 5mgd at the stream mouth, making faunal connectivity considerations in the Iao Stream system more significant than in the past. Long-term functional losses within the project area still need to be addressed both up- and downstream of the proposed footprint; these are well within the appropriate scope of the Draft EA impact analysis. Much of the impact to stream function has already occurred from earlier project elements, and some additional impacts	1. Comment acknowledged. 2. According to 40 CFR 1508.20, "Mitigation" includes: (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment or (e) compensating for the impact by replacing or providing substitute resource or environments. Mitigation measures are only applicable if the Proposed Action would result in significant adverse impacts to the environment. Earlier recommendations will be carried forward if they are needed to address impacts (if any) from the Proposed Action. Alternative F, the Proposed Action, is not anticipated to result in significant adverse impacts to the environment and thus mitigation measures would not be warranted or appropriate. Long-term functional losses within the stream footprint have resulted from changes in the streambed dynamic and upstream watershed use/development that have occurred during the past 30 years. The project area is located within a mostly urbanized portion of the watershed where the stream is isolated from the watershed to prevent overland flooding. The Proposed Action provides the opportunity, within a limited area, for the stream to return to its natural

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				(albeit minor) are now proposed. It is the position of the Service that these should not be reviewed in a piecemeal, out-of-context approach. Several of the recommendations put forth by the Service on earlier renditions of the proposed project, contained in our July 2011 and December 2011 FWCA 2b reports and in response to the original 2009 Draft EA, therefore remain relevant. 3. The Service continues to maintain that cumulative project impacts, including past stream channelization and modifications, should be included within the scope of the overall project impact analysis. The current NEPA process is being conducted to address a project design that corrects earlier project/construction deficiencies, and would therefore not be needed if not for problems that had arisen in regard to those earlier project elements. There is no reasonable basis under NEPA for segmenting review of new work and excluding earlier impacts. The Service continues to maintain that the Corps' approach of narrowing the scope of the project to only a review of the environmental impacts of the new project Alternative F, without analyzing cumulative impacts from the project as a whole, and in the absence of a watershed context, is in conflict with NEPA, the Clean Water Act and the Fish and Wildlife Coordination Act.	process of spreading across the floodplain during large storm events. The Proposed Action would not result in impediment of the continuous flow or the biological connectivity of the stream through Wailuku town and would not result in further isolation of the stream from the watershed; therefore, would not have any significant impacts to the watershed ecology. 3. Per 40 CFR 1508.7, "Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." The 1981 Flood Control Project was implemented after a NEPA-compliant EIS was completed with identified mitigation measures following approval of that EIS' Record of Decision. The current project is significantly temporally separate and is essentially incremental to the completed, approved, and mitigated original flood control project implemented in 1981project by 34 years. Any cumulative impacts on the watershed

Name	Affiliation	Source	Date	Summary of Comment	Response to Comments
					derive from those already experienced since the initial project construction. The Proposed Action has been evaluated in a NEPA-compliant EA that has assessed whether implementation of this Proposed Action would result in significant direct, indirect, or cumulative adverse impacts to the environment. Whether impacts to stream function have occurred from earlier project elements or not, the current project (the Proposed Action) considers the current conditions in the stream as the baseline and assess whether there would be any significant impacts under the Proposed Action. The project area is located within a mostly urbanized portion of the watershed where the stream is isolated from the watershed to prevent overland flooding. The Proposed Action provides the opportunity, within a limited area, for the stream to return to its natural process of spreading across the floodplain during large storm events. The Proposed Action would not result in impediment of the continuous flow or the biological connectivity of the stream through Wailuku town and would not result in further isolation of the stream from the watershed; therefore, is not anticipated to have any significant impacts to the watershed ecology.

Name	Affiliation	Source	Date	Summary of Comment	Response to Comments
				4. Given that the new IIFS flows will now establish permanent perennial connectivity throughout the length of the Iao Stream system, the Service maintains that all earlier recommendations to improve stream function and faunal passage are even more relevant and compelling for the Corps to consider in the context of this Draft EA. Design features that could help improve aquatic biological function in Iao Stream, and that should be evaluated in the context of this Draft EA include 1) realigning and possibly deepening the low flow channels throughout the length of the project, with specific attention to reconnecting the channels where they are bifurcated, and 2) creating native stream faunal passage/structures or modifying existing vertical drop structures to better enable faunal passage. The Service would be please to discuss these issues further in order to provide for their evaluation and implementation.	4. The project objective is to reduce flood risk and is not to restore the ecological function of the stream. USACE is not authorized to conduct ecosystem restoration. Funding to address concerns over stream function and faunal passage of Iao Stream may be available through the Continuing Authorities Program (CAP) Section 1135 that allows for environmental restoration of an existing Corps project particularly if matching funds were made available from a local sponsor. USACE would like to keep the conversation open with USFWS so that efforts to correct previous design deficiencies and restore the biological function of the stream can be considered/incorporated into future projects.

From:	Shimabuku, Lorayne P POH
To:	Kristi Ono; Miya Akiba; Martine C. Bissonnette; Wiggs, Jessica
Cc:	Ty Takeno; Cary Yamashita
Subject:	FW: MEDIA QUERY: Iao Stream Flood Control Modification Project (UNCLASSIFIED)
Date:	Thursday, June 25, 2015 9:30:09 AM

FYI below - our response to Maui News.

-----Original Message-----
From: Bonfiglio, Joseph POH
Sent: Thursday, June 25, 2015 7:56 AM
To: Shimabuku, Lorayne P POH; Chow, Derek J POH
Cc: DLL-CEPOH-PA Staff
Subject: FW: MEDIA QUERY: Iao Stream Flood Control Modification Project (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: FOUO

FYI - thanks for your prompt response.

-----Original Message-----
From: Bonfiglio, Joseph POH
Sent: Thursday, June 25, 2015 7:53 AM
To: Chris Sugidono
Cc: DLL-CEPOH-PA Staff
Subject: MEDIA QUERY: Iao Stream Flood Control Modification Project (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: FOUO

MEDIA QUERY: Iao Stream Flood Control Modification Project
Chris Sugidono
Staff Writer / Photographer
The Maui News
Work: 808.242.6349
csugidono@mauinews.com

Aloha Chris,

Mahalo for your patience. The answer to your question is below:

QUESTION:

My question is about the Iao Stream Flood Control Modification Project, specifically about the Overflow Channel.
My understanding is that one of the main points of the project is to reconnect the main channel to the overflow channel, or floodplain.

Why was the main channel not connected to the overflow channel? Was it connected in the past, and that's why it's being "reconnected?" What
is the overflow channel? Is it a bunch of farmland or an open area?

Any other information you have would be helpful and thank you for your time. I can be reached on my cell at 280-8806 or work 242-6349. Thanks.

ANSWER:

The Iao Stream Flood Control Project, constructed in 1981 by the U.S. Army Corps of Engineers,

includes channel improvements in the upper and lower reaches of the stream, levees, and designated floodplain along the left bank. The middle reach of the stream remained unlined. The Project is designed so that when stream flows exceed the 25-year flood frequency, water is diverted to the designated floodplain on the left bank to prevent the remaining flows in the stream from overtopping the stream banks and flooding the Wailuku area. The use of the floodplain during high stream flow conditions is an integral part of the overall function of the Project. Over the years, the channel invert (bottom) and right bank levee toe has deepened and eroded significantly as a result of high velocity flows and steep slopes.

The designated floodplain is restricted to agricultural purposes. As such, structures are not permitted within the floodplain.

The purpose of the overflow channe l, described in the Project modification, diverts flows to the floodplain more frequently, thus reducing damaging flows within the channel and to the right bank levees. The overflow channel is being built by lowering the left bank. Storm water will temporarily be detained in the floodplain before re-entering downstream.

Aloha/

Joseph Bonfiglio
Chief of Public Affairs
U.S. Army Corps of Engineers
Honolulu District
Ft. Shafter, Hawaii 96858
Office (808) 835-4002 / 4004
CEPOH-PA@USACE.ARMY.MIL

-----Original Message-----
From: Chris Sugidono [mailto:csugidono@mauinews.com]
Sent: Wednesday, June 24, 2015 2:55 PM
To: CEPOH-PA POH
Subject: [EXTERNAL] Iao Stream Flood Control Modification Project

Hi Joseph,

Thanks for taking my call. My question is about the Iao Stream Flood Control Modification Project, specifically about the Overflow Channel. My understanding is that one of the main points of the project is to reconnect the main channel to the overflow channel, or floodplain.

Why was the main channel not connected to the overflow channel? Was it connected in the past, and that's why it's being "reconnected?" What is the overflow channel? Is it a bunch of farmland or an open area?

Any other information you have would be helpful and thank you for your time. I can be reached on my cell at 280-8806 or work 242-6349. Thanks.

Best,
Chris

Chris Sugidono
Staff Writer / Photographer
The Maui News
Work: 808.242.6349
csugidono@mauinews.com

Classification: UNCLASSIFIED

From:	Shimabuku, Lorayne P POH
To:	Kristi Ono
Cc:	Miya Akiba; Wiggs, Jessica; Sakai, Michael Y POH
Subject:	RE: [EXTERNAL] Iao Stream Question from Tom Clark
Date:	Tuesday, June 30, 2015 3:36:46 PM

No problem. Mike was able to figure it out for us!

-----Original Message-----
From: Kristi Ono [mailto:Kristi.Ono@co.maui.hi.us]
Sent: Tuesday, June 30, 2015 3:36 PM
To: Shimabuku, Lorayne P POH
Cc: Miya Akiba; Wiggs, Jessica; Sakai, Michael Y POH
Subject: RE: [EXTERNAL] Iao Stream Question from Tom Clark

Thank you for confirming. Sorry I had the incorrect TMK.

Kristi

>>> "Shimabuku, Lorayne P POH" <Lorayne.P.Shimabuku@usace.army.mil> 6/30/2015 3:29 PM >>>
Kristi

Here are the results of your inquiry:
TMK: 3-4-020: 008 is actually inland on Mill Street, but didn't match the description you provided of being a "long, skinny parcel. Upon further research, we found that parcel TMK: 3-4-020: 080, owner Tom Clark, is located adjacent the stream, and adjacent several properties. This property is not identified as being affected by the proposed changes on the right bank. Parcels just downstream, TMK: 3-4-020: 044, 045, and 046 will be impacted. I would appreciate if you could follow up with Mr. Clark on this inquiry.

For future Iao inquiries, you can direct them to me via email at iaostreamea@usace.army.mil.

Nani

-----Original Message-----
From: Kristi Ono [mailto:Kristi.Ono@co.maui.hi.us]
Sent: Tuesday, June 30, 2015 9:24 AM
To: Shimabuku, Lorayne P POH
Subject: [EXTERNAL] Iao Stream Question from Tom Clark

Nani,

I received a phone call from Tom Clark, owner of TMK: 3-4-020: 008. He asked if the project will affect his property, which can be described as a long, skinny parcel located parallel to the right bank by Wili Pa Loop. It looks like the property is upstream of the improvements and it isn't listed as an affected property under Table 3-6 of the DEA. Can you please confirm that his property is outside the project limits?

I will gladly get back to him, but if you prefer to keep the project communication with USACE/GSI feel free to respond to him via email: clark.tom1@gmail.com. How would you like us to handle any future inquiries directed to COM-DPW?

Thank you,
Kristi

DAVID Y. IGE
GOVERNOR

DOUGLAS MURDOCK
Comptroller

AUDREY HIDANO
Deputy Comptroller

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

JUL - 1 2015

(P)1168.5

Ms. Lorayne Shimabuku
Honolulu District, U.S. Army Corp of Engineers
CEPOH-PP-C
Bldg 230, Room 307
Fort Shafter, HI 96858-5440

Dear Ms. Shimabuku:

Subject: Draft Environmental Assessment for
Modification to the Iao Stream Flood Control Project
Wailuku, Maui

Thank you for the opportunity to provide comments for the subject project. The subject project does not affect any of the Department of Accounting and General Services' existing facilities, and we have no comments to offer at this time.

If you have any questions, your staff may call Ms. Gayle Takasaki of the Public Works Division at 586-0584.

Sincerely,

for DOUGLAS MURDOCK
Comptroller

DAVID Y. IGE
GOVERNOR

FORD N. FUCHIGAMI
DIRECTOR

Deputy Directors
JADE T. BUTAY
ROSS M. HIGASHI
EDWIN H. SNIFFEN
DARRELL T. YOUNG

IN REPLY REFER TO:
STP 8.1822

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

July 2, 2015

Ms. Lorayne P. Shimabuku, P.E.
Project Manager
Honolulu District, U.S. Army Corps of Engineers
CEPOH-PP-C
Building 230, Room 307
Fort Shafter, Hawaii 96858-5440

Dear Ms. Shimabuku:

Subject: Modification to the Iao Stream Flood Control Project
Draft Environmental Assessment
Wailuku, Maui, Hawaii
TMK: (2) 3-4-020:044-046; 3-4-030:002 and 020; 3-4-031:001, 008, 015-017, 019 and 023; 3-4-032:001, 003 and 005

The subject project is not expected to significantly impact the State highway facility. However, the developer is required to obtain a permit from Department of Transportation (DOT) Highways Division, Maui District Office for the transport of oversized and/or overweight materials and equipment on State highway facilities.

If there are any questions, please contact Mr. Norren Kato of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Sincerely,

FORD N. FUCHIGAMI
Director of Transportation

From: Miya Akiba
To: Martine C. Bissonnette
Subject: FW: [EXTERNAL] Wailuku river/Iao stream
Date: Friday, July 10, 2015 11:01:34 AM

-----Original Message-----
From: Shimabuku, Lorayne P POH [mailto:Lorayne.P.Shimabuku@usace.army.mil] On Behalf Of Iao Stream EA, POH
Sent: Monday, July 06, 2015 1:53 PM
To: Miya Akiba
Cc: Kristi Ono
Subject: FW: [EXTERNAL] Wailuku river/Iao stream

Miya
Comment received.
Nani

-----Original Message-----
From: John Duey [mailto:jduey@maui.net]
Sent: Sunday, July 05, 2015 3:05 PM
To: Iao Stream EA, POH
Cc: D. Kapua Sproat; Koa Hewahewa; Isaac Moriwake; Rhiannon Chandler-Iao
Subject: [EXTERNAL] Wailuku river/Iao stream

Aloha to ACOE

Just leave it alone already. Stop wasting our money. You messed it up back in 1978 why do it again? Do not do anything in the low flow channel above HC&S intake it has been basically closed per agreement April, 14, 2014.

If you insist on doing something do the Dept. of Water Supply and the residences of central Maui a big favor and remove the existing cement in the Wailuku river bed as was suggested by all of us back in 2009 at a public meeting. Do u keep records?

John V. Duey
Pres. Hui O' Na Wai Eha
Sent from my iPad

DAVID Y. IGE
GOVERNOR

ARTHUR J. LOGAN
MAJOR GENERAL
ADJUTANT GENERAL

KENNETH S. HARA
COLONEL
DEPUTY ADJUTANT GENERAL

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

July 6, 2015

Ms. Lorayne P. Shimabuku, P.E.
Honolulu District, U.S. Army Corps of Engineers
CEPOH-PP-C
Building 230, Room 307
Fort Shafter, Hawaii 96858-5440

Subject: Draft Environmental Assessment
For Modification to the Iao Stream Flood Control Project
Wailuku, Island of Maui, Hawaii
Contract No. W9128A-14-P-005

Dear Ms. Shimabuku,

Thank you for the opportunity to comment on the above project. The State of Hawaii Department of Defense has no comments to offer relative to the project.

If you have any questions or concerns, please have your staff contact Mr. Lloyd Maki, Assistant Chief Engineering Officer at (808) 733-4250.

Sincerely,

ARTHUR J. LOGAN
Major General
Hawaii National Guard
Adjutant General

c: Ms. Havinne Okamura, Hawaii Emergency Management Agency

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
File:

07006PCTM.15

July 7, 2015

Ms. Lorayne P. Shimabuku, P.E.
Project Manager
Honolulu District, U.S. Army Corps of Engineers
CEPOH-PP-C
Bldg 230, Room 307
Fort Shafter, Hawaii 96858-5440

Dear Ms. Shimabuku:

SUBJECT: Comments on the Draft Environmental Assessment (DEA) for Modification to the Iao Stream Flood Control Project Wailuku, Island of Maui, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated June 22, 2015, 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/Clean-Water-Branch-Std-Comments.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 National Pollutant Discharge Elimination System (NPDES) permit coverage for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55).

For NPDES general permit coverage, a Notice of Intent (NOI) form must be submitted at least 30 calendar days before the commencement of the discharge. An application for a 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 applicable form ("CWB Individual NPDES Form" or "CWB NOI Form") through the e-Permitting Portal and the hard copy certification statement with the respective filing fee ($1,000 for an individual NPDES permit or $500 for a Notice of General Permit Coverage). Please open the e-Permitting Portal website located at: https://eha-cloud.doh.hawaii.gov/epermit/. 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 appropriate form. Follow the instructions to complete and submit the 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: 835-4303) 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.

5. It is the State's position that all projects must reduce, reuse, and recycle to protect, restore, and sustain water quality and beneficial uses of State waters. Project planning should:

   a. Treat storm water as a resource to be protected by integrating it into project planning and permitting. Storm water has long been recognized as a source of irrigation that will not deplete potable water resources. What is often overlooked is that storm water recharges ground water supplies and feeds streams and

estuaries; to ensure that these water cycles are not disrupted, storm water cannot be relegated as a waste product of impervious surfaces. Any project planning must recognize storm water as an asset that sustains and protects natural ecosystems and traditional beneficial uses of State waters, like community beautification, beach going, swimming, and fishing. The approaches necessary to do so, including low impact development methods or ecological bio-engineering of drainage ways must be identified in the planning stages to allow designers opportunity to include those approaches up front, prior to seeking zoning, construction, or building permits.

b. Clearly articulate the State's position on water quality and the beneficial uses of State waters. The plan should include statements regarding the implementation of methods to conserve natural resources (e.g. minimizing potable water for irrigation, gray water re-use options, energy conservation through smart design) and improve water quality.

c. Consider storm water Best Management Practice (BMP) approaches that minimize the use of potable water for irrigation through storm water storage and reuse, percolate storm water to recharge groundwater to revitalize natural hydrology, and treat storm water which is to be discharged.

d. Consider the use of green building practices, such as pervious pavement and landscaping with native vegetation, to improve water quality by reducing excessive runoff and the need for excessive fertilization, respectively.

e. Identify opportunities for retrofitting or bio-engineering existing storm water infrastructure to restore ecological function while maintaining, or even enhancing, hydraulic capacity. Particular consideration should be given to areas prone to flooding, or where the infrastructure is aged and will need to be rehabilitated.

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, P.E., CHIEF
Clean Water Branch

CTM:ay

c: U.S. Army Corps of Engineers, [via e-mail iaostreamea@usace.army.mil only]

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7845
Fax: (808) 270-7955



COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
200 SOUTH HIGH STREET, ROOM NO. 434
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

July 8, 2015

HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS
CEPOH-PP-C (Attn: Lorayne Shimabuku)
Bldg. 230, Room 307
Fort Shafter, Hawaii 96858-5440

Dear Ms. Shimabuku:

SUBJECT: MODIFICATION TO THE IAO STREAM FLOOD CONTROL PROJECT

We reviewed the subject application and have no comments.

Please call Rowena M. Dagdag-Andaya at (808) 270-7845 if you have any questions regarding this letter.

Sincerely,

for DAVID C. GOODE
Director of Public Works

DCG:RMDA:da
xc: Highways Division
Engineering Division
S:\DSA\Engr\CZM\Draft Comments\iao_stream_flood_cntrl_proj.wpd

DAVID Y. IGE
GOVERNOR

RACHAEL WONG, DrPH
DIRECTOR

PANKAJ BHANOT
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF HUMAN SERVICES
Benefit, Employment & Support Services Division
820 Mililani Street, Suite 606
Honolulu, Hawaii 96813

July 8, 2015

Re: 15-0353

Honolulu District, U.S. Army Corps of Engineers
CEPOH-PP-C (Attn: Lorayne Shimabuku)
Bldg 230, Room 307
Fort Shafter, HI 96858-5440

Dear Ms. Shimabuku:

Subject: Modification of Iao Stream Flood Control Project; Location - Wailuku Maui

This is in response to your letter dated June 22, 2015 requesting the Department of Human Services (DHS) review the Draft Environmental Assessment (DEA) on the Iao Stream Flood Control Project.

The DHS has reviewed the project website and has found there is a child care facility at the Maui Family Support Services Childcare Center located at 1844 Wili Pa Loop. You may contact this facility directly to discuss whether the facility will be impacted by the Iao Stream Project.

If you have any questions or need further information, please contact Ms. Jill Arizumi, Child Care Program Specialist, at (808) 586-5240.

Sincerely,

Scott Nakasone
Assistant Division Administrator

c: Rachael Wong, DrPH, Director

GSI Pacific, Inc.
181 s. Kukui St.
Honolulu, HI 96813

RECEIVED
JUL 20 2015

July, 15, 2015

Ref: Draft E. A. Modification of the Iao/Wailuku flood control Project Wailuku, HI
Contract # W9128a-14-P-005

U.S. Army Corps of Engineers project

To Whom it may concern

Aloha

Mahalo for sending the hard copy.

I have been heavily involved with the restoration of the water to Wailuku River since 2003 and the restoration of the proper name Wailuku River. I am not an innocent by-stander. My Ohana owns land that Wailuku River runs across, but our land will not be affected by this project. We own 18A. just below Kepanwai bridge. But I still am interested in the life of the River.

I have a few comments concerning this project.

1. Iao Stream has officially been changed back to Wailuku River as of May 27, 2015 by the Hawaii Board of Geographic Names. It is being brought up on the Federal level in the next couple of months.

2. Thank you for not hardening any more of Wailuku river channel.

3. I still believe the "no action alternative" is the right thing.

4. I still would like to see Alternative B would be the proper way to go, not to remove all concrete just the cement in the channel.

5. Happy that all of our testimony at the 2009 meeting was taken into consideration as to re-charge. There were appo. 20 people who testified at that meeting.

6. Page 1-2 do something about the 22" drop so stream live can have a better chance to migrate up-river.

7.Page 2-12 O&M clear the weir every year instead of every 5 years.

8. Page 3-64 I can not understand the statement "agricultural land would not be significantly impacted". That is an untrue statement. How would your feel if you were farming on one of those parcels?

9. Make available a place that CWRM can install a stream gauge as required by he settlement agreement of April, 2014

Mahalo



John V. Duey
President Hui 'O Na Wai Eha
575-a Iao Valley Rd
Wailuku, HI 96793
E-mail : jduey@maui.net

P.S. I am in Mi. on an extended vacation at.
8335 Enid Dr.
Evart, Mi 49631

DAVID Y. IGE
GOVERNOR OF HAWAII

RECEIVED
COUNTY OF MAUI
2015 JUL 21 AM 6:33
ENGINEERING DIVISION
DEPT OF PUBLIC WORKS

VIRGINIA PRESSLER, M.D.
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 96793-3378

July 16, 2015

Ms. Kristi Ono
Civil Engineer IV
County of Maui
Department of Public Works
Engineering Division
200 South High Street, 4th Floor
Wailuku, HI 96793

Dear Ms. Ono:

Subject:	Modification to the Iao Stream Flood Control Project
Applicant:	County of Maui
TMK:	(2) 3-4-020:044, 045, 046; (2) 3-4-030:002; (2) 3-4-030:020; (2) 3-4-030:888; (2) 3-4-031:001, 008, 015, 016, 017, 023, 019; (2) 3-4-032:001, 003, 005, 047, 048
District:	Wailuku

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) maybe required.

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 contact me at 808 984-8230 or email me at patricia.kitkowski@doh.hawaii.gov.

Sincerely yours,

Patti Kitkowski
District Environmental Health Program Chief

c EPO
GSI Pacific, Inc.

Water Resources Research Center

UNIVERSITY of HAWAI'I®
MĀNOA

July 20, 2015

Honolulu District, U.S. Army Corps of Engineers
CEPOH-PP-C (Attn: Ms. Lorayne Shimabuku)
Bldg 230, Room 307
Fort Shafter, HI 96858-5440

Ms. Shimabuku:

This is to acknowledge receipt of your letter for review of an Environmental Assessment.

Unfortunately, the Water Resources Research Center does not have the capacity to review the environmental impact statement at this time due to the faculty position vacancy.

While we continue to explore filling the current vacancy, the Center will exclude itself from commentary on this specific environmental assessment study.

Sincerely,

Darren T. Lerner, PhD
Interim Director

2540 Dole Street, Holmes Hall 283
Honolulu, Hawai'i 96822
Telephone: (808) 956-7847
Fax: (808) 956-5044
An Equal Opportunity/Affirmative Action Institution

ALAN M. ARAKAWA
Mayor

KYLE K. GINOZA, P.E.
Director

MICHAEL M. MIYAMOTO
Deputy Director

MICHAEL RATTE
Solid Waste Division

ERIC NAKAGAWA, P.E.
Wastewater Reclamation Division

COUNTY OF MAUI
DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
2050 MAIN STREET, SUITE 1C
WAILUKU, MAUI, HAWAII 96793

July 20, 2015

Honolulu District, U.S. Army Corps of Engineers
CEPOH-PP-C (Attn: Lorayne Shimabuku)
Bldg 230, Room 307
Fort Shafter, HI 96858-5440

SUBJECT: MODIFICATION TO THE IAO STREAM FLOOD CONTROL PROJECT DRAFT ENVIRONMENTAL ASSESSMENT WAILUKU, MAUI, HAWAII

We reviewed the subject application and have the following comments:

1. Solid Waste Division comments:

   a. None.

2. Wastewater Reclamation Division (WWRD) comments:

   a. Access to all existing sewer improvements will need to be provided for maintenance.
   b. Any manhole within anticipated flood areas will need to be sealed to the satisfaction of the Wastewater Reclamation Division in order to prevent water infiltration.
   c. Any sewer facility affected by the project shall be protected or relocated with approval by the Wastewater Reclamation Division.

If you have any questions regarding this memorandum, please contact Michael Miyamoto at 270-8230.

Sincerely,

KYLE K. GINOZA, P.E.
Director of Environmental Management

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
FIRST DEPUTY

W. ROY HARDY
ACTING DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 20, 2015

MEMORANDUM

Am 7-23-15

TO: Alton Miyasaka, Acting Administrator

FROM: Skippy Hau, Aquatic Biologist

SUBJECT: Modification to the Iao Stream Flood Control Project

For Honolulu District, U.S. Army Corps of Engineers
CEPOH-PP-C (Attn: Lorayne Shimabuku)
Bldg 230, Room 307
Fort Shafter, HI 96858-5440
Email: iaostreamea@usace.army.mil
(Due: July 23, 2015)

I reviewed the draft EA (DEA) and have the following comments:

Will kalo farming and lo'i be given priority in restoring the inundation area along with kuleana ditches? There appears to be historical information but with over a hundred years of diversions for sugar cane production, land use has changed. For example, farming banana and other crops could absorb water but water would not be expected to return to the stream. The irrigation system used for Waihe'e should be replicated. The terracing and natural flow for lo'i adjoining the stream is outstanding. Will CWRM (Commission on Water Resources Management) appurtenant permit holders be involved?

(P.3-35) Hihiwai (*Neritina granosa*) were collected from 'Iao Stream mouth from 2000 to 2006. Hihiwai recruitment stopped because of below average rainfall from 2007-2013. Hihiwai have returned in May 2015 possibly due to the continuous flow.

Appendix B
Section 404(B)(1) Evaluation (P.9)

Water measurements should be conducted during stream flow and not be repeating that low flow and/or dry conditions persist 90% of the year. Please gather some useful water quality information and make stream flow estimates for that location.

C. Suspended Particulate/Turbidity Determination
(No data presented.)

(P.11) 'O'opu nakea (Awaous) has been revised back to *Awaous stamineus* and all five fishes are endemic.

Water quality and biological surveys for the 'Iao Stream Flood Control Project Wailuku, Maui. June 18, 2012 AECOS No 1232

(Figure 3.) The two 2-inch channel irons have provided limited flow but has never been shown to provide amphidromous passage. (It should not be labeled as a passage channel.)

It appears to have provided continuous flow instead of dry dead zones between the diversion and lower pools.

(Figure 4A.) I asked the low flow channel be corrected for continuous stream flow. The low flow channel changes to the other side downstream. Instead of a plunge pool or staging area to climb the waterfall, there is a shallow concrete bottom with no hiding areas.

(Stenogobius and Eleotris have been found upstream. As post larvae, they were transported with the other 'o'opu collected by the Waiehu Bridge.)

Honu (*Chelonia mydas*) have been present in coastal waters and nesting has increased over time: Waihe'e (2002 & 2009); Waiehu (2007 & 2012).

Call me at Ph.#808-281-7091 if you have any questions.

OFFICE OF PLANNING
STATE OF HAWAII

DAVID Y. IGE
GOVERNOR

LEO R. ASUNCION
ACTING DIRECTOR
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
Web: http://planning.hawaii.gov/

Ref. No. P-14830

July 21, 2015

Ms. Lorayne P. Shimabuku, P.E.
Project Manager
Civil and Public Works Branch
Honolulu District, U.S. Army Corps of Engineers
CEPOH-PP-C
Building 230, Room 307
Fort Shafter, Hawaii 96858-5440

Dear Ms. Shimabuku:

Subject: Draft Environmental Assessment – Modification to the Iao Stream Flood Control Project, Wailuku, Maui, Hawaii; TMK: Various

Thank you for the opportunity to provide comments on the Draft Environmental Assessment (Draft EA) for the modifications to the Iao Stream Flood Control Project. The Draft EA review material was received by our office by letter, on June 22, 2015.

It is our understanding that Iao Stream is in danger of reverting to a flood hazard zone due to deterioration/scouring of the right stream bank and undermining of the levee toe resulting from changes in the streambed dynamic and upstream watershed use/development that have occurred during the past 30 years. In order to preserve the reliability of the existing flood control systems, additional structures are needed to protect the Wailuku community. The Draft EA was created in response to this. The Draft EA examined a number of alternatives for this action. The alternatives examined include: Alternative A - No Action; Alternative B - Removal of Flood Control Improvements; Alternative C - Roller Compacted Concrete (RCC) and Grouted Boulder Invert Channel; Alternative D - Dual Stilling and Sedimentation Basins; Alternative E - RCC Channel with Grade Control Structures; Other Alternatives; and Alternative F - Floodplain Reconnection (the preferred method).

The Draft EA was prepared pursuant to the National Environmental Policy Act, 40 CFR 1500-1508, Engineer Regulations 200-2-2, and Hawaii Revised Statutes (HRS), Chapter 343.

The Office of Planning has reviewed the transmitted material and has the following comments to offer:

1. Because this action is done in conjunction with the County of Maui Department of Public Works, it must meet HRS Chapter 343 requirements. Pursuant to Hawaii Administrative Rules § 11-200-17(h) – Land Use Plans, Policies, and Controls – the modification to the Iao Stream bank and flooding mitigation efforts may have an adverse environmental impact on the nearby marine environment. The Draft EA, therefore, should consider and evaluate this action based upon the statewide planning system in HRS Chapter 226, the Hawaii State Plan. The Hawaii State Plan provides goals, objectives, policies, and priority guidelines for growth, development, and the allocation of resources throughout the State. The Hawaii State Plan includes diverse objectives and policies of state interest including but not limited to the economy, agriculture, the visitor industry, federal expenditure, the physical environment, facility systems, socio-cultural advancement, climate change adaptation, and sustainability.

   The Draft EA should include an analysis that addresses whether the proposed project conforms or is in conflict with the goals, objectives, policies, and priority guidelines listed in the Hawaii State Plan. The goals of State interest that this action should consider include, but are not limited to: HRS § 226-11 (Physical Environment – Land-Based, Shoreline, and Marine Resources); HRS § 226-12 (Physical Environment – Scenic, Natural Beauty, and Historic Resources); and HRS § 226-13 (Physical Environment – Land, Air, and Water Quality).

2. The Draft EA, Section 3.7, pages 3-54 and 3-55, provide a synopsis of the Coastal Zone Management Act and an acknowledgement that this project will need to be consistent with the Hawaii Coastal Zone Management (CZM) program. The Draft EA, however, does not address the project's conformity with the enforceable policies of the Hawaii CZM program found in HRS § 205A-2.

   HRS § 205A-1 defines the entire state as being within coastal zone management area. Therefore, this project is within the CZM area and must conform to CZM objectives and policies. HRS Chapter 205A requires all State and county agencies to enforce CZM objectives and policies.

   To be compliant with HRS 343 requirements, the Final Environmental Assessment should include an assessment as to how the proposed project conforms to the CZM objectives and its supporting policies set forth in HRS § 205A-2. These objectives and policies include: recreational resources, historic resources, scenic and open space resources, coastal ecosystems, economic uses, coastal hazards, managing

development, public participation, beach protection, and marine resources.

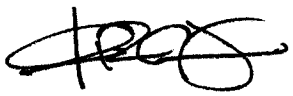
3. This project is an action proposed by the U.S. Army Corps of Engineers and will need to be comply with the National Clean Water Act mandates. Furthermore, as stated in an earlier consultation, dated March 30, 2009, this action will need an evaluation on Federal Consistency requirements.

   The national Coastal Zone Management Act (CZMA) requires direct federal activities and development projects to be consistent with approved state coastal programs to the maximum extent practicable. Federal actions are defined by the CZMA as activities performed by a Federal agency; activities not performed by a Federal agency, but require federal permits or approval; or State and local government projects that receive Federal financial assistance.

   This action is performed by a federal agency, uses federal funding, and requires a federal permit, therefore, an evaluation is needed. Please consult with the Office of Planning for further information on the Federal Consistency evaluation.

If you have any questions regarding this comment letter, please contact Josh Hekekia of our office at (808) 587-2845.

Sincerely,



Leo R. Asuncion
Acting Director

From:	Shimabuku, Lorayne P POH on behalf of Iao Stream EA, POH
To:	Martine C. Bissonnette
Cc:	Miya Akiba
Subject:	FW: Comments
Date:	Wednesday, July 22, 2015 4:48:29 PM
Attachments:	image001.gif

FYI. I believe Mr. Bernaldo was the gentleman that attended our meeting.

-----Original Message-----
From: Alan Bernaldo [mailto:alanbcpa@certfinancial.com]
Sent: Wednesday, July 22, 2015 4:15 PM
To: Iao Stream EA, POH
Subject: [EXTERNAL] Comments

Gentlemen:

Of major concern is the "right bank armoring and repair to existing revetments" mentioned in the scope of the Iao Stream Flood Control project.

My office building and other business owners have had the land eroded to a point dangerously close to the building structure itself.

Either due to lack of funding or project oversight the stream's present lining ends downstream of the eroded hillside.

The armoring on the right bank is crucial to prevent further catastrophic erosion along the bank supporting the affected buildings.

The address of my building is 1871 Wili Pa Loop. The lots adjacent to my building are similarly affected.

Apparently, if funded, the project is to start mid-2018. A timeline to address the right bank issue sooner should/need be considered and would be greatly appreciated.

Please contact me should you have any questions.

Thank you.

Alan K. Bernaldo, CPA

(808) 242-5951

This message contains information which is confidential and/or privileged. This information is intended for use only by the addressee indicated above. Any tax advice in this communication is not intended or written to be used, and cannot be used by you, or your business(s), or any other person or entity for the purpose of avoiding penalties that may be imposed on the taxpayer.

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
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 22, 2015

Honolulu District, U.S. Army Corps of Engineers
CEPOH-PP-C (Attn: Lorayne Shimabuku) email: iaostreamea@usace.army.mil
Building 230, Room 307
Fort Shafter, Hawaii 96858-5440

Dear Ms. Shimabuku:

SUBJECT: Draft Environmental Assessment (DEA) for the Modification to the Iao Stream Flood Control Project

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

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RECEIVED
LAND DIVISION
2015 JUL 21 AM 11:12
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

'15 JUN26 AM10:58 ENGINEERING

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809
June 25, 2015

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
___Office of Conservation & Coastal Lands
_X_ Land Division – Maui District
_X_ Historic Preservation

FROM: TO:
Russell Y. Tsuji, Land Administrator

SUBJECT: Draft Environmental Assessment (DEA) for the Modification to the Iao Stream Flood Control Project

LOCATION: Waikulu, Island of Maui; TMK: (2) 3-4-020:044, 045, 046; (2) 3-4-030:002; (2) 3-4-030:020; (2) 3-4-030:888; (2) 3-4-031:001, 008, 015, 016, 017, 023, 019; (2) 3-4-032:001, 003, 005, 047, 048

APPLICANT: 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 **July 21, 2015**.

The DEA can be found on-line at: http://health.hawaii.gov/oeqc/ (Click on the Current Environmental Notice under Quick Links on the right.)

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. Chang, Chief Engineer
Date: 7/21/15

cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/ Russell Y. Tsuji
Ref.: DEA for Modification to Iao Stream Flood Control Project
Maui.018

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 parts of the project site, according to the Flood Insurance Rate Map (FIRM), are located in Flood Zones AE, AEF, XS, and X. The National Flood Insurance Program regulates developments within Flood Zones AE, AEF, and XS as indicated in bold letters below, but not Flood Zone X.

( ) 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 of the City and County of Honolulu, Department of Planning and Permitting.

( ) Mr. Carter Romero (Acting) at (808) 961-8943 of the County of Hawaii, Department of Public Works.

(X) Mr. Carolyn Cortez at (808) 270-7253 of the County of Maui, Department of Planning.

( ) Mr. Stanford Iwamoto at (808) 241-4896 of the County of Kauai, Department of Public Works.

( ) The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: _____

_____

( ) Other: _____

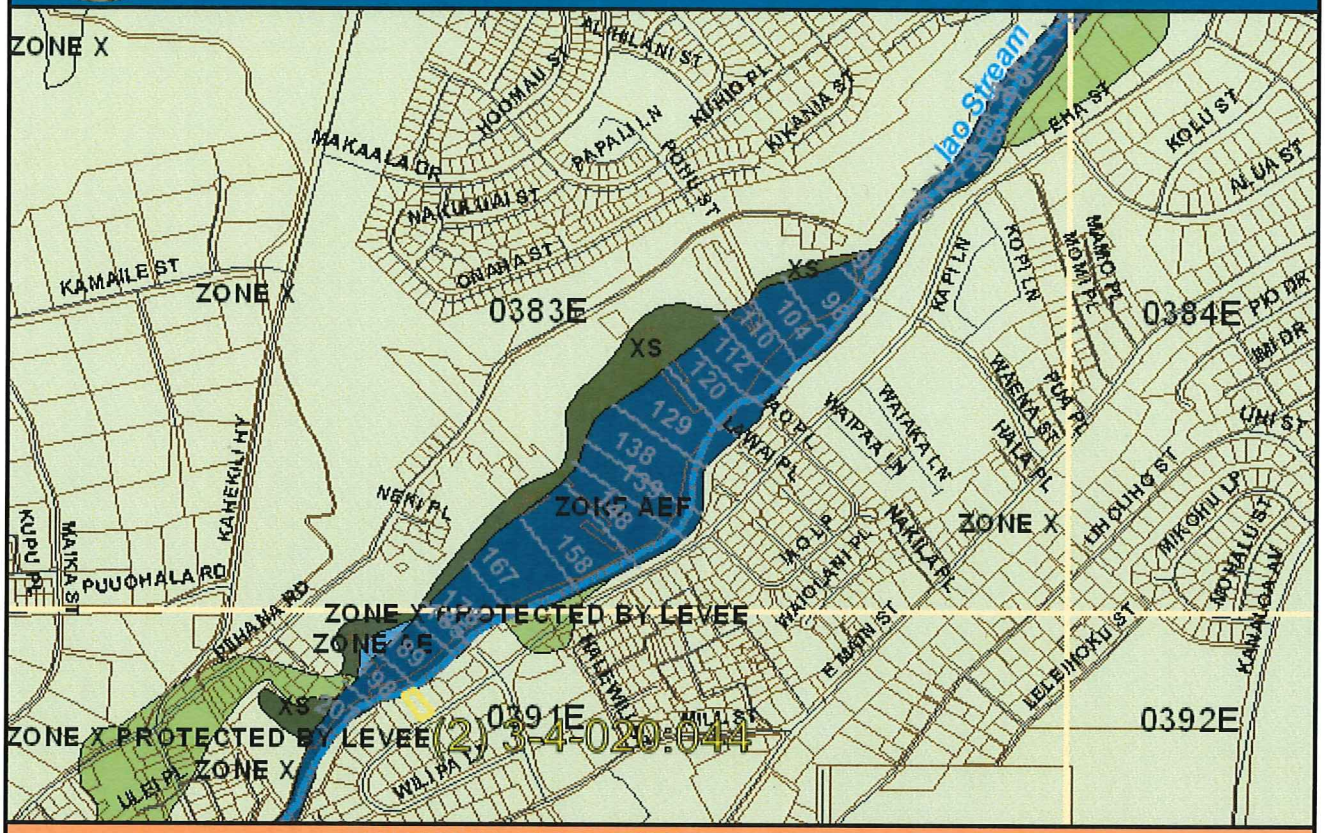
Should you have any questions, please call Mr. Dennis Imada of the Planning Branch at 587-0257.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: 7/21/15

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) 3-4-020-044
PARCEL ADDRESS:	1863 WILI PA LOOP WAILUKU, HI 96793
FIRM INDEX DATE:	SEPTEMBER 19, 2012
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1500030391E
PANEL EFFECTIVE DATE:	SEPTEMBER 25, 2009

PARCEL DATA FROM:	JULY 2013
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.

From:	Shimabuku, Lorayne P POH on behalf of Iao Stream EA, POH
To:	Kristi Ono
Cc:	Martinez, Nicole M NAF USARMY IMCOM PACIFIC (US); Miya Akiba
Subject:	RE: [EXTERNAL] Fwd: ʻIao Stream Flood Control Modification Project 5(b) DEA (AFNSI)
Date:	Thursday, July 23, 2015 11:19:16 AM

Thanks Kristi.

-----Original Message-----
From: Kristi Ono [mailto:Kristi.Ono@co.maui.hi.us]
Sent: Thursday, July 23, 2015 11:13 AM
To: Iao Stream EA, POH
Subject: [EXTERNAL] Fwd: ʻĪao Stream Flood Control Modification Project 5(b) DEA (AFNSI)

>>> Ashley Lindsey <ashleyawakea@gmail.com> 7/23/2015 11:06 AM >>>

To Whom It May Concern:

My name is Ashley Lindsey. My family owns parcels TMK: 2340300020000 and 2340310010000 which both abut the ʻIao Stream/Wailuku River. I am writing you in response to the "Modification to the Iao Stream Flood Control Environmental Assessment" document dated June 10, 2015.

I do appreciate that the Army Corps of Engineers is working to update the Flood Control that does exist at ʻIao Stream for the safety of our community. Although, I do have some reservations on what you are planning for the property. It is important to us that we put back this agricultural property into active farming, more specifically Hawaiian farming of kalo or taro. Upon the purchase of the property, it did come with rights to use water from the stream for cultivation of things like kalo, where the water is returned further down the stream. Water is very important to bring agriculture back to this once fruitful valley. Fortunately, with the recent Na Wai Eha enforcement there will be constant flow in the stream. As with many other farms, it would also need the ability to have farm structures on the properties. With the O&M road and the building of the Berm that exists on the plan, it might preclude us or create such financial hardship that would prevent us from farming. The O&M road stretches from the lower portion of TMK: 340300010000 through the upper portion of TMK: 340300020000 and the berm will be located at the upper portion of TMK: 340300020000. Please take this into consideration with designing the specifics of the plan.

Mahalo,

Ashley Lindsey

ashleyawakea@gmail.com

ALAN M. ARAKAWA
Mayor

WILLIAM R. SPENCE
Director

MICHELE CHOUTEAU McLEAN
Deputy Director

COUNTY OF MAUI
DEPARTMENT OF PLANNING

July 23, 2015

Honolulu District, U.S. Army Corps of Engineers
CEPOH-PP-C (Attn: Lorayne P. Shimabuku, P.E.)
Building 230, Room 307
Fort Shafter, Hawaii 96858-5440

Dear Ms. Shimabuku:

SUBJECT: COMMENTS ON A DRAFT ENVIRONMENTAL ASSESSMENT (EA) FOR THE MODIFICATION TO THE IAO STREAM FLOOD CONTROL PROJECT, WITHIN THE APPROXIMATELY 0.4-MILE STRETCH OF IAO STREAM BETWEEN SLIGHTLY DOWNSTREAM OF WAENA STREET (RIVER STATION [RS] 42+30) AND UPSTREAM OF IMI KALA STREET (RS 83+25); INCLUDING PRINCIPALLY PORTIONS OF TMKS: (2) 3-4-031:001 AND (2) 3-4-032:001, BUT ALSO INCLUDING ALL OR PORTIONS OF TMKS: (2) 3-4-020:044, (2) 3-4-020:045, (2) 3-4-020:046, (2) 3-4-030:002, (2) 3-4-030:020, (2) 3-4-030:888, (2) 3-4-031:008, (2) 3-4-031:015, (2) 3-4-031:016, (2) 3-4-031:017 , (2) 3-4-031:019, (2) 3-4-031:023, (2) 3-4-032:002, (2) 3-4-032:003, (2) 3-4-032:005, (2) 3-4-032:047, AND (2) 3-4-032:048; WAILUKU, ISLAND OF MAUI, HAWAII (EAC 2015/0007)

The Department of Planning (Department) is in receipt of your request for comments on the Draft EA for the above-referenced project. The Department understands that the proposed action includes the following:

> The project consists of features that would reconnect the main channel of Iao Stream with the existing floodplain on the left bank to reduce damaging flows along the main channel and right bank levees. The reconnection would be accomplished by lowering the left bank approximately 5 to 9 ft between River Stations (RS) 78+99 and 75+10 (an approximate length of 417 ft along the left bank) and grading the overflow area to disperse flow into the floodplain. Following grading, revegetation (in the form of grass) would be provided throughout the approximately 116,060-squrare foot overflow channel to prevent erosion during diversion of stream waters. The stream would be constricted by a concrete diversion wall, located within the channel at RS 75+10, downstream and at the base of the overflow channel section. The diversion wall would be approximately 18-ft high with a 15-ft wide opening to allow for fish passage and some flow to remain in the channel. The invert of this structure would be at or below the existing stream bed elevation and low flow through the opening would be controlled by the natural riffles and pools formed by the existing boulder stream bed both up and downstream of the diversion wall. The left bank between RS 66+60 and 61+05 (approximately 473 linear ft along the bank) would be

raised by an earthen berm, up to approximately 6 ft, to contain the overflow within the floodplain. Further downstream, between RS 45+60 and 43+60, the left bank would be lowered to allow the return of the overflow into the main channel. At two locations, from RS 83+25 to 81+25 and RS 44+10 to 42+30, slope revetment is necessary to protect the bank from eroding under conditions of high stream velocities. These locations would be stabilized with boulder concrete slope lining or "shotcrete" to accommodate the steep bank slopes and protect the bank from erosion. In addition, from RS 55+50 to 51+90, approximately 290 linear ft of revetment along the left bank would be removed entirely and restored to a natural earth embankment typical of upstream and downstream conditions. Along the right bank, from RS 55+10 to 50+25 (approximately 470 linear ft), the concrete toe berm that has severely eroded would be removed and replaced with a concrete retaining wall to provide support to the existing embankment and prevent further erosion of the bank toe. Also included would be construction of a permanent 15-ft wide gravel road along the stream on the left bank between RS 75+10 and 43+60. Site access during construction activities would be from Piihana Road along an existing road ending at RS 79+00.

Based on the foregoing and review of the Draft EA, the Department provides the following comments:

1. The project is within the areas covered by the Maui Island Plan and Wailuku-Kahului Community Plan. We do not find that the Draft EA listed the land use designations for the project area from those two (2) plans. The project is within the Urban Growth Boundary in the Maui Island Plan. Figure 1-3 in the Draft EA maps the "Approx Extent of Standard Project Flood." That area includes lands having the following land use designations in the Wailuku-Kahului Community Plan. The definition of each from the Community Plan and the general area of the "Approx Extent of Standard Project Flood" within each designation are also included.

   - Single-Family (SF) - "This includes single-family and duplex dwellings." - TMK Nos. (2) 3-4-032:003, (2) 3-4-032:005, (2) 3-4-032:047, and (2) 3-4-032:048.

   - Project District (PD) – "This category provides for a flexible and creative planning approach rather than specific land use designations for quality developments. The planning approach would establish a continuity in land uses and designs while providing for a comprehensive network of infrastructural facilities and systems. A variety of uses as well as open space, parks, and other project uses are intended in accord with each individual project district objective." - North side of far west portion of the "Approx Extent of Standard Project Flood" in TMK No. (2) 3-4-032:001.

   - Open Space (OS) – "This use 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 would include but not be limited to shoreline buffer areas, landscape buffers, drainageways, viewplanes, flood plains, anti-tsunami areas. Other appropriate urban and non-urban uses may be allowed on a permit basis. - TMK No. (2) 3-4-032:001 and all other parcels within the "Approx Extent of Standard Project Flood."

2. The project could impact the feasibility of the development of Project District 2 of the Wailuku-Kahului Community Plan as envisioned within the Community Plan. It is currently described as follows.

> PROJECT DISTRICT 2 (Piihana) 78 acres - This project district should be oriented toward providing low and moderate income units with a mixture of housing types ranging from single-family to multi-family units. Land for 20 percent of the housing units will be made available as a joint venture with the County for housing to meet the County's needs. Public amenities should include a park and open space system of pedestrian ways, greenbelts and buffer zones along major transportation routes. The project district should be compatible in scale to adjacent single family areas. Circulation should reflect a unified pattern with adjacent land uses. Recommended guidelines for spatial allocations within the project district are:
>
> Parks, open space, buffer zones.....12 acres
> Public use (fire station, etc.).....1 acre
> Residential use.....65 acres
> Residential units based on 6 dwelling
> units per acre average density.....390 units

3. The Wailuku-Kahului Community Plan includes the following objectives and policies which are supported by the project.

- ENVIRONMENT - Objectives and Policies No. 3. – "Protect shoreline wetland resources and flood plain areas as valuable natural systems and open space resources. These natural systems are important for flood control, as habitat area for wildlife, and for various forms of recreation. Future development actions should emphasize flood prevention and protection of the natural landscape."

- DRAINAGE - Objectives and Policies No. 4. – "Ensure that storm water run-off and siltation from proposed development will not adversely affect the marine environment and nearshore and offshore water quality. Minimize the increase in discharge of storm water runoff to coastal waters by preserving flood storage capacity in low-lying areas, and encouraging infiltration of runoff."

Thank you for the opportunity to comment. Should you require further clarification, please contact Current Planning Supervisor Jeffrey Dack at jeffrey.dack@mauicounty.gov or at 270-6275.

Sincerely,

CLAYTON I. YOSHIDA, AICP
Planning Program Administrator

for WILLIAM R. SPENCE
Planning Director

xc: Clayton I. Yoshida, AICP, Planning Program Administrator (PDF)
Jeffrey P. Dack, Current Planning Supervisor (PDF)
Rowena Dagdag-Andaya, Department of Public Works (PDF)
EAC Project File
General File

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EARTHJUSTICE

ALASKA CALIFORNIA FLORIDA MID-PACIFIC NORTHEAST NORTHERN ROCKIES
NORTHWEST ROCKY MOUNTAIN WASHINGTON, DC INTERNATIONAL

July 23, 2015

VIA ELECTRONIC TRANSMITTAL
Honolulu District, U.S. Army Corps of Engineers
Attn: Nani Shimabuku
Building 230, CEPOH-PP-C
Fort Shafter, Hawai'i 96858-5440

Re: Comments on the Draft Environmental Assessment for Modification of the 'Īao Stream[1] Flood Control Project

Dear Ms. Shimabuku:

On behalf of Hui o Nā Wai 'Ehā ("Hui"), we respectfully submit these comments on the Draft Environmental Assessment ("DEA") for Modification to the 'Īao Stream Flood Control Project ("proposed action"). The Hui is a community organization of residents of Maui and Nā Wai 'Ehā who are dedicated to promoting the conservation and sound management of the waters of Waihe'e, Waiehu, Wailuku, and Waikapū. As detailed below, the Hui is concerned that this proposal to modify the existing flood control project ("project") disregards previous concerns raised by the Hui, other community members, and state and federal agencies regarding the project's cumulative impacts on native stream life, aquifer recharge, archeological resources, and traditional and customary Native Hawaiian rights and practices. The Hui respectfully urges the U.S. Army Corps of Engineers ("USACE") to modify the proposed action to address these concerns.

Impacts to Native Stream Life, Habitat, and Migration

Aside from mentioning that pursuant to the "April 2014 Settlement Agreement, the Wailuku Water Company began the release of 10 million gallons of water per day into 'Īao Stream on October 13, 2014," DEA at 14,[2] the DEA provides few details on what impact the proposed action will have on native amphidromous species migration in light of the restoration of stream flows. Instead, the DEA uses vague language that does not provide the level of transparency necessary to facilitate meaningful public comment in the environmental review process.

[1] On May 27, 2015, the Hawai'i Board on Geographic Names voted to restore the name Wailuku River to the body of water emerging from 'Īao Valley that was more recently referred to as 'Īao Stream. *See* http://files.hawaii.gov/dbedt /op/gis/bgn/HBGN_Minutes_5-27-2015_JDS_Draft.pdf. This name change is pending before the U.S. Board on Geographical Names.

[2] Citations to the DEA and attachments refer to the page number of the consolidated electronic pdf document obtained from USACE's website.

223 SOUTH KING STREET, SUITE 400 HONOLULU, HI 96813-4501
T: 808.599.2436 F: 808.521.6841 E: eajushi@earthjustice.org W: www.earthjustice.org

The DEA contains a general narrative description of the proposed action, but does not provide any clear illustrations and diagrams that would enable laypeople in the public to readily understand how the proposed structures will look and operate in their specific environmental settings. This includes, for example, how much (if any) additional streambed will be covered by new concrete. While technical engineering drawings are provided in an appendix, this format is not accessible to general readers and limits public transparency and understanding of the proposed action's details.

The DEA states, "[t]he Proposed Action would not impact the ability for an IIFS of greater than 5 mgd to remain in the channel through the project area and downstream to the stream mouth and has been designed to facilitate fish passage by incorporating a 15-ft wide opening in the diversion wall." *Id.* at 81. At the interagency meeting on September 17, 2014, included in Appendix E, both U.S. Fish and Wildlife Service ("USFWS") and the State of Hawai'i Department of Land and Natural Resources ("DLNR") inquired about the amount of water that would remain after the diversion wall and indicated that they would like to see a minimum flow remain in the stream. *Id.* at 266. We agree, and further observe that the current IIFS represents the floor for the restored stream flow, not the ceiling. The DEA does not make clear how much instream flow the diversion wall will accommodate.

What is clear from the DEA is that because the proposed action is supposedly less adverse to existing biological resources than USACE's 2009 proposal, USACE will not be adding any additional features to assist the migration of amphidromous species. *Id.* at 81. The DEA further implies that other resource agencies at the interagency meeting on September 17, 2014, agreed that no further action was needed to improve stream habitat in conjunction with the proposed action. *Id.* at 82. The meeting minutes in Appendix E, however, do not reflect these sentiments. *Id.* at 266. At this meeting, "USFWS noted that they have previously submitted comments to USACE outlining some of their other concerns with the 1981 project, and that they still would like to see a path forward by the USACE on addressing those comments. The team discussed some of the measures proposed by USFWS to help restore the biological function of the overall stream, including areas outside of the project area of Alternative F." *Id.* Yet, USACE replied that without a local partner, "USACE currently does not have funding under Civil Works to correct design deficiencies from the past." *Id.*

It is unclear why USACE is relying on other agencies for funding to correct its own project's habitat design deficiencies. The DEA observes, "[Continuing Authorities Program] Section 1135 allows for environmental restoration of an existing Corps project." *Id.* This raises the question why, under that authority, USACE could not make even limited improvements to stream habitat in conjunction with the proposed action. For example, the current DEA provides, "the existing revetment between the overflow channel and outflow return location would be reconstructed as part of the Proposed Action." *Id.* at 20. To the degree that USACE is already improving revetments along substantial portions of the channel, stream habitat should also be improved to facilitate species migration. An action as simple as partnering with the United States Geological Survey ("USGS") to install and maintain stream flow gauges as a part of the proposed action would enhance the project's value, and would ensure that modifications do not impair ongoing stream flow restoration efforts.

The DEA provides little discussion of existing challenges for species migrating upstream. For example, the "Matrix of the Proposed Alternatives for a Draft Environmental Assessment," contained in Appendix C, which allows for a comparison of how the various proposed alternatives meet the USACE's desired outcomes, answers "YES" to the question regarding whether the existing flood control project (No Action Alternative A) and the preferred action (Alternative F) "Facilitates Aquatic Organism Passage." *Id.* at 226. This disregards the ongoing concerns regarding the existing project that the community, DLNR, and USFWS have expressed over many years. Nowhere in the DEA does USACE mention the various challenges for migrating species such as the 22 foot wall structure and the lack of a contiguous low flow channel at that point, which are highlighted in the Water Quality and Biological Survey at Appendix F. *Id.* at 278.

To facilitate species migration for both the existing project and the proposed action, USACE could remediate the 22 foot wall by adding a fish ladder structure and a shallow pool at the base. Adding some boulder-type features to this space would create valuable shelter and shading. It is clear that USACE has the capacity to add these habitat improvement features because many of them were proposed as mitigation in the previous 2009 DEA, and in the current DEA in conjunction with Alternative C. *Id.* at 28. Such features would go a long way toward improving stream habitat that was destroyed by the project. *Id.* at 82. With regard to habitat improvements, special attention should be given to state DLNR biologist Skippy Hau's comments, given the depth of his experience in general, and in the project area in particular. *Id.* at 160.

The DEA describes cumulative impacts as "impacts on the environment which result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." *Id.* at 39. Here, cumulative impact analysis must include the existing project, as well as the recent stream flow restoration. With the restoration of flows, it is "reasonably foreseeable" that more stream life will be migrating upstream. The DEA acknowledges, "[a]s the stream continues to experience more frequent continuous flow to the ocean, the number of each species currently present in the stream is expected to increase over time." *Id.* at 73. Among the new species recently detected in the stream mouth are hīhīwai and hapawai. *Id.*

Whereas the dominant factor preventing native stream migration used to be flow diversions, which "made it nearly impossible for juvenile snails to migrate past the flood control channel," *id.*, the restoration of stream flows has now effectively highlighted the negative impacts of the project. As the DEA recognizes, "[p]er ER 1105-2-100, Planning Guidance Notebook C-3.d(3)(l), it is USACE's policy to 'demonstrate that damages to significant ecological resources have been avoided or minimized to the extent practicable; that unavoidable damages to these resources have been compensated to the extent justified; and, that restoration opportunities for significant ecological resources have been given appropriate consideration during the project planning phase.'" *Id.* at 81. The USACE's lack of alternatives that would improve habitat for species migration, coupled with a finding that the current action would not

have a significant impact on these same amphidromous species, disregards the requirements of the cumulative impact analysis. USACE should take measurable steps toward mitigating long-term and cumulative effects of the project to protect amphidromous species that are ecologically and culturally significant in Nā Wai ‘Ehā.

Impacts to Groundwater Recharge, Coastal Springs, and Nearshore Resources

Along related lines, the DEA appears to foreclose better alternatives for the environment by taking a narrow approach to community members’ previous input regarding the project’s cumulative and long-term impacts on recharge of the groundwater aquifer and traditionally valuable coastal springs. While the Hui appreciates that the preferred alternative of diverting waters to a flood plain “incorporates designs that minimize channel hardening within the stream, which in turn minimizes potential impacts to groundwater recharge,” *id.* at 32, the DEA provides no other discussion of alternatives that would mitigate the project’s impacts on groundwater recharge and coastal spring flow.

In providing comments on the 2009 DEA, several community members, including the Hui’s President John Duey, requested that USACE consider an alternative that would remove the concrete at the base of the channel, thereby restoring the natural variation in topography, slowing water flow to allow sediments to settle, promoting aquifer recharge, and improving habitat for aquatic species. *Id.* at 190. Mr. Duey’s comment requested that only the bed of the channel be exposed, leaving the concrete walls and other flood control measures within the channel in place. *Id.* The DEA fails to consider this option, and instead proposes Alternative B which, “would include removal of all existing man-made improvements to the existing channel, including levees, concrete channels, flood walls, and drop structures, and returning the stream to its original natural state.” *Id.* at 27. In proposing such an extreme alternative, USACE essentially disqualifies the alternative at the outset. This all-or-nothing approach to environmental review, refusing to consider alternatives such as remedial repairs, reconfiguration of the existing structure, or retention of the natural streambed bottom, does not provide the full range of alternatives that the law requires. Accordingly, any alternatives that would expose the base of the channel and facilitate aquifer recharge deserve meaningful consideration.

Like the 2009 DEA, the current DEA estimates the economic value of protecting this flood-prone land, without analyzing both the economic and the priceless, non-economic value of a healthy, functioning stream system from mauka to makai. *Id.* at 193. As Mr. Duey pointed out, USGS calculates that 1 mgd of ground water recharge in the ‘Īao Aquifer is lost daily as a result of previous channel hardening. *Id.* at 191. The daily loss of aquifer recharge alone is economically quantifiable, and staggering, over the thirty year life of the project.

In addition, sediment the channel transports directly to the nearshore areas continues to degrade the reefs and marine life, as well as the traditional and customary practices associated with gathering nearshore resources. *Id.* at 76. Along these lines, the Hui shares NOAA’s concern, expressed at the September 17, 2014 interagency meeting, regarding the possibility that sediment from the flood plain area will reenter the main channel near the river mouth, impairing nearshore waters. *Id.* at 265. The DEA does not directly address this concern.

Impacts to Archaeological Resources and Cultural Practices

The DEA overly downplays the likelihood of encountering archeological resources in relation to ground disturbing activities. Relying on the results of a "limited archaeological inventory survey (AIS) . . . conducted by Pacific Consulting Services, Inc. (PCSI) in May 2014 to determine the presence/absence of significant cultural deposits within the project area," the DEA flatly states, "[t]he AIS determined that no historical resources were present in the project area; therefore, implementation of the Proposed Action would not adversely affect historic properties or any other historical resources." *Id.* at 85, 135. Given that only 10 trenches were dug at varying depths of 60 to 260 centimeters, *id.* at 390, the limited study may simply not have intercepted the existing features. *Id.* at 85. In addition, since there are hundreds of marked and unmarked burials along the sand dunes at Mahalani Cemetery on Piʻihana near the proposed flood plain area, it cannot be readily assumed that "the coast is clear"; rather, utmost caution is necessary.

Yet, the DEA is far from clear to what extent, if any, mitigation measures will actually be implemented with regard to archeological resources. For example, the DEA states passively, "archaeological monitoring by a qualified archaeologist should be conducted during ground disturbing activities to ensure proper treatment of any possible subsurface historical, cultural, and/or archaeological resources encountered." *Id.* at 92. The DEA mentions this mitigation measure and relies on it to minimize the potential harm, but provides no indication or assurance of any follow through. The DEA continues, "[i]f required, an Archaeological Monitoring Plan (AMP) shall be completed prior to the start of construction activities by a qualified archaeologist and submitted to the SHPD for review and comment before its finalization." *Id.* Because archeological work at a nearby parcel in 2004 revealed a former loʻi wall and radiocarbon samples dating back to the thirteenth century, *id.* at 85, an AMP is warranted and should be produced in conjunction with the proposed action.

Additionally, while the DEA proclaims that "[i]mplementation of the Proposed Action would have less than significant short-term impacts on historic and cultural resources within the project area during the construction period," *id.* at 91, the DEA provides no detail in the archeological impacts section regarding the extent of ground disturbing activities. Instead, in the section of the DEA that discusses traffic impacts, the DEA reveals, "[t]he number of haul trips required to dispose of the soil excavated to construct the overflow channel is estimated to be 390 trips using a 20-cubic yard (CY) dump truck." *Id.* at 121. There is no mention of this large volume of soil disturbance in the archeological impacts section. Given the magnitude of the proposed ground disturbance, a qualified archaeologist must be on hand to monitor ground disturbing activities in addition to implementation of an AMP. The DEA cannot dismiss potential impacts to archeological resources in this historically and culturally significant area by downplaying impacts and relying on indefinite plans. As in the case of the Honolulu High–Capacity Transit Corridor Project (aka, the rail project), compliance is often cheaper than litigation. *See Kaleikini v. Yoshioka*, 128 Hawaiʻi 53, 57, 283 P.3d 60, 64 (2012).

Moreover, the DEA provides little discussion of the project's true impacts on traditional and customary Native Hawaiian rights and practices. As discussed above, in failing to offer a range of alternatives that would restore ecosystem functionality for amphidromous species, or remedy channel hardening to allow for aquifer recharge and the upwelling of coastal springs, the proposed action continues long-standing impacts to traditional and cultural practices. USACE's continued refusal to acknowledge or remedy past mistakes, regardless of their ongoing cultural, ecological, and economical costs to the community, is disheartening to the community to say the least. Given the acknowledged negative impacts of channelization, the high ecological value of this riparian ecosystem and its connected wetland and nearshore marine environments, and the ongoing significant controversy over the project, the Hui respectfully urges that the proposed action incorporate modifications to address these concerns.

Mahalo for this opportunity to comment. If you have any questions or require further information, please do not hesitate to contact us. We appreciate your consideration of these comments and your efforts to protect irreplaceable public trust resources for present and future generations.

Very truly yours,



Rhiannon T. Chandler-ʻĪao
D. Kapuaʻala Sproat
Isaac H. Moriwake
EARTHJUSTICE

cc: Office of Environmental Quality Control, State of Hawaiʻi
Skippy Hau, Aquatic Biologist, State of Hawaiʻi, DLNR-DAR
John Duey, President, Hui o Nā Wai ʻEhā

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DAVID Y. IGE
GOVERNOR OF HAWAII

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FISCAL/ANALYST
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By ____ Date ____

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ENGINEERING DIVISION
DEPARTMENT OF PUBLIC WORKS

JESSICA E. WOOLEY
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: oeqchawaii@doh.hawaii.gov

In reply, please refer to:
File:

OEQC 15-077
'Iao Stream Flood Control

July 23, 2015

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DEPT OF PUBLIC WORKS
COUNTY OF MAUI

Mr. David C. Goode, Director
Department of Public Works, Engineering Division
County of Maui
200 S. High Street
Wailuku, Hawai'i 96793

Dear Mr. Goode,

SUBJECT: Draft Environmental Assessment (EA) for the Modification to the `Iao Stream Flood Control Project, Wailuku, Maui, Hawai'i

The Office of Environmental Quality reviewed the Draft EA prepared for the subject project, and offers the following comments for your consideration.

1) Incorporate a list of all permits and approvals required into the body of the EA

We note a listing of permits was included on the Publication Form submitted to our Office; however, such a list is required content within the body of an EA pursuant to Section 11-200-10, Hawai'i Administrative Rules (HAR).

2) Incorporate the anticipated determination and the findings & reasons supporting the agency's anticipated determination

A "Summary of Potential Project Impacts per Section 11-200-12 HAR" was included in the materials submitted to our Office, presumably to satisfy the referenced rule that such significance criteria is to be considered by the agency in the course of their determining whether the proposed action may have a significant effect on the environment. This material is required content of the EA, and must be included within the body of the EA document, not as a stand-alone document.

Further, this referenced Summary incorrectly states that the U.S. Army Corps of Engineers is making the anticipated determination; this determination must be made by the proposing/determining agency, which is correctly noted on the Publication

Form as the Department of Public Works, and cannot be a federal agency, pursuant to Section 11-200-2, HAR.

3) Clarify the details of Alternative F-Proposed Action

The Preferred Alternative F has numerous elements that are described in narrative and tabular form in pages 2-7 through 2-12 of the Draft EA; this description could be enhanced for the readers by the inclusion of graphic material that is easier to comprehend than Figure 1-3. Perhaps additional figures (at varying perspectives and relevant scales) could highlight the specifics of the multiple project elements.

4) Withdraw the still-active 2009 Draft EA for the 'Iao Stream Flood Control Project

As noted in the introduction section of the subject Draft EA, another draft EA for a closely related project was released in 2009. That 2009 document is still pending, which means there are essentially 2 simultaneously active Draft EAs for the subject `Iao Stream Flood Control Project, with the same proposing entities. Since the present Draft EA appears to be the document that will assess the impacts of the proposed work, we suggest you withdraw the 2009 Draft EA to alleviate confusion.

Should you have any questions regarding these comments, please contact me or Tom Eisen of my staff at (808) 586-4185.

Sincerely,

Jessica Wooley

Jessica E. Wooley, Director
Office of Environmental Quality Control

PHONE (808) 594-1888

FAX (808) 594-1938

STATE OF HAWAIʻI
OFFICE OF HAWAIIAN AFFAIRS
560 N. NIMITZ HWY., SUITE 200
HONOLULU, HAWAIʻI 96817

HRD15/3219F

July 23, 2015

U.S. Army Corps of Engineers, Honolulu District
CEPOH-PP-C (Attn: Lorayne P. Shimabuku)
Bldg. 230, Room 307
Fort Shafter, HI 96858-5440

Re: Comments on the Draft Environmental Assessment for the Modification to the ʻĪao Stream Flood Control Project
Wailuku Ahupuaʻa, Pūʻali Komohana Moku, Maui Mokupuni

Aloha Ms. Shimabuku:

The Office of Hawaiian Affairs (OHA) is in receipt of your June 22, 2015 letter requesting comments on the draft environmental assessment (DEA) for the *Modification to the ʻĪao Stream Flood Control Project* (the Project). The Project is proposed by the U.S. Army Corps of Engineers (USACE), along with its non-Federal sponsor, the County of Maui.

The Project, as currently proposed, will reconnect the main channel of ʻĪao Stream[1] near Imi Kala Street to an existing floodplain along the left bank of the stream, with reentry to the main ʻĪao Stream channel to occur ma kai of Waena Street. The proposed project entails: lowering the left bank near the site of the floodplain entry and outflow points; grading and installing riprap at the transition areas to the floodplain entry and outflow points; constructing a 18-foot high diversion weir to direct flood flows into the overflow area; stabilizing the stream bank ma uka of the floodplain entry and ma kai of the floodplain outflow points; building a 473 linear foot earthen berm between the floodplain and main channel; and removing approximately 290 linear feet of concrete lining in the stream ma kai of ʻĪao Place, and replacing another 470-foot concrete berm with a concrete retaining wall.[2]

[1] Also known as the Wailuku River.
[2] DEA for the Modification to the ʻĪao Stream Flood Control Project (hereinafter "DEA:"), Fig. 1-3; 2-7 to 2-8; 2-11.

OHA is the constitutionally established body responsible for protecting and promoting the rights of Native Hawaiians. Hawai'i state law mandates OHA to "[s]erve as the principal public agency in the State of Hawai'i responsible for the performance, development, and coordination of programs and activities relating to native Hawaiians and Hawaiians; . . . and [t]o assess the policies and practices of other agencies impacting on native Hawaiians and Hawaiians, and conducting advocacy efforts for native Hawaiians and Hawaiians."[3] Accordingly, we offer the following comments on the DEA for the proposed Project.

At the outset, we note that the current preferred alternative for the Project is an improvement from the previous preferred alternative for this project, which entailed the construction of a 7,200-foot long roller-compacted, concrete-lined channel for 'Īao Stream. As described throughout this DEA, the 2009 preferred alternative of this project drew sharp criticism from government agencies and community members alike, who raised concerns such as negative impacts to groundwater recharge, sediment loading to stream and coastal environments, and native aquatic species and their habitats. We appreciate the efforts of the USACE to reconsider its range of alternatives and identify a preferred alternative with substantially less modifications to the natural stream environment than previously proposed.

Commit to archaeological and cultural monitoring for the ground disturbing activities

Given the level of ground disturbance and location for the project, the USACE should commit to archaeological and cultural monitoring during ground disturbing activities. The DEA discusses monitoring with some ambiguity, stating:

> archaeological monitoring by a qualified archaeologist *should* be conducted during ground disturbing activities to ensure proper treatment of any possible subsurface historical, cultural, and/or archaeological resources encountered. *If required*, an Archaeological Monitoring Plan (AMP) shall be completed prior to the start of construction activities by a qualified archaeologist and submitted to the [State Historic Preservation Division] for review and comment before its finalization.[4] (emphasis added).

In consultation documents for the past version of this project, the USACE committed to archaeological monitoring during construction, which it "deemed necessary to ensure that [subsurface cultural remnants are] properly identified and its significance and proper disposition evaluated and determined in consultation with [OHA]."[5] The current version of the Project still includes the construction of a 473-foot long earthen berm along the floodplain area, large-scale grading, and significant work along the stream bank, including the removal of 31,000 square feet of concrete lining. As such, we strongly recommend archaeological and cultural monitoring as an appropriate measure to minimize and hopefully avoid impacts to unidentified Native Hawaiian cultural features.

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[3] Hawai'i Revised Statutes § 10-3.
[4] DEA 3-53 to 3-54.
[5] Letter from Anthony J. Paresa, P.E., Deputy Engineer for Programs and Project Management, USACE, Honolulu District, to Kamana`opono Crabbe, Ph.D., Ka Pouhana, Office of Hawaiian Affairs, Oct. 25, 2012.

As this this writing, OHA has yet to receive correspondence initiating consultation for the modified Project scope.

Revisit and incorporate stream improvements discussed in the 2009 DEA and in consultation with government agencies and knowledgeable community groups

OHA supports the analysis and recommendation of the U.S. Fish and Wildlife Service (USFWS) to integrate mitigation measures to modified and concreted sections of ʻĪao Stream ma uka and ma kai of the Project area.[6]

USACE has taken the position that mitigation measures would not be required because "hardening within the stream is no longer being proposed and since no significant impacts to biological resources are anticipated."[7] Although the DEA states that USFWS, U.S. Environmental Protection Agency, National Marine Fisheries Service, State of Hawai'i Division of Aquatic Resources, and COM concurred with the USACE's determination that mitigation measures were not required at an inter-agency meeting on September 17, 2014,[8] we can find no evidence of such a concurrence in the meeting minutes provided.[9]

USACE itself recognized the impacts of past stream modifications and the relationship of past modifications to the current project. The cumulative impact section of the DEA states "no changes to the dynamic of ʻĪao Stream *in addition to those caused by the construction of flood control structures in the past* are anticipated." [10] (emphasis added). As stated by the USFWS in its Planning Aid Letter, the Project "corrects earlier project/construction deficiencies, and would therefore not be needed if not for problems that had arisen in regard to these earlier project elements. There is no reasonable basis under NEPA for segmenting review of the new work and excluding earlier impacts."[11]

OHA strongly urges the USACE to reincorporate project elements that will mitigate the impact of channelization ma uka and ma kai of the current project boundaries and improve the overall habitability of ʻĪao Stream. Improvements—such as the placement of large boulders to provide shading and resting places for migrating native aquatic species, deepening, widening, and possibly rerouting of low-flow channels; and providing for areas for overhanging vegetation growth to shade and cool the low-flow channel—have all been identified by resource agencies in past consultations and should not be discarded just because the most detrimental components of the Project have been eliminated. OHA still sees the Project as an opportunity to improve the overall condition of ʻĪao Stream and the resources within the watershed on which our beneficiaries rely.

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[6] *See* DEA, Appendix I, USFWS Planning Aid Letter.
[7] DEA 2-9.
[8] DEA 2-9.
[9] DEA, Appendix E.
[10] DEA 3-88.
[11] DEA, Appendix I, USFWS Planning Aid Letter.

Incorporate Hawaiian plants in landscaping

The USACE and COM are encouraged to incorporate Hawaiian (indigenous and Polynesian-introduced) plants into its landscaping for this project. We note that the Hawai'i Procurement Code already requires the use of such plants in new state and county funded landscaping projects wherever and whenever feasible,[12] and that this requirement has been further clarified by HB 206, which was included in OHA's 2015 legislative package and passed by the Hawai'i State Legislature.

Mahalo for the opportunity to provide comments. Should you have any questions, please contact Everett Ohta, OHA Lead Compliance Specialist, at 594-0231 or by email at everetto@oha.org.

'O wau iho nō me ka 'oia 'i'o,

Kamana'opono M. Crabbe, Ph.D.
Ka Pouhana, Chief Executive Officer

KC:eo

C: Hulu Lindsey, OHA Maui Trustee
Thelma Shimaoka, OHA Maui Community Outreach Coordinator (*via email*)

**Please address replies and similar, future correspondence to our agency:*
Dr. Kamana'opono Crabbe
Attn: OHA Compliance Enforcement
560 N. Nimitz Hwy., Suite 200
Honolulu, Hawai'i 96817

[12] HRS §103D-408.

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Steve & Michele Haller
1060 E. Kuiaha Road Haiku, HI 96708
(808) 572-6920 Phone
Steve Cell (808) 283-4085

July 23, 2015

Department of Public Works, Engineering Division
200 S. High St.
Wailuku, HI 96793

To Whom It May Concern:

Aloha,
This letter is in response to the June 27, 2015 Maui News article "Flood Control Modification Proposed for Stream". As current landowners of the downstream proposed area, we have serious concerns. Our property (TMK 2-3-4-031-001 and TMK 2-3-4-030-002) would be affected by the proposed Iao Stream Flood Control Modification Project. This proposed project would have a grave negative impact to our land, as it is currently in agricultural production.

Although portions of our parcels have designated flood level zones, deliberate flooding was never anticipated.

The 6/27/15 Maui News article incorrectly states that the area has been unused for two decades. Currently this historical farmland is in active agricultural use, and has been in active agricultural use for the last ten years.

If this proposal goes through as outlined, we feel that it will be a negative impact to us (as co-owners) and to the group of farmers that have been farming with us for the last ten years.

Thank you for giving us the opportunity to respond.

Mahalo,

Steve Haller
Steve Haller
July 23, 2105

Michele Haller
Michele Haller
July 23, 2015

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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

In Reply Refer To:
2010-CPA-0147
2011-CPA-061
2015-TA-0335

AUG 1 2 2015

received
8/14/15
PP – Copied
PPZ – TPY
PPC – original
PPE – Copied

Anthony J. Paresa, P.E.
Deputy District Engineer
Programs and Project Management
U.S. Army Corps of Engineers
Civil and Public Works Branch
Fort Shafter, Hawaii 96858-5440

Subject: Review of the Draft Environmental Impact Statement (DEIS), Department of Defense (DOD), U. S. Army Corps of Engineers, Modification to the Iao Stream Flood Control Project, Wailuku, Island of Maui, Hawaii

Dear Mr. Paresa,

Thank you for the opportunity to comment on the Draft Environmental Impact Statement (DEIS), Department of Defense (DOD), U. S. Army Corps of Engineers (Corps), Modification To the Iao Stream Flood Control Project, Wailuku, Island of Maui, Hawaii.

The U. S. Fish and Wildlife Service (Service) has received and reviewed the subject document and our comments have been prepared under the authority of and in accordance with provisions of the National Environmental Policy Act (NEPA) of 1969 [42 U.S.C. 4321 *et seq .*; 83 Stat. 852], as amended, the Fish and Wildlife Coordination Act (FWCA) of 1934 [16 U.S.C. 661 *et seq .*; 48 Stat. 401], as amended; the Clean Water Act (CWA) of 1977 [33 USC 1251 *et seq.*; 91 Stat. 1566], as amended; the Endangered Species Act (ESA) of 1973 [16 USC 1531 *et seq .*; 87 Stat. 884], as amended; and other authorities mandating Service review for impacts to trust resources.

The Service has the following comments for your consideration:

The proposed action involves modifications to an existing Iao Stream flood control project, located within the 10-square-mile Iao Stream drainage basin. The Service realizes that the alternatives analysis for these modifications has been a prolonged process that has been ongoing since the release of an initial DEIS in March 2009, and commends the Corps on taking into account extensive comments from the Service and other state and federal resource agencies in the design of the final preferred alternative (Alternative F). This alternative consists of an overflow section located on the left bank of Iao Stream, and a channel constriction located within the channel at the downstream end of the overflow section. These modifications would divert flood flows into the existing left bank floodplain, thereby detaining floodwaters and allowing them to be more gradually released back into the channel over time. The Service concurs with the conclusions reached in the DEIS that such an approach to flood control will be more beneficial than other alternatives previously considered, particularly in regard to the nearshore marine environment at the mouth of the stream.

At the same time, the current DEIS reiterates the previous Corps position that because Alternative F avoids and minimizes impacts to the aquatic environment more effectively than earlier proposed alternatives, mitigation should not be necessary or required. The Service does not entirely agree with this position due to 1) long-term permanent losses of aquatic habitat already resulting from earlier project phases; 2) the relationship of the proposed alternative to earlier work (the current proposal was developed to correct deficiencies in the earlier construction); 3) because of existing and future watershed-level impacts that could be rectified to conserve stream function to support native stream fauna; and 4) because a recent 2014 decision by the State of Hawaii Commission on Water Resource Management (CWRM) has now established an Interim Instream Flow Standard (IIFS) of 10 million gallons per day (mgd) near Kepaniwai Park, and 5 mgd at the stream mouth, making faunal connectivity considerations in the Iao Stream system more significant than in the past.

The Service acknowledges that the Corps does not agree with the necessity of compensatory mitigation under the Clean Water Act because the Corps asserts that the smaller project footprint in comparison to the earlier proposed alternatives alleviates the need to replace functional losses. Although the Service concurs that the preferred Alternative F is better (i.e., less environmentally damaging) than any other proposed to date, the Service still recommends that mitigating measures be undertaken. Long-term functional losses within the project area still need to be addressed both up- and downstream of the proposed footprint; these are well within the appropriate scope of the DEIS impact analysis. Much of the impact to stream function has already occurred from earlier project elements, and some additional impacts (albeit minor) are now proposed. It is the position of the Service that these should not be reviewed in a piecemeal, out-of-context approach. Several of the recommendations put forth by the Service on earlier renditions of the proposed project, contained in our July 2011 and December 2011 FWCA 2b reports and in response to the original 2009 Draft Environmental Assessment, therefore remain relevant.

The Service continues to maintain that cumulative project impacts, including past stream channelization and modifications, should be included within the scope of the overall project impact analysis. The Service has consistently disagreed with the Corps' assertion that the scope of their authority for environmental review, and for rectifying earlier damage, is limited. The current NEPA process is being conducted to address a project design that corrects earlier project/ construction deficiencies, and would therefore not be needed if not for problems that had arisen in regard to these earlier project elements. There is no reasonable basis under NEPA for segmenting review of the new work and excluding earlier impacts. The Service continues to maintain that the Corps' approach of narrowing the scope of the project to only a review of the environmental impacts of the new project Alternative F, without analyzing cumulative impacts from the project as a whole, and in the absence of a watershed context, is in conflict with NEPA, the Clean Water Act and the Fish and Wildlife Coordination Act.

Although the current DEIS considers the new CWRM order for an IIFS in Iao Stream, it does so only in the context of the new Alternative F footprint, rather than considering how existing design deficiencies throughout the project as a whole inhibit faunal passage for native diadromous aquatic organisms. Given that the new IIFS flows will now establish permanent perennial connectivity throughout the length of the Iao Stream system, the Service maintains that all earlier recommendations to improve stream function and faunal passage are even more relevant and compelling for the Corps to consider in the context of this DEIS. The Service contends that evaluation of project impacts for the new proposal must be considered in relation to, and not separate from, impacts that have already taken place, and in the context of the newly mandated base flow restoration.

Design features that could help improve aquatic biological function in Iao Stream, and that should be evaluated in the context of this DEIS, include 1) realigning and possibly deepening the low flow channels throughout the length of the project, with specific attention to reconnecting the channels where they are bifurcated, and 2) creating native stream faunal passage/structures or modifying existing vertical drop structures to better enable faunal passage. The Service would be pleased to discuss these issues further with you in order to provide for their evaluation and implementation.

The Service appreciates the opportunity to review this project. If you have any questions regarding this letter, please contact Fish and Wildlife Biologist Dan Polhemus by telephone at (808) 792-9400 or by electronic mail at Dan_Polhemus@fws.gov.

Sincerely,

for Kristi Young
Acting Field Supervisor

cc:
NMFS
EPA
DAR

REVIEW COMMENT	PROJECT:	Iao Stream Flood Control Project	LOCATION:	Wailuku, Maui, Hawaii
	DOCUMENT:	Draft Environmental Assessment		
	DATE:	March-April 2009	Document Developed By:	GSI Pacific, Inc.
	REVIEWER:	Various		USACE
	PHONE:			

Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
Department of Business, Economic Development & Tourism: Office of Planning	03.30.09	The proposal to modify the flood control channel must be submitted for CZM federal consistency review, as required under the CZM Act of 1972, Section 307(c).	Concur. The project team will comply with CZM federal consistency requirements.	
State of Hawaii: Department of Hawaiian Home Lands	03.25.09	No Comment	Thank you for your review.	
State of Hawaii Department of Land and Natural Resources: Div. of Forestry & Wildlife	03.19.09	No Comment	Thank you for your review.	
State of Hawaii Department of Land and Natural Resources: Land Division – Maui District	03.19.09	No Comment	Thank you for your review.	
State of Hawaii Department of Land and Natural Resources: Engineering Division	03.19.09	Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zones A5, A6 and B. The National Flood Insurance Program does regulate developments within these flood zones as indicated in bold letters below.	Comment noted.	

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State of Hawaii Department of Land and Natural Resources: Engineering Division	03.19.09	Please note that the project site 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.	Concur, thank you for providing guidance.	
State of Hawaii Department of Land and Natural Resources: Engineering Division	03.19.09	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.	Concur, thank you for providing guidance.	
State of Hawaii Department of Land and Natural Resources: Engineering Division	03.19.09	Project must comply with Federal E.O. 11988	Concur, thank you for providing guidance.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(vii) ACRONYMS AND ABBREVIATIONS DAR Division of Aquatic Resources	Revision has been made to acronym list.	

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	DATE: March-April 2009 REVIEWER: Various PHONE:	Document Developed By: GSI Pacific, Inc. USACE

Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(ES-2) Although I did mention that the shading does cool water in the concrete channel, I am unclear of the vegetated stream banks and what would be planted for shading? The morning sun is blocked by the concrete walls in the flood stream project for part of the day. "Large" boulders placed in the low flow channel could provide "similar shading" without the need for planting overhanging vegetation or full channel modifications.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(ES-3) The proposed straightening of the stream may not totally address the erosion from high water conditions. The stream naturally curves and may still result in eroded areas where flow is "constricted." Since water is absent 90% of the time, how will more groundwater be facilitated during low flow?	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(ES-3) Erosion is a natural process and the eroded banks appear to be the result of the large volume of water constricted in certain locations during heavy flooding.	Comment noted.	

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State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(ES-8) The additional traffic over the Imi Kala Bridge will greatly impact the usual Post Office traffic.	Comment noted.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(ES-8) Please describe and fully explain "project failure"	"Project failure" refers to the case in which the original flood control project can no longer provide the adequate protection against flooding as it was originally intended to. Section 1.2 (Project Location and Background) and Section 1.4 (Purpose and Need for Action) of the EA describes the current state of the existing flood control structures and the need for action to avoid potential "failure" of the structures.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(1-2) I cannot take all the credit for stream recruitment. During the late 1980s, there was sufficient rainfall and recruitment to make 'o'opu (fish) and opae (shrimp) common throughout the State Park. A certain level of flow is needed to maintain natural stream populations. The increase in reproduction usually coincides with rainy season. However, reproduction can occur throughout the year with consistent rains.	Concur. The requirement of stream flow to maintain natural stream populations has been added to Section 3.5.3 (Biological Resources; Existing Conditions) of the EA.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(1-2) The low rainfall and drought have helped to magnify how critical stream flow is necessary for healthy stream ecosystem and watershed. My continued collection of post larvae is to document that recruitment will need continuous stream flow.	Concur, as noted above.	

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State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	<u>Waiehu Beach Road (Sta 22+00)</u> I collected post larvae stream animals (shrimp, fish, prawn) migrating upstream in the concrete run. When stream flow stops, pools form and the animals survive for another one to four days. The animals must survive the increasing water temperature that can exceed 90 degrees F. during the summer. The water eventually dries killing the stream animals. In intermittent stream a stream canopy or vegetation helps to cool the water temperature.	Comment noted.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	<u>22-foot drop structure at Station 97+23</u> I am not in support of a new stepped drop structure. The "lack of flowing water" rather than the sheer drop prohibits migration. Ordinarily, the first waterfall in a stream helps keep invasive species and poor climbers from inhabiting upstream locations.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	<u>22-foot drop structure at Station 97+23</u> I strongly recommend hydraulic improvements. Could a weir or some other structure be used to pool water? Deeper depths would allow water to slow. Water could flow over a lip which could also help aerate the lower stream.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	

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Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	<u>22-foot drop structure at Station 97+23</u> Could a waterfall or boulder transition zone be made to flow into the low flow channel that was built on the left (downstream) side?	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	<u>22-foot drop structure at Station 97+23</u> I do not consider the "low flow" channel "ideal." The "low flow channel" would be functional if water and stream flow were both present.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(1-12) Alternative III (Please describe the boulders in the main channel low flow section. I would like to see much "larger" boulders placed or imbedded in the concrete channel. I am not against the proposed levee.)	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	

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State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(1-12) Alternative III Instead of baffle blocks, it seems the large boulders that are being removed from the stream by tractors should be moved to certain locations.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(2-1) (Station 40+00) As described previously, could one or more weirs be made to slow down the water flowing in this area? Can water depth be increased with a natural pool? This might also create an area that would deposit substrate with increased flows. In my discussion with taro farmers, they would redirect water with the placement of boulders or rocks to prevent erosion in irrigation ditches.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	

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State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(3-14) Groundwater recharge basin and diversion levee Is the negative impact introduced species? Introduced species will never be eradicated and will continue to flow downstream with flooding. Gupples, swordtails, toads, and apple snails have been found from the State Park to the ocean. The intermittent stream and lack of flow is the biggest impediment for maintaining a healthy stream.	The negative impacts were mentioned during the 3/31/08 site visit, specifically: Backwater will create habitat for undesirable species, as well as remove important low stream flows from the low flow channel. In addition, the small dam will make it more difficult for aquatic migration during low flows. Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would not include construction of the structures that have raised concerns mentioned in this comment. The new design alternative alleviates the concern expressed in this comment.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(3-14) Groundwater recharge basin and diversion levee I suggest that the back of the debris basin be reviewed. The waterfall and stream flowing into the debris basin should be duplicated. If the rocks and boulders could be allowed to remain in the basin, it would provide needed stream habitat.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(3-14) Groundwater recharge basin and diversion levee Although, I would love to see the pavement trail for public use, it does not appear to be necessary for the stream to flow naturally to the ocean (Figure 3-7).	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	

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State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(3-25) The County of Maui has been placing boulders against the eroding levee toe. I would suggest larger boulder be placed upstream to redirect and dissipate flow away from the levee toe.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(5-5) Fresh water spring on Sevilla property. If flow is restored to lower Iao Stream, the natural stream areas currently proposed for full channelization may help to restore flow to this spring is the future. If channelized, we may not know what level of flow was needed for such springs to flow to the ocean. Once flow is restored, a period of time may be needed for the stream to become saturated and natural springs to re-appear downstream.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(5-5) The location of the heiau was determined by the rocks deposited by the natural stream. If kalo were being raised throughout the watershed, wetlands and flooding would be better understood. Flood plains would also be clearly known and development would not be allowed to occur in those areas.	Comment noted.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(5-7) Iao Streaam attractions is recognized by visitors to the Kepaniwai County and Iao State Parks. Many people may not know that the dry stream next to the heiau is the same stream they photographed in the valley by the Needle.	Comment noted.	

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State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(5-8) Do three diversion features exist? Is there a Kama ditch diversion? I've only found two diversions and came across what might be concrete remnants of the Kama ditch diversion above the debris basin.	According to Hui O Nā Wai 'Ehā and Maui Tomorrow Foundation, Inc.'s petition to amend interim instream flow standards [IIFS] (dated June 25, 2004), "Two smaller ditches, the Maniania Ditch and the Iao-Waikapu Ditch, carry about 18 Mgal/d from diversions in the Iao Stream and from tunnels driven in the Iao Stream valley. A third small ditch, the Kama Ditch, diverts water from Iao Stream at a lower elevation than the shared diversion of the Maniania and Iao-Waikapu Ditches." Although diversion of stream waters is no longer in place following implementation of the IIFS in October 2014, mention of the three diversion features from which water was historically diverted will be left as is in the EA.	
State of Hawaii Department of Land and Natural Resources: Div. of Aquatic Resources – Skippy Hau	03.19.09	(5-27) Stream animals have survived the conditions in the flood control project. Although not optimal, I strongly recommend that as much of the stream as possible, be kept natural. I do not believe total concrete channelization is necessary.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
State of Hawaii: Department of Defense – Office of the Director of Civil Defense	04.14.09	No Comment	Thank you for your review.	
State of Hawaii: Department of Transportation	04.17.09	The proposed subject modification to the existing 1981 Iao Stream Flood Control project will not adversely impact DOT State highway facilities.	Comment noted.	

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State of Hawaii: Department of Transportation	04.17.09	A permit is required from the DOT Highway Division Maui District Office, at telephone number (808) 873-3538, for the transport of oversized equipment/overweight loads within the State highway facilities and for all work done within the State Highway right-of-way.	Thank you for providing guidance, the project team will make sure to comply with all applicable DOT Highways regulations.	
County of Maui: Department of Parks & Recreation	04.15.09	No Comment	Thank you for your review.	
County of Maui: Department of Public Works	04.16.09	No Comment	Thank you for your review.	
NOAA: Pacific Islands Regional Office - Danielle Jayewardene Ph.D. - Coral Reef Ecologist	04.22.09	We are concerned that the proposed RCC lining of 7,200 ft of the stream (alternative III)will significantly increase the in-stream flow and decrease the filtration function of the current non-channelized stream bed and banks, and that this will result in an increase in pollutants, nutrients, debris, and sediment entering the marine environment.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	

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NOAA: Pacific Islands Regional Office - Danielle Jayewardene Ph.D. - Coral Reef Ecologist	04.22.09	While we understand that the proposed Alternative III is preferable to channelizing the system as proposed in Alternatives I and II, and that Alternatives V and VI would have serious negative impact to the Wailuku community during flood events, we question the lack of a proposed alternative which would improve flood control while keeping intact the more natural stream system (e.g. by maintaining the stream bed in its natural condition, stabilizing banks with structures other than concrete, creating riparian buffers, increasing the function of natural vegetated flood plains etc).	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
NOAA: Pacific Islands Regional Office - Danielle Jayewardene Ph.D. - Coral Reef Ecologist	04.22.09	We understand that this project is well on its way, but hope that there is justification for not exploring a more environmentally sound alternative. We recommend that such an alternative, which encompasses an impact assessment to also the marine environment, be fully investigated in future stream modification projects.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
Wailuku Main Street Association	04.22.09	Will submit comments at a later time.	Comment noted.	
DLNR - Div. of State Parks	04.23.09	No comment	Thank you for your review.	
DLNR - Commission on Water Resource Management	04.27.09	No comment	Thank you for your review.	

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State of Hawaii – Department of Health	04.22.09	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 water. c. Water quality criteria (HAR, Section 11-54-4 through (11-54-8)	Thank you for providing guidance. The project team will make sure to comply with all applicable state and federal regulations.	

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State of Hawaii – Department of Health	04.22.09	2) You are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharge of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). For the following types of discharge into Class A or Class 2 State waters, you may apply for NPDES general permit coverage by submitting a Notice of Intent (NOI) from: a. Storm water associated with industrial activities, as defined in Title 40, Code of Feral Regulations (CRF), Section 122.26 (b)(14)(i) through 122.26(b)(14)(ix) and 122.26(b)(14)(xi). b. Storm water associated with construction activities, including excavation, grading, clearing, demolition, uprooting of vegetation, equipment staging, and storage areas that results in the disturbance of equal or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. An NPDES permit is required before the start of the construction activates. c. Hydrotesting water. d. Construction dewatering effluent.	Thank you for providing guidance. The project team will make sure to comply with all applicable state and federal regulations.	
State of Hawaii – Department of Health	04.22.09	3) For types of waste water discharges not covered by an NPDES general permit or discharges to Class AA or 1 State waters, you may need an NPDES individual permit.	Thank you for providing guidance. The project team will make sure to comply with all applicable state and federal regulations.	

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State of Hawaii – Department of Health	04.22.09	4) You must also submit a copy of the NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the CWB that SHPD has or is in the process of evaluating your project.	Thank you for providing guidance. The project team will make sure to comply with all applicable state and federal regulations.	
State of Hawaii – Department of Health	04.22.09	5) 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 "any 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.." The term "discharge" is defined in CWA, Subsection 502(16), 502912), and 502(6); Title 40, CRF, Section 122.2; and HAR, Chapter 11-54	Thank you for providing guidance. The project team will make sure to comply with all applicable state and federal regulations.	
State of Hawaii – Department of Health	04.22.09	6) Please note that all discharge related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 Water Quality Certification are required, must comply with the 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.	Thank you for providing guidance. The project team will make sure to comply with all applicable state and federal regulations.	

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State of Hawaii – Department of Health	04.22.09	7) The Iao Stream is identified as Category 3 water in the CWA, Section 303(d) list of impaired water bodies in Chapter IV of the 2006 State of Hawaii Water Quality Monitoring and Assessment Report and the Total Daily Maximum Load (TMDL) Priority is listed as Medium.	Comment noted. Updated information from the 2014 Water Quality and Assessment Report has been added to the EA.	
State of Hawaii – Office of Hawaiian Affairs	04.22.09	Besides being indicative of poor urban planning, OHA notes that this situation has required the application to propose to essentially destroy some 70% of the remaining natural alluvial stream channel, which will potentially create one of the longest channelized streambeds in the state.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
State of Hawaii – Office of Hawaiian Affairs	04.22.09	Further, OHA is unconvinced of the proposition that the applicant can convert 7,200 feet of natural stream bed to a roller compacted concrete lined channel (DEA, page 1-2) and somehow create a fake stream that, "Not only will the aquatic fauna have an environment in which to survive, but the stream itself appear more natural and aesthetically pleasing". (DEA, page ES-12)	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
State of Hawaii – Office of Hawaiian Affairs	04.22.09	Further, we point out that this project will inevitably have drastic consequences for and on the existing habitats, stream flow, groundwater recharge, sediment discharge and the ecologic systems that are a part of this stream.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment.	
State of Hawaii –	04.22.09	For example, some native species such as opae	The new design alternative (Alternative F) no longer	

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Office of Hawaiian Affairs		oeha'a and o'opu-akupa, which are listed specifically under that State Water Code 174C-101, may not survive. (DEA, page 3-27) Coral reefs such as those in Kahului Bay and wetlands, which are also given additional legal protections, will also be negatively affected by this proposal. OHA urges that the applicant must at least verify and jurisdictionally delineate the wetlands in the assessed and recommendation made. (See DEA, page ES-5)	proposes lining of the natural streambed; therefore, adverse impacts to the native species in the stream are no longer anticipated. The IIFS implemented in October 2014 is anticipated to facilitate upstream migration of the aquatic species that have an amphidromous life cycle. Alternative F incorporates designs to allow for the IIFS of up to 10 million gallons per day (mgd) to remain in the channel and to facilitate fish passage in the stream. In addition, diversion of stream waters at the overflow channel section would allow flood waters to be dispersed into the natural floodplain where sediment and other entrained constituents would be able to settle out instead of being directly channeled downstream and into the nearshore marine environment. Reduction of stream flow in the main channel during large storm events would decrease erosion of the stream banks and further reduce suspended sediment load entering Kahului Bay. Decrease in sedimentation and turbidity is expected to improve water clarity and the current condition of reef habitats within the nearshore environment. According to the U.S. Fish and Wildlife Service's *National Wetlands Inventory*, potential pockets of wetlands are present within the project area; however, none have been identified during biological or stream surveys conducted along the stream. A survey would be conducted prior to the start of the proposed construction activities to document the presence or absence of wetlands within the area.	

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			Work practices during construction activities would be modified as needed to avoid or minimize any impacts to any identified wetlands.	
State of Hawaii – Office of Hawaiian Affairs	04.22.09	Generally, OHA wishes to see stormwater as a resource to be captured and conserved rather than a nuisance to be channeled and drained away.	Concur. The entire watershed is a receptacle to capture and conserve rainfall and stormwater, and we agree that this is critical to replenishing aquifers. The new design alternative (Alternative F) no longer includes channel hardening of the natural streambed; thereby eliminating concerns regarding reduction in groundwater recharge. Rather than channeling away stormwater, Alternative F would allow stormwater to spread out in the existing floodplain allowing natural groundwater recharge.	
State of Hawaii – Office of Hawaiian Affairs	04.22.09	Furthermore, because this is a flood plain it is not unexpected and quite natural that flooding will occur here. As such, we are unconvinced that these improvements will prevent future flood events or even offer probable benefits that outweigh the clear irreversible and negative impacts that this project contains.	The project team understands that some degree of flooding is natural. Following additional alternative screening analysis, a new design alternative was developed that would prevent loss of life and property as a result of extreme flood events but involve significantly less disturbance to the existing environment, compared to the previously selected alternative. Smaller, more routine flood events would be contained by the channel and the natural floodplain that will remain on the left bank.	

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State of Hawaii – Office of Hawaiian Affairs	04.22.09	Further, we are unconvinced of the adequacy and implementation of the proposed mitigations, For example, the preferred alternative often relies on mitigation measures to facilitate the movement of aquatic organisms though modified channels. However, on page ES-4 the DEA states that these mitigations measures are "currently under discussion" and page 3-25 states that they "have been proposed" and "accepted". However, it is not clear what this means and yet these conditional measures are presented factually throughout the rest of this document. (See pages ES-8 and 3-25, for example.) This must be clarified. The adequacy of this review is compromised when mitigations that the applicant relies upon for their preferred alternative are not presented well.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
State of Hawaii – Office of Hawaiian Affairs	04.22.09	Additionally, OHA points out that while the proposed action probably will reduce the increased sedimentation that results from high water or storm events, it will generally increase the discharge of sediments into the nearshore area under normal conditions. This must be addressed in this environmental document so that reviewers can assess the overall benefits and negative impacts of this proposal and make a determination as to whether or how to proceed.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	

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State of Hawaii – Office of Hawaiian Affairs	04.22.09	OHA also notes that the applicants states that a National Historic Preservation Act Section 106 consultation was initiated by the U.S. Army Engineer District. However, our agency has no record of receiving this invitation and as such, does not recognize the initiation of the 106 process. This communicated to the applicant in a cultural impacts assessment comment letter on October 27, 2007.	The preliminary findings of the Archaeological Inventory Survey (AIS) conducted in May 2014 were forwarded to the State Historic Preservation Division (SHPD) via email in June 2014. The formal Section 106 consultation process will be initiated with submittal of the draft AIS for SHPD review and comment. The draft EA will be updated with Section 106 consultation letters as they become available.	
State of Hawaii – Office of Hawaiian Affairs	04.22.09	Additionally, we point out that negative reactions from the community and project criticism are not to be considered "cultural impacts"….OHA knows that there are numerous lo'i, heiau, and other culturally significant sites in the area as well as constitutionally protected Native Hawaii rights being practiced in the area. Therefore, the cultural impacts statement should address these concerns.	Section 3.6, Historical and Cultural Resources, includes discussion of the existing cultural resources within and in the vicinity of the proposed project area and evaluates whether any potential impacts are anticipated under the Proposed Action.	
U.S. Fish and Wildlife Service	04.29.09	*Anticipated Impacts:* Trust resources that will be impacted by the modified project include over a mile of natural stream and riparian habitat for several species of native, amphidromous stream fish and invertebrates from project construction. An unknown portion of the nearshore environment (including coral reefs) will be impacted from high volume and velocity flood flows directed to the ocean via the channelized stream.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	

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U.S. Fish and Wildlife Service	04.29.09	*Project Alternatives:* A CWA Section 404(b)(1) Analysis has not been provided, nor is the least environmentally damaging practical alternative (LEDPA) identified.	The CWA Section 404(b)(1) analysis is included as Appendix B. The EA has been revised to identify the LEDPA.	
U.S. Fish and Wildlife Service	04.29.09	*Project Alternatives:* Three of the five alternatives currently under consideration in the Draft EA for the modified project involve placement of concrete lining over 7,200 linear feet (ft) of stream channel that is currently natural substrate. One alternative (V), evaluated but not supported by the USACE involves removal of all existing 2,500 ft of existing concrete flood control structures (installed in segments during the previous project both up- and downstream of the proposed project area) to facilitate a watershed scale ecological restoration of Iao Stream. Should any of the first three alternatives be implemented, the existing 2,500 ft of previously hardened stream would be expanded by an additional 7,200 ft of concrete channel. This would result in 9,700 ft of continuous channelized stream, the longest in Hawaii. Ecological restoration of the stream is not considered a viable option due to flood risk to human safety and property that has been developed in the floodplain.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	

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U.S. Fish and Wildlife Service	04.29.09	*FWS Recommendations:* The 2006 Revised Draft FWCA report recommendations acknowledge project requirements for flood control and provide conditional recommendations for project alternatives with prescribed mitigation measures, including enhanced stream flow. Subsequent to the report and based on site visits with USACOE and Hawaii DAR personnel, FWS offered additional technical assistance with developing mitigation in the form of structural design features that will help native stream fauna survive.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). We appreciate continued USFWS guidance and support of this project.	
U.S. Fish and Wildlife Service	04.29.09	*FWS Recommendations:* The USACE Honolulu Engineer District prepared a Draft Environmental Assessment (DEA) in March 2009, with a public review period open until April 30th, 2009. FWS recommendations from the 2006 report, as well as design modifications and mitigation measures developed and recommended based on FWS, USACE, and DAR site visits, were clearly considered in the alternatives analysis of the EA. However, FWS continues to believe that anticipated project impacts need further evaluation and will have substantial unacceptable impacts to the aquatic environment that could be resolved through further inter-agency coordination and technical assistance.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). We appreciate continued USFWS guidance and support of this project.	

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U.S. Fish and Wildlife Service	04.29.09	***Discussion:*** The USACE construes the FWS 2006 recommendations as support for recommended Alternative III (USACE preferred alternative). They seeks our agreement that the design is environmentally acceptable with integration of a grouted boulder, low-flow channel and other stream bed and structural retro-fits to the previously installed concrete channels, to mimic the natural habitat of Iao Stream and to facilitate up and downstream migration of native organisms.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). We appreciate continued USFWS guidance and support of this project.	
U.S. Fish and Wildlife Service	04.29.09	***Discussion:*** A three year time period has elapsed between the submittal of recommendations in the 2006 FWCA report and the USACE development of the DEA. Over this interim period, additional information has been gathered including public concerns expressed at the informational meeting held in Wailuku, Maui on April 16, 2009, and some broader perspectives and concerns expressed by new FWS personnel assigned to the project.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). We appreciate continued USFWS guidance and support of this project.	

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U.S. Fish and Wildlife Service	04.29.09	***Discussion:*** Because of our unresolved concerns about impacts of the proposed project on trust resources, an inter-agency discussion and coordination effort is recommended prior to completion of the Final EA. This discussion is needed to consider updated policy and views of the resource agencies, including the USACE, EPA, NOAA and Hawaii DAR and to consider other technical approaches to developing more holistic mitigation and a project design that also is more sensitive to broader watershed concerns such as floodplain function, groundwater recharge, and protection of coral reef from land based sources of pollution.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). We appreciate continued guidance and support from USFWS, USEPA, NOAA, and Hawaii DAR for this project. The consultation will be documented in the EA.	
U.S. Fish and Wildlife Service	04.29.09	Applicability of Executive Order 11988 (Floodplain Management). Federal action agencies are required to discourage development in floodplains. Implementation of this flood control project could encourage further development in hazardous, flood-prone areas	The intent of the Proposed Action is to reconnect the main channel with the floodplain to reduce damaging flows along the main channel and right bank levees. The Proposed Action is not anticipated to encourage development within the floodplain.	
U.S. Fish and Wildlife Service	04.29.09	Applicability of Executive Order 13089 (Protection of Coral Reefs). Sec. 2. Policy. (a) All Federal Agencies whose actions may affect U.S. coral reef ecosystems; (b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems	Concur. Please refer to Section 4.12 of the EA for a discussion of E.O. 13089.	

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U.S. Fish and Wildlife Service	04.29.09	Resource agencies evolving perspectives. Perspectives on ecosystem and watershed approaches to restoring stream and riparian habitat function to maintain native species are now linked to the protection of shoreline and nearshore marine resources including coral reefs. The 2006 FWCA report noted that impacts to the marine environment from sediment, urban runoff and freshwater pulses from the flood controls were considered secondary in nature as the focus of the analysis of effects at the time was limited to the footprint within the stream. The stated purpose of the project in the DEA is to redirect flood flows directly to the ocean, and therefore, these impacts should be considered as being primary and need to be more carefully evaluated.	Comment noted. Thank you.	
U.S. Fish and Wildlife Service	04.29.09	Federal agency responsibility to evaluate the effects of climate change on authorized activities: Need to address through modeling or other data analysis, the projected effects of climate change on flooding and stream flow at this site, from extreme draught to more frequent or intensified flooding. Address the flow limited situation in the current structure and the fact that engineered design modifications to accommodate native stream species with conservation flows, or to protect from flooding.	Discussion of the impacts of climate change has been added to the EA (see Section 3.2.5 Climate, Air Quality, and Greenhouse Gases; Potential Impacts and Mitigation).	

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		The proposed baffle blocks, construction of weirs, low flow channel and a graduated drop structure, are all moot with minimal or inadequate flows to support native aquatic species passage. The USACE acknowledges that partially restored stream flow for the low-flow design elements of Alternative III would function to enhance passage of native stream fauna. Therefore, we support the USACE's good faith integration of these design features. However, the features themselves are not adequate to mitigate comprehensively for impacts to aquatic resources at various life history stages under a range of flow conditions. Additional modeling and natural habitat replacement may be needed.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). We appreciate continued USFWS guidance and support of this project.	
U.S. Fish and Wildlife Service	04.29.09	Additional design features. Consideration should be given to inclusion of bioengineered/fish-friendly approach to stream bank stabilization and erosion control, trash racks or interceptors, sediment retention features, treatment of floodwaters, and possible screening at diversion points to prevent fish entrainment, among other potential features.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). We appreciate continued USFWS guidance and support of this project.	

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U.S. Fish and Wildlife Service	04.29.09	Pending court cases to restore stream flow: There is also new knowledge that stream flow restoration is being adjudicated and under discussion by County, State and Federal Resource Agencies, community groups and private entities that hold licenses for diversions of Iao Stream water. If the stream is completely channelized for flood control, this could adversely affect allocations of restored flow to the stream.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). We appreciate continued USFWS guidance and support of this project.	
U.S. Fish and Wildlife Service	04.29.09	Implementation of the April 10, 2008, Final Rule for Compensatory Mitigation for Losses of Aquatic Resources: In addition to the proposed engineering modifications to the project, structural or design features that are flow-limited do not specifically provide any natural habitat values for native fish and wildlife resources. It is important to identify opportunities for in-stream, riparian, upper and lower watershed habitat enhancements or protection to provide a better replacement of ecological function, consistent with the April 2008 Mitigation Rule.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). We appreciate continued USFWS guidance and support of this project.	

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U.S. Fish and Wildlife Service	04.29.09	Project Operation and Maintenance**.** The USACE makes the case that volunteer vegetation that colonizes or establishes itself in the channel or banks will be allowed to remain to provide shade (cooling) for the low-flow channel. It will be important for the USACE to work closely with the local project sponsor to ensure that maintenance of the flood control does not preclude development of overhanging vegetation on the channel walls and establishment on the channel bed to provide shading of the low—flow channel.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). We appreciate continued USFWS guidance and support of this project.	
U.S. Fish and Wildlife Service	04.29.09	Project consistency with concurrent ahupua'a watershed conservation planning. The West Maui Watershed Partnership has expressed substantial concern for protection of coral reefs from land-based sources of pollution and also for impacts of this project on ground water recharge. The proposed design appears inadequate to protect coral reefs and to compensate for anticipated reductions of groundwater. It is important that the USACE re-evaluate how to effectively accommodate these concerns.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). Please refer to Appendix F, for our CZMA evaluation report.	

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County of Maui - Department of Environmental Management – Solid Waste Division	05.12.09	None	Thank you for your review.	
County of Maui - Department of Environmental Management – Wastewater Reclamation Division	05.12.09	Access to all existing sewer improvements will need to be provided for maintenance.	Comment noted.	
County of Maui - Department of Environmental Management – Wastewater Reclamation Division	05.12.09	Any manhole within anticipated flood areas will need to be sealed to the satisfaction of the Wastewater Reclamation Division in order to prevent water infiltration.	Comment noted.	
County of Maui - Department of Planning	5.13.09	The applicant is asked to review the proposed project and associated mitigation alternatives for consistency with the Draft Maui Island Plan 2030.	Comment noted.	
County of Maui - Department of Planning	5.13.09	The Department requests that the Applicant address any inconsistencies with the Maui Island Plan relative to preferred mitigation alternative;	Comment noted.	
County of Maui - Department of Planning	5.13.09	Any proposed actions should take into consideration that the area is culturally significant, and is likely to contain burial grounds and other traditional cultural properties;	Section 3.6, Historical and Cultural Resources, includes discussion of the existing cultural resources within and in the vicinity of the proposed project area and evaluates whether any potential impacts are anticipated under the Preferred Alternative.	

REVIEW COMMENT	PROJECT:	Iao Stream Flood Control Project	LOCATION:	Wailuku, Maui, Hawaii	
	DOCUMENT:	Draft Environmental Assessment			
	DATE:	March-April 2009	Document Developed By:	GSI Pacific, Inc.	
	REVIEWER:	Various		USACE	
	PHONE:				

Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
County of Maui - Department of Planning	5.13.09	The area is also known to be rich in archaeological sites, including terraced landscapes and loi, and is proximate to Maui Island's two (2) most significant heiau. Please identify these archaeological sites and provide mitigation alternatives to preserve all archaeological sites;	Section 3.6, Historical and Cultural Resources, includes discussion of the existing cultural resources within and in the vicinity of the proposed project area and evaluates whether any potential impacts are anticipated under the Preferred Alternative.	
County of Maui - Department of Planning	5.13.09	Provide mitigation alternative analysis in order to minimize the expected increased sedimentation that may occur as a result of the proposed project, including the transport of sediment from the existing channel into near-shore coastal waters;	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
County of Maui - Department of Planning	5.13.09	The Department is forwarding the application to the Cultural Resources Commission (CRC) for review and comment. The Department requests an additional four (4) weeks for receipt of comments from a CRC meeting scheduled for June 4, 2009	Comment noted.	

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	REVIEWER:	Various		USACE
	PHONE:			

Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
County of Maui - Department of Planning	5.13.09	The Department asks that a representative from your agency be present at the June 4, 2009 CRC meeting to explain the proposed project and receive comments directly from the CRC. The emphasis of the discussion will be on preservation of cultural resources.	The Corps was unable to attend the meeting; however, Joe Krueger, County of Maui, attended the meeting as a representative and provided an overview of the proposed project. Responses to the comments received during the meeting were provided by the Corps following the meeting. Any additional comments on the current EA that evaluates the new design alternative (Alternative F; the preferred alternative), if any, will be addressed following the 30-day public review period.	
County of Maui - Department of Water Supply	5.08.09	3.1 Technical We understand that the existing flood control structure can not certified as 100-year flood protection in its current condition. Although the recommended alternative will harden 7,200 feet of stream channel, raised levees, and remove 70% of the remaining natural alluvial concrete channel, inclusion of a low flow channel along a vegetated stream bank, and provision of other low flow design elements to facilitate migration of native aquatic species.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	

REVIEW COMMENT	PROJECT: Iao Stream Flood Control Project DOCUMENT: Draft Environmental Assessment	LOCATION: Wailuku, Maui, Hawaii
	DATE: March-April 2009 REVIEWER: Various PHONE:	Document Developed By: GSI Pacific, Inc. USACE

Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
County of Maui - Department of Water Supply	5.08.09	4.4 Oceanography, Hydrology and flooding: Anticipated impacts to groundwater recharge from the project should be quantified. USGS has measured the loss of stream flow to groundwater in Iao Stream. Above the concrete lining an estimated 3.6 mgd is contributed from the stream to groundwater, while a contribution of 1.9 mgd is estimated at or blow the concrete lining.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates the concern expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
County of Maui - Department of Water Supply	5.08.09	The State Commission on Water Resource Management (CWRM) has proposed an amended interim instream flow standard (IIFS) for Iao Stream of 13 mgd below the Iao-Waikapu and Iao-Maniania ditches, 8 mgd below the Spreckles ditch diversion and 6.7 mgd at the mouth.	The current status of stream flow restoration will be addressed in the EA.	
County of Maui - Department of Water Supply	5.08.09	The reciprocal impacts of the proposed flood control project and the proposed restoration of stream flow should be discussed in the EA.	The current status of stream flow restoration will be addressed in the EA.	
County of Maui - Department of Water Supply	5.08.09	Will the project be able to provide for flood control protection without jeopardizing the Commission's objective of increased and adequate stream flow for native migratory species?	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	

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County of Maui - Department of Water Supply	5.08.09	How are such concerns accounted for in the project design?	Please see response above.	
County of Maui - Department of Water Supply	5.08.09	For instance, how is the optimal number of weepholes in the lining determined?	The new design alternative (Alternative F; the preferred alternative) no longer proposes lining of the natural streambed; therefore, this comment is no longer applicable.	

REVIEW COMMENT	PROJECT:	F02-011 Iao Stream Flood Control Project	LOCATION:	Wailuku, Maui, Hawaii
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	DATE:	April 16, 2009	Document Developed By:	GSI Pacific, Inc.
	REVIEWER:	Various		USACE
	PHONE:			

Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
Maui Tomorrow Foundation, Inc.	04.21.09	Rivers and streams themselves can serve as flood management	Comments noted. Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates concerns expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
Maui Tomorrow Foundation, Inc.	04.21.09	Wetland areas act as giant sponges, soaking up flood waters as well as filtering water and adding to ground water supplies		
Maui Tomorrow Foundation, Inc.	04.21.09	Flood management measures constructed in the past have reduced the natural live storage capacity of rivers and stream channels by cutting off meanders, leading to increased flow velocities		
Maui Tomorrow Foundation, Inc.	04.21.09	Increased impervious cover in urban watersheds alters stream hydrology and degrades stream habitat, water quality and aquatic diversity		
Maui Tomorrow Foundation, Inc.	04.21.09	Sustainable growth principles have led to recent efforts to restore natural stream functions. These efforts include breaching or setting back levees; restoring meanders; and restoring vegetated banks and wetlands		
Maui Tomorrow Foundation, Inc.	04.21.09	Maui Tomorrow Foundation would ask for a combination of Alternatives IV and V to be considered for the Iao Stream Flood Control Project		

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	DATE: April 16, 2009 REVIEWER: Various PHONE:	Document Developed By: GSI Pacific, Inc. USACE

Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
Hui O' Na Eha: John V. Duey - President	04.16.09	First of all the hearing officer in our petition to amend the IIFS in the Na Wai Eha streams has released his finding, In his decision and order his recommendations to the full board is 13MGD should be in Iao below WWC intake, 8MGD should be below HC&S intake and 6.7MGD should be at the mouth. This will surly effect stream life. Water should be released to the other streams also, not just Iao, but we are talking about Iao here.	Comment noted.	
Hui O' Na Eha: John V. Duey - President	04.16.09	HC&S intakes in Iao Stream should be closed, at least the low flow channel should go around it at present larva being washed down stream go into the intake and into spreckles ditch.	In response to ruling to restore stream flow, this has been taken care of by HC&S in 2014.	
Hui O' Na Eha: John V. Duey - President	04.16.09	I/we are in favor of Alt. #5 removing flood control improvements. Mainly the floor the sides can remain. There is talk in the draft, and I read it cover to cover, about protection. Who told Iao Parkside and others to build next to the river? Now we are suppose to pay to protect their property. Nature is nature.	Comment noted.	

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	REVIEWER:	Various		USACE
	PHONE:			

Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
Hui O' Na Eha: John V. Duey - President	04.16.09	According to the Hawaii Stream Assessment done in 1990 out of the 376 perennial streams in Hawaii only 44 streams state wide where "candidates for stream protection" 9 of which are on Maui and all 4 of the streams in Na Wai Eha where designated as "blue ribbon resources". Putting more cement in Iao even with rocks in it would degrade Iao.	Comments noted. Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates concerns expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
Hui O' Na Eha: John V. Duey - President	04.16.09	Dr. Delwyn Oki, of USGS in his written testimony to the hearings officer in the CCH dated 9/14/07 at paragraphs 61 thru 64 states the following ----------go to his report		
Hui O' Na Eha: John V. Duey - President	04.16.09	So bottom line is this, by covering and additional 7,200' of the river bottom we would lose 1.38MGD of water to the Iao aquifer that is already being stretched to very near its limit of its S.Y. of 20MGD.		
Hui O' Na Eha: John V. Duey - President	04.16.09	And further by going with Alt. 5 removal of channel as I count it 5,230' of existing concrete we would add 2.2MGD to the aquifer using the 'flow –restoration amounts' by Dr. Oki of 2.2MGD of loss per mile. These are facts I don't make up figures.		
Hui O' Na Eha: John V. Duey - President	04.16.09	By doing Alt #3 as recommend Iao would become the longest length of cemented stream in the state. This would be nothing to be proud of.		

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Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
Hui O' Na Eha: John V. Duey - President	04.16.09	John Ford of SWCA environmental consultants testified on June 2008 page 44 of his report "it is our firms belief that the channelized section of streams the primary factor preventing recruitment of native amphidromous species in Iao Stream"	Comment noted.	
Earthjustice: Isaac H. Moriwake – Attorney for Na Wai Eha	04.22.09	As further explained below, the Hui has serious concerns about this proposal to channelize most of the remaining natural streambed in lower Iao Stream, and the failure of the DEA to adequately examine the rationale for the project and its potential environmental and cultural impacts. The Hui respectfully urges that a full Environmental Impact Statement (EIS) be conducted to better address these problems.	Comments noted. Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates concerns expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
Earthjustice: Isaac H. Moriwake – Attorney for Na Wai Eha	04.22.09	The DEA should include discussion of the modern shift towards avoiding and even undoing channelization, identify examples where alternatives to channelization were acknowledged and pursed, and seriously contemplate whether such alternatives would be appropriate in this case.		

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Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
Earthjustice: Isaac H. Moriwake – Attorney for Na Wai Eha	04.22.09	Along related lines, the DEA appears to foreclose better alternatives for the environment by defining the "purpose' of this project so narrowly as to leave channelizing the entire streambed as the only option. For example, the DEA fails to consider, or disqualifies at the outset, alternatives such as remedial repairs or reconfiguration of the existing structure or retention of the natural streambed bottom, simply by declaring that other alternatives will not meet the project's predetermined purpose. The law does not allow such a "fait accompli" to circumvent full environmental analysis and disclosure.	Comments noted. Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates concerns expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
Earthjustice: Isaac H. Moriwake – Attorney for Na Wai Eha	04.22.09	The DEA estimates the economic value of protecting this flood-prone land; it also should analyze both the economic and the priceless, non-economic value of a healthy, functioning stream system.		

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	DATE: April 16, 2009 REVIEWER: Various PHONE:	Document Developed By: GSI Pacific, Inc. USACE

Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
Earthjustice: Isaac H. Moriwake – Attorney for Na Wai Eha	04.22.09	The DEA repeatedly suggests that the U.S. Fish & Wildlife Service (USFWS) has approved the preferred alternative. Review of the documents, however, indicate that value habitat demanding a no net loss policy, expressed concerns regarding the proposed project, and recommended that any further channelization of Iao Stream be the <u>last</u> alternative.	During preparation of the EA for the new design alternative (Alternative F; the preferred alternative), USACE continued coordination with the USFWS; during a coordination meeting with the resource agencies (USFWS, EPA, NMFS, DAR, and COM) on September 17, 2014, USACE provided an overview of the new preferred alternative and explained that no significant impacts to biological resources are anticipated. The resource agencies concurred with this determination and expressed support on the proposed action. The meeting minutes from this meeting are included in Appendix E of the current EA.	

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	REVIEWER:	Various		USACE
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Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
Earthjustice: Isaac H. Moriwake – Attorney for Na Wai Eha	04.22.09	USFWS also recommended numerous specific measures necessary to mitigate (but not offset or eliminate) the potential impacts, including efforts to engage and cooperate with state authorities regarding the need for flow restoration. Yet, the DEA is far from clear to what extent, if any, these mitigation measures will actually be implemented. For example, USFWS recommended that the low-flow channel be located to maximize vegetative shade and cooling of flows for migrating native stream life. The DEA mentions this mitigation measure and relies on it to minimize the potential harm, but provides no indication or assurance of any follow through. Rather, the DEA simply states that the low-flow channel would be aligned close to the stream bank "where possible" and that vegetation "could grow" among the grouted boulders of the low-flow channel. The DEA cannot dismiss potential impacts by relying on such indefinite plans.	Please see response above.	

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Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
Earthjustice: Isaac H. Moriwake – Attorney for Na Wai Eha	04.22.09	The DEA does not engage in any substantive analysis of impacts to wetlands, but rather only notes the presence of emergent wetlands on USFWS maps and states that they "may or may not be present." …… Channelizing the remaining natural streambed in the lower Iao Stream would all but eliminated this recharge from the stream, potentially affecting the surrounding wetlands. The DEA does not address this impact at all.	Comments noted. Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates concerns expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
Earthjustice: Isaac H. Moriwake – Attorney for Na Wai Eha	04.22.09	In discussing impacts on water quality, the DEA recognizes that both Iao Stream and its receiving waters of Kahului Bay are listed as impaired under the federal Clean Water Act, but proceeds to mention only the impact of natural stream bank erosion on sediment pollution. …… The DEA should consider the water quality impact of the proposed channelization in relation to the natural streambed.		

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Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
Earthjustice: Isaac H. Moriwake – Attorney for Na Wai Eha	04.22.09	The DEA on numerous occasions appears to cite the current lack of consistent flow in Iao Stream as a way to rationalize the proposed project and its potential impacts. While the negative impact of the lack of flows can be taken as a given in analyzing the project's impacts. …… Indeed, rather than diminishing the project's potential impacts because of the lack off flows, USFWS recommends that flow restoration be pursued as part of the necessary mitigation of the project's potential impacts.	Comment noted. The current EA which assesses the new design alternative (Alternative F) takes into consideration the current stream condition following implementation of the IIFS in October 2014.	
Earthjustice: Isaac H. Moriwake – Attorney for Na Wai Eha	04.22.09	In the end, the various shortfalls of the DEA highlights the more fundamental problems – namely that a full EIS is necessary in this case to better analyze the rationale for the proposed project and its potential significant environmental effects. …… Preparation of a full EIS will enable more deliberate and thoughtful analysis of the wisdom of further, widescale elimination of natural stream habitat in this day and age.	Comment noted. Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates concerns expressed in this comment. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	

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Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
David W. Ivy consultant to North Shore at Waiehu, LLC	04.29.09	North Shore at Waiehu, LLC endorses Alternative V, the removal of the previous flood control measures and the return of the Iao Stream to its previous condition as a natural stream.	Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. An EA is now being prepared in order to assess the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
David W. Ivy consultant to North Shore at Waiehu, LLC	04.29.09	We believe that the return of water to these streams will enhance the value of the lands along these waters in many ways. The economic values of free flowing natural streams must be considered in evaluating this project.		
David W. Ivy consultant to North Shore at Waiehu, LLC	04.29.09	How much damage will be caused by a project that will inevitably dump thousands of tons of silt and debris onto the reef and into near shore waters? This project will increase the velocity of run-off in a way that will destroy this reef area forever.	Please see response above. As documented in the current EA, the new preferred alternative would result in overall reduction of sediment transport to the nearshore waters.	
David W. Ivy consultant to North Shore at Waiehu, LLC	04.29.09	What is the cultural value of a river restored to support Hawaiian cultural practices on the north bank of the river in the present flood zone instead of development? The owner of this land (88 acres), Vernon Lindsay, has stated his support for Alternative V. Is the value of sedimentation in the flood plane being adequately addressed in the EA as this will certainly have a negative impact on the value of his land for farming?	Comments noted. Following the receipt of comments and conducting additional alternative screening analysis, a new design alternative was developed that would involve significantly less disturbance to the existing environment, as compared to the previously selected alternative. The new design alternative alleviates concerns expressed in this comment. An EA is now being prepared in order to assess	

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David W. Ivy consultant to North Shore at Waiehu, LLC	04.29.09	Ancient Hawaiian spiritual values are based upon the flow of water from the mountain to the sea. What is the spiritual value of restoration of a natural balance in this river valley?	the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative).	
David W. Ivy consultant to North Shore at Waiehu, LLC	04.29.09	In recent years we have seen a dangerous lowering of the levels of water in the Iao Aquifer. This project threatens to diminish the capacity of the river to replenish the aquifer. What is the economic value of a healthy and sustainable fresh water resource like the Iao?		
David W. Ivy consultant to North Shore at Waiehu, LLC	04.29.09	We respectfully urge the ACE and the County to consider stream restoration in conjunction with the removal of the existing channels to provide a solution that meets the project goals. We believe that a natural stream restoration project is not being adequately investigated as an alternative to channelization. Is a hybrid plan of reconstruction or reinforcement of critical portions of the levees in conjunction with stream restoration being considered as a viable solution?	The current EA assesses the potential environmental, social and economic effects associated with the new design alternative (Alternative F; the preferred alternative). The new design alternative (Alternative F) takes into consideration the current stream condition following implementation of the IIFS in October 2014.	
David W. Ivy consultant to North Shore at Waiehu, LLC	04.29.09	The County of Maui in its Wailuku-Kahului Community Plan has indicated that this area is to be preserved as a green belt area from the Iao Valley to the sea. We encourage the ACE to include this impact on the Community Plan in the EA and the EIS.	The Wailuku-Kahului Community Plan has been reviewed and evaluation of the impacts of the preferred alternative on the Community Plan will be included in the EA.	

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Reviewer Company Name	Date	COMMENTS	RESPONSES (Contractor)	Back check by:
David W. Ivy consultant to North Shore at Waiehu, LLC	04.29.09	We would like to know if this project would be subject to SMA review and approval. Through the SMA process the public would have the opportunity to participate in the decision-making process. The cultural, social, environmental, ecological, recreational and spiritual values of this river are very important to this community. We feel that the community deserves the right to participate in a decision that will affect a valuable natural resource for generations to come.	Since the new design alternative (Alternative F) is not within the SMA, as defined by the state of Hawaii, it is not subject to the SMA process. The EA process provides opportunities for the public to participate in the decision-making process by holding public meetings where the public has an opportunity to voice their opinions as well as 30-day public review periods for the draft and final EAs.	

Appendix C:

Section 404(B)(1) Evaluation

SECTION 404(B)(1) EVALUATION

ENVIRONMENTAL ASSESSMENT FOR ʻĪAO STREAM

FLOOD CONTROL PROJECT

WAILUKU, ISLAND OF MAUI, HAWAIʻI

I. PROJECT DESCRIPTION

A. Background – The United States Army Corps of Engineers (USACE) is proposing to implement engineering designs to address existing flood hazards and provide the authorized level of reduced flood risk along ʻĪao Stream, Wailuku, Maui, Hawaiʻi. A joint National Environmental Policy Act (NEPA) and Hawaiʻi Revised Statues (HRS) Chapter 343 compliant Environmental Assessment (EA) is being prepared for the Proposed Action. The Proposed Action is authorized under Section 203 of the Flood Control Act of 1968 (Public Law [PL] 90-483), which authorizes works of improvement for the control of destructive floodwaters. The County of Maui (COM), Department of Public Works is the non-Federal sponsor and the requesting agency for concurrent compliance with HRS Chapter 343.

ʻĪao Stream is located within the Nā Wai ʻEhā Watershed in the town of Wailuku and flows into Kahului Bay. The stream is about 12,000 feet (ft) in length from the upstream sediment basin to its outlet into Kahului Bay, and about 30 percent (%) is lined with existing concrete channels. The remaining portions of the stream are an alluvial channel where the stabilization problems occur. Levees are situated on the right bank to protect the town of Wailuku.

For more than a century, stream flow had been intermittent below the ʻĪao intake due to three diversion structures which redirected the water to agricultural areas. Downstream of these agricultural diversion structures, stream flow had been absent 80 to 90% of the time, punctuated by infrequent high flows following intense rainfall events when stream discharge volume was sufficient to overtop the agricultural diversion structures (USFWS, 2006). High water flows into the channelized portion of ʻĪao Stream occurred only during periods of prolonged intense rainfall. In April 2014, an interim instream flow standard (IIFS) was established following an Order and Agreement issued by the Commission on Water Resource Management. Pursuant to the April 2014 Settlement Agreement, the Wailuku Water Company began the release of 10 million gallons per day (mgd) of water into ʻĪao Stream on October 13, 2014.

High water flows into the channelized portion of ʻĪao Stream occur only during periods of prolonged intense rainfall. The existing stream channel has a relatively narrow width of 40 to 60 ft, is boulder-lined, and has an average slope of 2.6%. This steep stream channel results in critical and supercritical flows in the stream. Average channel velocity through the unlined portion of the stream varies between 8 and 32 ft per second (fps) with an average velocity in excess of 20 fps during annual floods. These high velocities have eroded the channel bed and caused severe undermining of the existing levees.

Implementation of the Proposed Action would occur within the approximately 0.4-mile stretch of the stream between slightly downstream of Waena Street (River Station [RS] 42+30) and upstream of Imi Kala Street (river station 83+25), approximately 1.4 miles upstream from the shoreline. The segment is classified as having "Class 2 inland waters" by the State of Hawai'i, while Kahului Bay is classified as "Class A marine waters". The area is characterized by extensive residential development on the right bank and an existing natural flood plain on the left bank, and is located upstream of existing residential and urban development associated with the town of Wailuku.

The 'Īao Stream drainage basin is a 10 square mile area that begins at the boundary between the Lahaina and Wailuku Judicial districts and extends along the crests of the Kaho'olewa and Kapilau Ridges to the Pacific Ocean. The basin is eight miles long and averages 1.25 miles in width. It is characterized by two major topographic features: a coastal plain that extends about three miles inland, and 'Īao Valley, the largest valley in West Maui, which extends from the coastal plain to the summit of Pu'u Kukui at an elevation of 5,800 ft above sea level.

The stream drains a steep valley with flows at the upstream limit conveyed into an existing debris basin and flood control system which was constructed between 1977 and 1981. This flood control system consists of the debris basin located 2.5 miles upstream from the stream mouth, a 3,500-ft long channel downstream from the debris basin, a drop structure with a 22-ft vertical drop, levees along the left and right bank, flood plain management along 6,950 ft of the left bank, and stream realignment for a 1,730-ft reach to the shoreline. In the flood plain management reach, levees are located on the right stream bank and are offset up to 80 ft beyond the existing stream bank.

The 33-year old flood control system no longer provides adequate levels of reduced flood risk to the town of Wailuku. Repeated floods in the area have caused high stream flows, undermining the existing flood plain levees in several locations along the stream. High stream flows have resulted in downcutting of the natural streambed and erosion of the base of the east bank levee structure. Several residential and commercial structures along the right bank are in danger of being undercut if streambank erosion continues, as is the heiau along the lower reach of the left bank.

A number of possible management measure alternatives that address these increased flood hazards and provide the authorized level of reduced flood risk to the Wailuku community were analyzed. The measures also aimed to reduce further streambed erosion and to withstand a 100-yr frequency flood; all in compliance with numerous environmental regulations and executive orders (EO), which are identified and discussed in further detail in the EA. These measures included both non-structural and structural flood damage reduction measures/alternatives that would best meet the project purpose and need in a feasible and effective manner.

The alternatives went through an initial screening that used the following criteria: utilization of floodplain; real estate requirements/acquisition; increases erosion and sediment transport; facilitates aquatic organism passage; reduces potential for groundwater recharge; level of channel hardening; operation and maintenance (O&M) requirements/ease of maintenance;

implementation cost; and net benefits. Based on the screening measures, the following alternatives were selected to be evaluated:

Alternative A – No Action;

Alternative B – Removal of Flood Control Improvements;

Alternative C – Roller Compacted Concrete (RCC) and Grouted Boulder Invert Channel;

Alternative D – Dual Stilling and Sedimentation Basins;

Alternative E – RCC with Grade Control Structures;

Alternative F (Proposed Action) – Floodplain Reconnection

Other Alternatives

This array of alternatives was compared against four decision criteria ratings of effectiveness, acceptability, efficiency, and completeness to determine the alternative that would best meet the purpose and need of the project. Each decision criteria was specifically defined in terms of appropriate metrics to measure how well (high, medium, or low, or in other cases, yes or no) each alternative met each criteria. A memorandum describing the logistics behind the selection of the initial alternatives formulation process, descriptions of each screening criteria used, as well as a complete matrix table showing the rating of each alternative under each criterion, is included in Appendix C of the EA. Based on the criteria matrix, Alternative F was selected as the Proposed Action.

Alternative F consists of features that would reconnect the main channel with the existing floodplain on the left bank to reduce damaging flows along the main channel and right bank levees (Figure 1-3 of the EA; refer Appendix D of the EA for the engineering drawings). The reconnection would be accomplished by lowering the left bank approximately 5 to 9 ft between river stations 78+99 and 75+10 (an approximate length of 417 ft along the left bank) and grading the overflow area to disperse flow into the floodplain. The stream would be constricted by a concrete diversion weir, located within the channel at river station 75+10, downstream and at the base of the overflow channel section. The diversion weir would be approximately 18-ft high with a 15-ft wide opening to allow for fish passage and some flow to remain in the channel. The invert of this structure will be at or below the existing stream bed elevation and low flow through the opening will be controlled by the natural riffles and pools formed by the existing boulder stream bed both up and downstream of the diversion wall. Constriction of the stream would force flood flows to leave the main channel and enter the existing designated floodplain area on the left bank of ʻĪao Stream.

Flood flows entering the floodplain at the overflow channel would spread out and follow the natural topographic gradient until reentering the main channel downstream at the outflow section. The left bank between RS 66+60 and 61+05 (approximately 473 linear ft along the bank) would be raised by an earthen berm, up to approximately 6 ft, to contain the overflow

within the floodplain. Further downstream, between RS 45+60 and 43+60, the left bank would be lowered to allow the return of the overflow into the main channel.

At two locations, from RS 83+25 to 81+25 and RS 44+10 to 42+30, slope revetment is necessary to protect the bank from eroding under conditions of high stream velocities. These locations would be stabilized with boulder concrete slope lining or "shotcrete" to accommodate the steep bank slopes and protect the bank from erosion. In addition, from RS 55+50 to 51+90, approximately 290 linear ft of revetment along the left bank would be removed entirely and restored to a natural earth embankment typical of upstream and downstream conditions. Along the right bank, from RS 55+10 to 50+25 (approximately 470 linear ft), the concrete toe berm that has severely eroded would be removed and replaced with a concrete retaining wall to provide support to the existing embankment and prevent further erosion of the bank toe.

Other features of this alternative include construction of a permanent 15-ft wide gravel road along the stream on the left bank between RS 75+10 and 43+60. This road would be used for future O&M activities. Site access during construction activities would be from Piihana Road along an existing road ending at RS 79+00. This road would also be used for future O&M activities.

The major elements of the Preferred Alternative are included in Table 1.

Table 1: Preferred Alternative Construction Details

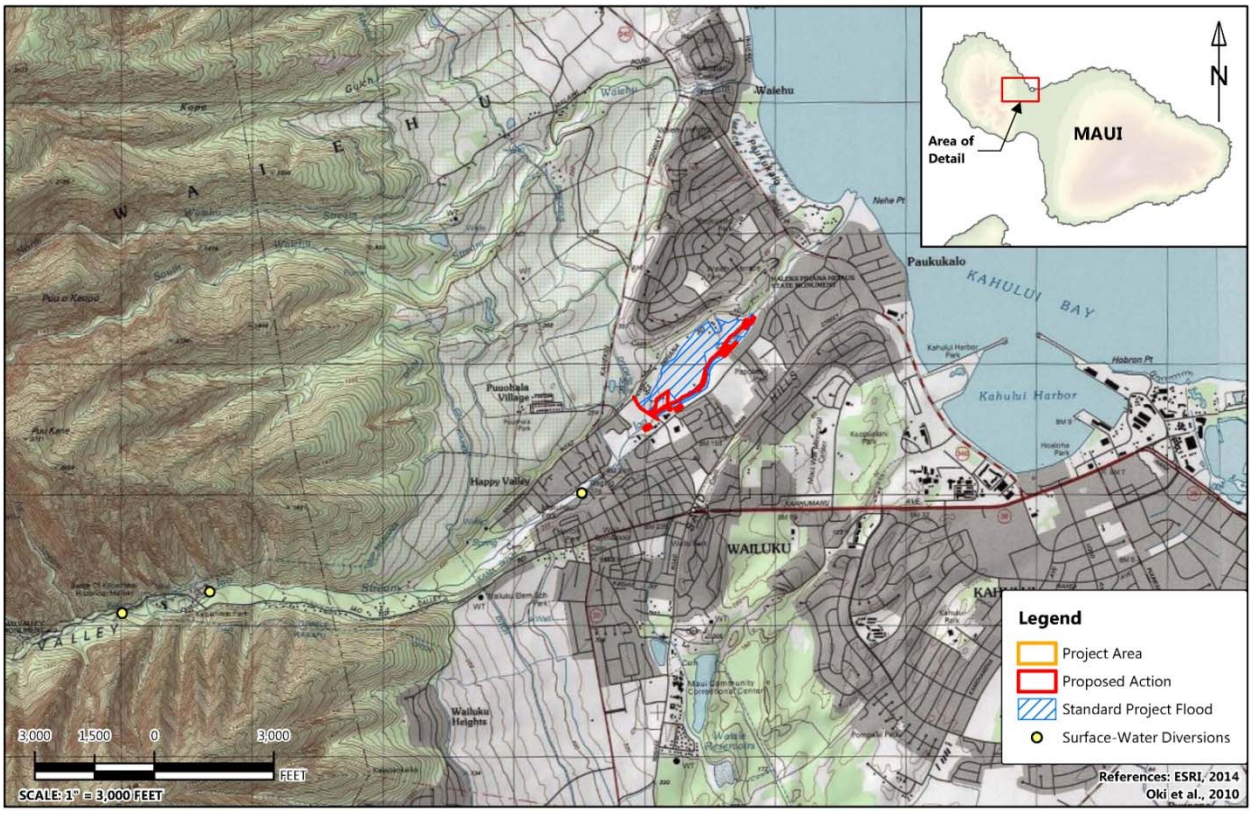
Element	Description
Overflow Channel	• Lower the left bank by approximately 5 to 9 ft between RS 79+20 and 75+12 (approximate length of 437 ft). • Placement of grouted riprap along the lowered left bank for bank protection. • Grade and provide grassing throughout the approximately 116, 060-square foot overflow channel on the left bank. • An approximately 18-ft high concrete diversion weir downstream of the overflow channel.
Raised Berm	Placement of an approximately 6-ft high (maximum height) earthen berm on the left bank between RS 66+60 and 61+05 (approximately 473 linear ft).
Floodplain Outflow	• Lower the left bank between RS 45+60 and 43+60 (up to 6 ft). • Placement of partially grouted riprap on the left bank for protection against erosion during the return of the overflow to the main channel.

Element	Description
Slope Revetment	• Placement of boulder concrete slope lining or "shotcrete" on the right bank between RS 83+25 and 81+25 (approximately 200 linear ft). • Removal of revetment along the left bank between RS 55+00 and 51+90 (approximately 290 linear ft) and restoration to natural earth embankment typical of upstream and downstream conditions. • Removal of existing concrete toe berm between RS 55+00 and 50+25 (approximately 470 linear ft) and replacement with a concrete retaining wall. • Placement of boulder concrete slope lining or "shotcrete" on the right bank between RS 44+10 and 42+30 (approximately 180 linear ft).
Grading required	The existing grade within the overflow channel would be evened out to create a flat surface.
Total impervious surface	Approximately 38,650 square feet or 0.9 acres; approximately 8,500 square feet for bank stabilization (shotcrete), 6,000 square feet for the concrete diversion weir and related invert (concrete), and 24,150 square feet for the overflow weir (grouted riprap).
Staging areas	Two staging areas at the overflow channel location: one on the right bank (near Eha Street and Imi Kala Street) and one on the left bank near the Imi Kala Bridge.
Site Access	• From Piihana Road along an existing 15-ft wide, 750-ft long gravel road. • A permanent 15-ft wide gravel O&M road will be constructed along the stream between RS 75+10 and 43+60.
Best management practices (BMPs) to be included during construction	Use of silt fences; concrete structures would be constructed in halves by temporarily diverting the stream to one side of the channel. While one side is constructed, the other side would be used for stream flow to accommodate the IIFS of 5 mgd.
Types of construction equipment to be used	Excavator, front-end loader, and dump trucks.
Location of disposal of debris and excavated materials	• Excavated soil removed to create the overflow channel will be tested and reused to construct the raised berm downstream. • Any excess excavated material will be tested and disposed of at the Maui Demolition and Construction Landfill (approximately 6 miles from project site) in Mā'alaea, Maui.
Construction duration	Approximately 21.32 months.
O&M	• Clearing the overflow channel and diversion weir once every five years • Grass cutting at the diversion weir, new berm, and access/O&M road six times per year.

This alternative would divert high-velocity and high-volume flood flows into the existing left-bank floodplain thereby reducing the main channel flow in the approximately 3,200 ft long reach of the stream. This would result in a reduced risk of flooding during high-flow/flood events to authorized levels. Diversion of stream waters would also reduce erosion of the stream banks, which would prevent further damage to the existing flood control systems and increase their reliability.

B. Location – The project area affected by the Proposed Action is the Nā Wai ʻEhā Watershed in Wailuku, Maui (Figure 1). The ʻĪao Stream drainage basin is a 10 square mile area that begins at the boundary between the Lahaina and Wailuku Judicial districts and extends along the crests of the Kahoolewa and Kapilau Ridges to the Pacific Ocean. The basin is eight miles long and averages 1.25 miles in width. The proposed activities would occur within the approximately 0.4-mile stretch of the stream between slightly downstream of Waena Street (river station 43+60) and upstream of Imi Kala Street (river station 83+25), approximately 1.4 miles upstream from the shoreline. The area is characterized by extensive residential development on the right bank and an existing natural flood plain on the left bank, and is located upstream of existing residential and urban development associated with the town of Wailuku.

Figure 1: Project Area Map



C. General Description – This evaluation addresses the effects that would result from the placement of fill in waters of the United States in conjunction with the construction of an overflow channel system that involves work within and on the banks of ʻĪao Stream. The

Proposed Action consists of features intended to reconnect the main channel with the floodplain to reduce damaging flows along the main channel and right bank levees. The reconnection would be accomplished by lowering the left bank, grading the overflow area to disperse flow into the floodplain, and constricting the main channel with a concrete diversion weir to force flood flows to leave the main channel and enter the existing floodplain on the left bank of the stream. A portion of the left bank would be raised further downstream to contain the overflow within the floodplain. Even further downstream, the left bank would be lowered to allow the return of the overflow into the main channel. The Proposed Action would also include bank stabilization and bank revetment repairs at locations upstream and downstream of the proposed overflow channel.

D. Authority and Purpose – The Proposed Action is authorized under Section 203 of the Flood Control Act of 1968 (Public Law 90-483), which authorizes works of improvement for the control of destructive floodwaters.

The purpose of the Proposed Action is to address increased flood hazards from ʻĪao Stream caused by design deficiencies and damages to the existing flood control structures, and to provide the authorized level of reduced flood risk to the town of Wailuku.

E. General Description of Dredged or Fill Material

1. General Characteristics of Material – Three types of revetment are utilized in the design of the Proposed Action: partially grouted riprap, fully grouted riprap, and shotcrete. Partially grouted riprap was included at the floodplain outflow to protect the bank against erosion during the return of the overflow to the main channel. At the lateral overflow weir, a stronger revetment of fully grouted riprap was required to accommodate the high stream velocities and the increased levels of turbulence resulting from changes in flow direction. At the riverbend upstream of the Imi Kala Street Bridge, boulder concrete slope lining or "shotcrete" was the chosen revetment to accommodate the steep bank slopes.

2. Quantity of Material – The quantity of material needed is not known at this time. More detailed construction plans will be developed by the USACE during the design phase of the project.

3. Source of Material – All stone would be clean and reasonably free from soil, quarry fines, and would contain no refuse. Materials would be obtained from approved pits/quarries in the project vicinity and would be free of chemical contaminants.

F. Description of Proposed Discharge Sites – No discharge sites are anticipated at the proposed project site. Excavated soil will be reused to create the desired topography of the stream, and the excess will be transported off-site and disposed into a landfill.

1. Location – Maui Demolitions and Construction Landfill (approximately 0.5 miles from the proposed project site) in Māʻalaea, Maui.

2. Size – 14.8 acres

3. Type of Site/Type of Habitat – Construction and demolitions landfill/NA

4. Timing and Duration – Construction duration of the proposed project is approximately 21.32 months.

G. Description of Disposal Method – Material would be moved and placed mechanically. Backhoes, dump trucks, and other suited heavy machinery would be used to deliver and place rock materials and other fill materials during construction. Riprap would generally be placed in a systematic manner to ensure a continuous uniform layer of well-graded stone. Stone placed underwater would not be cast across the surface of the water.

II. FACTUAL DETERMINATIONS

A. Physical Substrate Determinations

1. Substrate Elevation and Slope – Substrate would be excavated before placement and aggregate filter layer(s) to ensure that existing substrate grade is maintained. Riprap placed on slopes for erosion protection would follow the existing contour. An exception to this armoring technique would be at areas of significant water depth in existing channels, where armoring would be placed directly over existing grade to avoid dredging below the water surface elevation. The areas where different armoring placement strategies are utilized will be determined through newly constructed hydraulic structures; the substrate will consist of concrete at the locations of the hydraulic structures.

2. Sediment Type – Soils in the area of Wailuku retain a high organic matter content, and are composed of clay, silt, and sand, mixed with varying degrees of gravel, cobble, and boulders. Major soil types underlying the proposed project area and standard project flood area include ʻĪao cobbly silty clay (Idb), ʻĪao clay (IcB), Pulehu cobbly clay loam (PtA), and the Puʻuone sand (PZUE).

3. Dredged/Fill Material Movement – Excavated soil removed to create the overflow channel will be used to construct the raised berm downstream. Any excess excavated material will be disposed of at the Maui Demolition and Construction Landfill (approximately 0.5 miles from project site) in Māʻalaea, Maui.

4. Actions Take to Minimize Impacts – Standard construction procedures in compliance with federal and state requirements, and standard BMPs identified via a Storm Water Pollution Prevention Plan would be employed during construction (e.g., silt fencing, tarping/covering exposed and stockpiled soils, surface revegetation, etc.). These measures are expected to minimize/eliminate stormwater flow from the proposed construction site, as well as any association of degradation of water quality. Work would be done during no or low flow periods to limit downstream sedimentation. Construction sequencing would be used to minimize impacts. Temporary erosion prevention and sedimentation control measures would be used project-wide and shall be operated and maintained in accordance with necessary permit(s).

B. Water Circulation, Fluctuation, and Salinity Determinations

1. General Water Chemistry – The use of clean fill material would reduce any significant impacts on water chemistry during project construction. Some minor, short-term decreases in water clarity are expected from the proposed fill activities. No significant impacts on water color, odor, dissolved oxygen, temperature, or nutrient levels are anticipated in the long-term.

2. Water Circulation, Fluctuation, and Salinity Determination –
    a. Current Patterns and Flow – Stream flow in the past was absent 80 to 90% of the time, punctuated by infrequent high flows following intense rainfall events when stream discharge volume was sufficient to overtop the water diversion structures (USFWS, 2006). On October 13, 2014, Wailuku Water Company began releasing 10 mgd of water into Wailuku River pursuant to the April 2014 Settlement Agreement in the Na Wai ʻEha Contested Case. Currently, there is continuous flow through the section of the proposed project area. The proposed action would not impact the ability for an IIFS of greater than 5 mgd to remain in the channel through the project area and downstream to the stream mouth.

    b. Velocity – When flow occurs, average channel velocity through the unlined portion of the stream varies between 8 and 32 fps with an average velocity in excess of 20 fps during annual floods. With the implementation of the Proposed Action, the velocity of the water in the main stream channel is expected to decrease when it flows out through the overflow channel and into the flood plain.

    c. Sedimentation Patterns – The Proposed Action may decrease sedimentation, as the lower main channel flow and right bank armoring upstream are designed to decrease erosion, thus decreasing the amount of sediment and nutrient loads released into the stream and entering Kahului Bay.

3. Actions Taken to Minimize Impact – Standard construction procedures in compliance with Federal and State requirements would be used. Standard BMPs identified in a Storm Water Pollution Prevention Plan would be employed during construction (e.g., silt fencing, tarping/covering exposed and stockpiled soils, surface revegetation, etc.) to minimize/eliminate stormwater flow from the proposed construction site, and any associated degradation of water quality.

C. Suspended Particulate/Turbidity Determination

1. Suspended Particulates and Turbidity – Turbidity and the concentration of suspended solids would be expected to increase temporarily during construction of the Proposed Action. However, increases would be relatively minor and restricted to a relatively localized area. A water quality monitoring program will be implemented during construction activities to ensure that state water quality standards are not exceeded. No long-term adverse impacts on water quality are expected; in contrast, the reduced erosion from the Proposed Action would decrease turbidity in the stream.

2. Effects on Chemical and Physical Properties of the Water Column – Some minor short-term impacts on light penetration and aquatic organisms would occur during riprap placement due to increased turbidity. However, these effects would be rapidly dissipated upon project completion. No effects are expected on toxic metal concentrations, pathogens, or the aesthetics of the water column.

3. Actions Taken to Minimize Impacts – Impacts would be minimized by requiring BMPs be implemented to limit the extent of turbidity plumes, such as silt curtains, to be followed during construction.

D. Contaminant Determinations - The use of clean, quarry-run rock riprap for construction would not introduce contaminants into the aquatic system. Neither the materials used nor the placement method would cause relocation or increases of contaminants in the aquatic system.

E. Aquatic Ecosystem and Organism Determinations

1. Effects on Benthos – The Proposed Action is to expected have an overall positive effect on the benthos community downstream of the proposed project area by diverting stream flows and allowing suspended solids to settle out prior to the return of the stream waters to the main channel; thereby improving the water quality downstream. Impacts on water quality would be minimized during construction activities to prevent effects on benthos downstream. No long-term effects on benthos are anticipated as a result of the implementation of the Proposed Action.

2. Effects on Fish –Short-term increases in turbidity and suspended solids during construction, as well as general noise and disturbance may temporarily displace fish occupying the vicinity of the construction areas. In the long-term, however, reduced turbidity, sedimentation, and velocity flow would be advantageous for fish. The Proposed Action also avoids effects on fish by incorporating a 15-ft wide opening in the diversion wall to allow for fish passage and some flow to remain in the channel.

3. Effects on Aquatic Food Web – Due to the temporal nature of the proposed construction activities, no long-term effects on aquatic food web are anticipated neither as a result of construction activities nor following completion of the Proposed Action.

4. Effects on Special Aquatic Sites – Potential pockets of freshwater emergent wetlands exist within the proposed project area. A biological survey would be conducted prior to

the start of construction activities to confirm that there are no wetlands present within the proposed construction area. Work practices during construction activities would be modified as needed to minimize potential impacts to any existing wetlands. No significant long-term impacts to wetlands are anticipated since the existing wetland flora and fauna (if any are identified) would return following completion of construction activities.

5. Threatened or Endangered Species – A total of 110 species of ferns and flowering plants were recorded as growing in the stream channel and along the stream banks during field surveys. With a few exceptions, all of these plants are non-native species and most are common weedy species that have established in highly disturbed banks and sand/mud bars that form in the concrete channel. Nine native or early Polynesian introduced species were noted. These included three trees (*kukui*, *kou*, and *hau*) observed near the stream, one tree (*ʻulu*) in the overflow channel area, two planted shrubs (*ki* and *naupaka kahakai*), a sedge (*Fimbristylis cymosa*), and two low growing herbs (wood sorrel or *ʻihiʻai* and *kīpūkai*). These are common widespread species in the Hawaiian Islands. All of the plant species observed within the project area were widespread species. No endangered or threatened plant species were observed (USFWS, 2011a).

The aquatic biota surveys conducted at the proposed project site observed typical non-native estuarine fish, five endemic fish species (*nehu* [*Encrasicholina purpurea*], *ʻoʻopu akupa* [*Eleotris sandwicensis*], *ʻoʻopu ʻalamoʻo* [*Lentipes concolor*], *ʻoʻopu nopili* [*Sicyopterus stimpsoni*], and *ʻoʻopu naniha* [*Stenogobius hawaiiensis*]) and six indigenous fish species (including *ʻoʻopu nākea* [*Awaous stamineus*]). In addition, two indigenous species of algae, numerous endemic species of damselflies (*Megalagrion blackburni*, *M. hawaiiense*, and *M. nigrohamatum*), and two endemic aquatic amphidromous mollusks (*hīhīwai* [*Neritina granosa*] and *hapawai* [*Neritina vespertina*]) were recorded. No endangered or threatened aquatic biota were observed (AECOS, 2012).

Since no known threatened or endangered species, or critical habitat for any threatened or endangered species, occur within the project area; no significant impacts are anticipated.

Hawaiian Stilts are known to occur in the vicinity of the proposed project area; however, considering that the stream is dry most of the time and that flood events large enough to create ponding in the floodplain would be sporadic, impacts to Hawaiian Stilts are anticipated to be less than significant.

6. Other Wildlife – No other wildlife of concern are anticipated to be impacted by the Proposed Action.

7. Actions Taken to Minimize Impacts – Construction/grading activities would be conducted as much as possible during periods of low stream flow. In addition, BMPs adhering to federal and state regulations would be instituted to minimize sediment discharges and alterations of stream flow.

There may be less than significant impacts to surface water quality during the construction period. The Proposed Action would include soil excavation and stockpiling during grading activities. BMPs strictly employed during construction (e.g., silt fencing, tarping/covering exposed and stockpiled soils, surface revegetation, etc.) would minimize/eliminate stormwater flow from the proposed construction site, and any associated degradation of water quality.

Concrete structures will be constructed in halves in order to avoid impediment of stream. The USACE will monitor the marine water quality at the mouth of the stream before, during, and after construction to assure water quality standards are not exceeded. The Proposed Action would be completed in accordance with state and Federal regulations, including Section 404 (b)(1) of the Clean Water Act (CWA), which would further minimize any impacts to water quality in ʻĪao Stream and Kahului Bay.

F. Proposed Disposal Site Determinations

1. Mixing Zone Determination – The proposed fill activities would have minimal mixing zones. The fill material used for the project would be large and relatively clean so that very little exposed material could be suspended in the water column.

2. Determination of Compliance with Applicable Water Quality Standards - The fill materials used for this project would be obtained from approved quarries in the project area or excavated on-site. The area does not have a history of contamination, which should ensure that State water quality standards would not be violated because of project-related activities.

3. Potential Effects on Human Use Characteristics – The Proposed Action would provide the Wailuku community with increased flood protection without adversely affecting the stream. Land use activities surrounding the project site include residential, commercial, and public lands designated as either urban or agricultural. These uses would remain unchanged and may even be enhanced by decreased flooding and flood risk after the implementation of the Proposed Action. The proposed construction activities are not anticipated to have any potential adverse effects on human use of the project area or the surrounding areas.

G. Determination of Cumulative Effects on the Aquatic Ecosystem – No cumulative effects on the aquatic ecosystem of ʻĪao Stream are anticipated as a result of the Proposed Action.

H. Determination of Secondary Effects on the Aquatic Ecosystem – There could be beneficial secondary effects to coral and other organisms in Kahului Bay downstream of the proposed project area. The proposed overflow channel system would allow flood waters to be dispersed into the natural floodplain where sediment and other entrained constituents would be able to settle out instead of being directly channeled downstream and into the nearshore marine environment. Decrease in erosion within the main channel due to diversion of stream waters during large storm events is expected to further reduce the amount of sedimentation within the stream as well as in Kahului Bay. Decrease in sedimentation and turbidity is expected to improve water clarity and the current condition of reef habitats within the nearshore environment.

Improved water quality may also have positive impacts on the green sea turtles that nest on beaches within the vicinity of the mouth of ʻĪao Stream.

III. FINDING OF COMPLIANCE WITH RESTRICTIONS ON DISCHARGE

The proposed fill activities associated with the Proposed Action - Floodplain Reconnection would comply with Section 404(b)(1) guidelines of the Clean Water Act, as amended. No significant adaptations of the guidelines were made for this evaluation. Other structural alternatives considered to reduce the flood risk to Wailuku included no action, removal of flood control improvements, roller compacted concrete and grouted boulder invert channel, dual stilling and sedimentation basins, and rectangular and compound channel with grade control structures. Other alternatives were not selected because they were prohibitively more costly, were significantly less effective in reducing flood risk and reducing debris, had extensive environmental impacts that would have been logistically very difficult to mitigate, required high operations and maintenance, or did not meet the overall project purpose of reducing flood risk.

The proposed fill activities would comply with all State water quality standards, Section 307 of the Clean Water Act, and the Endangered Species Act of 1973, as amended. The proposed fill activities would not have significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife would not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity, and stability and on recreational, aesthetic, and economic values would not occur.

To minimize the potential for adverse impacts, the fill would be placed during periods of low to no water levels. Since the Proposed Action would result in few adverse effects, no additional measures to minimize impacts would be required.

On the basis of evaluation, it has been determined that the Proposed Action complies with the requirements of the 404(b)(1) guidelines for the discharge of fill material.

Prepared by: GSI Pacific, Inc.
Date: October 3, 2014 (updated June 2017)

References:

AECOS, 2017. *Water quality and biological surveys for the ʻĪao Stream Flood Control Project, Wailuku, Maui.* 18, January 2017.

USACE, 2009. *Draft Environmental Assessment, ʻĪao Stream Flood Control Project, Wailuku, Maui, Hawaiʻi.* March, 2009.

USFWS, 2006. *Revised Draft Fish and Wildlife Coordination Act Report for the ʻĪao Stream Flood Control Project, Maui, Hawai'i*. U.S. Department of the Interior. November. Prepared for U.S. Army Corps of Engineers, Pacific Ocean Division, Honolulu Engineering District.

USFWS, 2011a. *Draft Fish and Wildlife Coordination Act Report; Phase I Supplemental Stream Survey ʻĪao Stream Flood Control Project Wailuku, Maui, HI.* July 2011.

USFWS, 2011b. *Final Fish and Wildlife Coordination Act Report Addendum; Phase 1 Marine Habitat Characterization ʻĪao Stream Flood Control Project Wailuku, Maui, HI.* December 2011.

Appendix D:

Alternatives Screening Matrix

CEPOH-PP-C January 2014

MEMORANDUM FOR RECORD

SUBJECT: A meeting for Iao Stream Flood Control Project Alternatives Screening

1. A meeting was held for the Iao Stream Flood Control Project on 5 November 2013 at 0900 at Bldg 230, Room 318 Conference Room. The following people were in attendance:

Name	Discipline	Office	Phone
Jarrett Hara		CEPOH-EC-T	835-4149
Tracy Kazunaga		CEPOH-EC-S	835-4330
Michael Sakai		CEPOH-PP-R	835-4052
Colette Sakoda		Environet	833-2225 ext. 1004
Lance Shiroma		CEPOH-EC-T	835-4152
Sonia Shjegstad		Environet	833-2225 ext. 1006
Kanalei Shun		CEPOH-PP-E	835-4097
Jessica Wiggs		CEPOH-EC-T	835-4155
Michael Wong		CEPOH-EC-T	835-4138
Max Solmssen		Environet	833-2225 ext. 1012
Nani Shimabuku		CEPOH	835-4030

2. The purpose of the meeting was to conduct the alternatives screening to identify a range of reasonable and prudent alternatives, using the results of the screening to identify a subset of alternatives retained for a full evaluation. The screening was conducted by applying the project screening criteria to each alternative and using the metrics established for each of the criteria to assign potential impacts. This memo presents a brief background of the project purpose and need, applicable regulations and policies considered, and a summary of the alternatives screening exercise.

3. **Purpose and Need.** The purpose of the proposed Iao Stream Flood Control Project is to correct deficiencies associated with the existing Flood Control Project components that were constructed in 1981. Frequent repairs have proved to be costly, both financially and environmentally, and do not adequately address the long-term problems of erosion, sedimentation, and aquatic species degradation. The purpose of this project aims to help preserve the existing watershed and the natural ecosystem within and surrounding the Iao Stream. The preferred alternative has been planned in order to create an aquatic environment that would work to maintain the natural stream and flood plain function, while providing the necessary level of flood control.

4. Modifications to the 1981 Flood Control Project are needed to prevent further property damage resulting from undermining of stream bank and levee locations, and to protect Wailuku town from flood damage. In addition, levee certification that the completed project can withstand a 100-year frequency flood is required by the Federal Emergency Management Agency (FEMA) by February 2009; otherwise, the area protected by the

project will revert to a flood hazard area in Fall 2009. A government agency responsible for levee construction or a Registered Professional Engineer must provide this certification. In its present condition, the project cannot be certified as providing 100-year flood protection because the project is deficient.

5. NEPA. The Council on Environmental Quality regulations (Title 40, Code of Federal Regulations (CFR) §1502.14) for implementing the National Environmental Policy Act of 1969 (NEPA) requires that federal agencies perform the following tasks:

    a. Rigorously explore and objectively evaluate all reasonable alternatives and, for alternatives that were eliminated from detailed study, briefly discuss the reasons for their having been eliminated;

    b. Devote substantial treatment to each alternative considered in detail, including the Proposed Action, so that reviewers may evaluate their comparative merits;

    c. Include reasonable alternatives not within the jurisdiction of the agency; and

    d. Include the No Action alternative.

6. USACE SMART Planning Policy Overview. overview of? or Define the ACOE guidelines being used for Iao Stream..an abbreviated SMART planning policy?

    In February 2012, USACE implemented a SMART planning strategy (MG Walsh Memo 8 February 2012) to its Civil Works planning studies by establishing a disciplined, methodical approach to alternatives formulation and analysis which would yield focused, collaborative and efficient decision making throughout its project development and execution process. SMART is defined as Specific, Measurable, Attainable, Risk-informed, and Timely. Because of the advanced progress of the Iao Stream project, the Project Development Team (PDT) was authorized to apply an abbreviated but effective project alternatives analysis methodology to facilitate decision-making for this project.

7. Identification and Screening of Alternatives. The screening of alternatives involved four key steps. These steps are presented in detail in the following section.

    a. <u>Step 1</u>. Identify All Possible Alternatives.

        i. *Alternative A*: No Action

        ii. *Alternative B*: Removal of Flood Control Improvements; unlined channel remains

        iii. *Alternative C*: Roller Compacted Concrete (RCC) and Grouted Boulder Invert Channel following existing alignment, RCC channel and low-flow channel replace existing channel

iv. *Alternative D*: Dual Stilling and Sedimentation Basins; RCC channel and low-flow channel replace existing stream features: 50:50 hardened and pseudo-natural with design features mimicking natural stream components.

v. *Alternative E*: RCC Channel with Grade Control Structures; RCC channel replacing existing stream features: fully lined, but includes a low-flow channel and some pools.

vi. *Alternative F*: Overflow Section, limited upstream bank armoring and Channel Constriction; retains existing project features.

vii. *Other Alternatives Considered, but Eliminated*: Three alternatives from an earlier project development phase were screened using the same evaluation measures. The alternatives were:

1. Rectangular and Compound Channel;
2. Levee Toe Reconstruction, retains existing project features;
3. Trapezoidal Concrete-lined Channel.

viii. By applying the evaluation criteria to these 3 alternatives, it was concluded by the PDT that they did not meet the project purpose and need.

b. Step 2: Establish and define decision criteria required to ensure an alternative is meeting the purpose and need. Each of the decision criteria (attached) were specifically defined in terms of appropriate metrics to measure how well (high, medium, low, or in other cases, yes or no) an alternative meets each criteria. PDT members used Best Professional Judgment to clearly define the metrics.

c. Step 3: Conduct a rigorous screening of the alternatives using environmentally sound and operationally workable decision criteria for various aspects including completeness, effectiveness, acceptability and efficiency.

i. Completeness.

Technical Feasibility was defined as the ability to meet the project purpose and need. Possible metrics were yes or no; yes is preferred. Of the alternatives considered, Alternatives A and B measured no, while the remaining alternatives measured yes.

Life Safety was defined as the level of life safety risk reduction. Possible metrics were yes or no; yes is preferred. Of the alternatives considered, Alternatives A and B measured no, while the remaining alternatives under consideration measured yes.

ii. Effectiveness.

Meets SPF level of protection (within 20%) was defined as the ability of the alternative to meet the SPF. Possible metrics were yes or no; yes is preferred. Of the alternatives considered, Alternatives A and B measured no, while the remaining alternatives considered measured yes.

Utilization of the floodplain was defined as the ability of the alternative to retain the floodplain as a restricted area, where urbanized development is not allowed. Possible metrics were yes or no; yes is preferred. Of the alternatives considered, Alternative B measured no, while the remaining alternatives considered measured yes.

iii. Acceptability. Real Estate Requirements/Acquisition was defined as the relative magnitude of acres required to implement the alternative (e.g., channel alignment/staging area/access road construction). Possible metrics were low, medium, and high; low is preferred. Of the alternatives considered, Alternatives A and B measured low, Alternatives C and F measured medium and Alternatives D and E measured high.

Increases erosion and sediment transport was defined as the relative magnitude of the sedimentation impacts directly relatable to the alternative. Possible metrics were high, medium, and low; low is preferred. Of the alternatives considered, Alternatives D and F, which include measures to stabilize the channel and also include a significant amount of natural stream bottom to trap sediments, measured low. Alternatives A, C and E either provide incomplete fixes to the current problem of erosion and/or fully line the channel and thereby increase the potential for upstream sedimentation to be transported to the ocean. Therefore these alternatives measured medium. The remaining alternative B, which would lead to additional erosion with no sediment entrapment features, measured high.

Facilitates aquatic organism passage was defined as whether or not the alternative avoids additional impacts to the passage of aquatic organisms in the stream. Possible metrics were yes or no; yes is preferred. All of the alternatives considered would avoid additional impacts to the passage of aquatic organisms, and thus measure yes.

Reduces potential for groundwater recharge was defined as the relative magnitude of any reduction in groundwater recharge directly relatable to the alternative. Possible metrics were high, medium, and low; low is preferred. Of the alternatives considered, Alternative B, which removes all flood control improvements, measured low. Alternatives A, D, E, F, all include some degree of unlined channel bottom, and thus measured

medium. Alternative C, the rectangular and compound channel and the trapezoidal concrete-lined channel, which fully line the stream, all measured high.

iv. Efficiency.

Level of channel hardening was defined as the total percentage of channel hardened. Possible metrics were high, medium and low; low is preferred. Of the alternatives considered, Alternative B was low, Alternatives A, D and F were medium, and Alternatives C and E were high.

O&M Requirements / Ease of Maintenance was defined as the relative magnitude of anticipated O&M costs directly relatable to the implemented alternative. Possible metrics were high, medium, and low; low is preferred. Of the alternatives considered, Alternatives C, D and E would all reduce the frequency and magnitude of channel maintenance required, and thus measured low. Alternatives A and F would require some channel maintenance, equivalent to the current expenditure, and thus measured medium. Alternative B, which would remove all flood control improvements and require an increased level of channel maintenance, measured high.

Implementation cost was defined as the relative magnitude of total project cost. Possible metrics were high, medium and low; low is preferred. Of the alternatives considered, Alternative F measured low. Alternatives B, C, D, and E all measured high. The remaining alternatives were not screened for this decision criteria, either because they represented the no action (A) or because the alternatives were removed from consideration due to technical inadequacies earlier on the screening process.

Net benefits were defined as the difference between the annualized benefits and costs. Possible metrics were yes or no; yes is preferred. Of the alternatives considered, only Alternative F offered positive net benefits.

d. Step 4: Arrive at a Final Array of Alternatives while eliminating those that did not meet the decision criteria. The Alternatives Matrix (attached) provides an overview of the proposed alternatives and analyses of each alternative by evaluation criteria. Based on the alternatives screening exercise, the alternatives retained for the final array include Alternative A and Alternative F. The remaining alternatives were dropped from consideration for not adequately meeting one or more of the other decision criteria.

e. Step 5: Findings, Conclusions, arrival at the Tentatively Selected Plan (TSP): All project alternatives under final consideration were run through a rigorous screening process that rated each alternative based on the criteria established for

the alternative selection process (Step 3). The TSP was then selected based on its feasibility to be implemented and lack of disturbance to the existing environment. The TSP for the project was Alternative F: Overflow Section, limited upstream bank armoring and Channel Constriction; retains existing project features. Alternative F offers adequate flood protection to the existing built environment while only affecting a small portion of the existing stream channel where the overflow section and limited armoring would occur. Alternative F would channel flood waters from the main channel onto the designated flood plain where flood waters would be able to be dispersed into the natural flood plain. Flow velocity would be reduced in the main channel during flood events as a result of Alternative F, and sediment and other entrained constituents would be able to settle out into the natural flood plain area instead of being directly channeled downstream and into the near shore marine environment.

Ms. Nani Shimabuku
Project Manager

Iao Stream Flood Control Project
Screening Criteria for Alternatives to
Identify Tentatively Selected Plan
6 November 2013
Revised 13 November 2013

Decision Criteria	Metrics	PDT Assignments
Completeness		
1. Technical Feasibility	Yes/No. *Does it meet the purpose and need?*	Michael/Jessica
2. Life Safety (Flood Risk)	Yes/No. *Does the alternative reduce life safety risk?*	Lance
Effectiveness		
3. Meets SPF Level of Flood Protection (within 20%)	Yes/No. *Does the alternative provide the Standard Project Flood level of protection?*	Michael/Jessica
4. Utilization of Floodplain	Yes/No. *Does the floodplain remain a restricted floodplain, where urbanized development is not allowed?*	Michael/Jessica
Acceptability		
5. Real Estate Requirements/ Acquisition	High/Medium/Low. *Number of acres needed for channel alignment/staging area/access road. Amount of land acquisition.* • High = *A Lot (>5 acres)* • Medium = *Some (3.1-4.9 acres)* • Low = *Little to None (<3 acres)*	Mike
6. Increases Erosion & Sediment Transport (Sedimentation Impacts)	High/Medium/Low. *Increases erosion and/or transport of sediment.* • High = *Significant Increase* • Medium = *Little to Moderate Increase* • Low = *Reduction in Sediment*	Environet
7. Facilitates Aquatic Organism Passage	Yes/No. *Does it avoid additional impacts to aquatic organism passage?*	Michael/Jessica Environet
8. Reduces Potential for Groundwater Recharge	High/Medium/Low. *Extent of exist channel improvements removed to allow for groundwater recharge* : • High = *Significant Reduction in Recharge*	Environet

*Low and Yes are preferred.

Decision Criteria	Metrics	PDT Assignments
	• Medium = *Allows Some Recharge* • Low = *Increases Recharge*	
Efficiency		
9. Level of Channel Hardening	High/Medium/Low. *Total percentage of channel hardening.* • High = *Greater than 70%* • Medium = *20% to 70%* • Low = *Less than 20%*	Michael/Jessica Environet
10. O&M Requirements/ Ease of Maintenance	High/Medium/Low. *Rough Order Magnitude O&M costs based on BPJ.* • High = *Increases Annual Costs* • Medium = *Same as Current* • Low = *Reduces Annual Costs*	PDT Michael/Jessica
11. Implementation Cost (real estate and environmental costs not included)	High/Medium/Low. *Total Project Costs.* • *High = greater than $30M* • *Medium = $10M-$30M* • *Low = less than $10M*	Tracy
12. Net Benefits	Yes/No. *Is there a positive net benefit?* *Net Benefits = Annualized Benefits – Annualized Costs*	Lance

*Low and Yes are preferred.

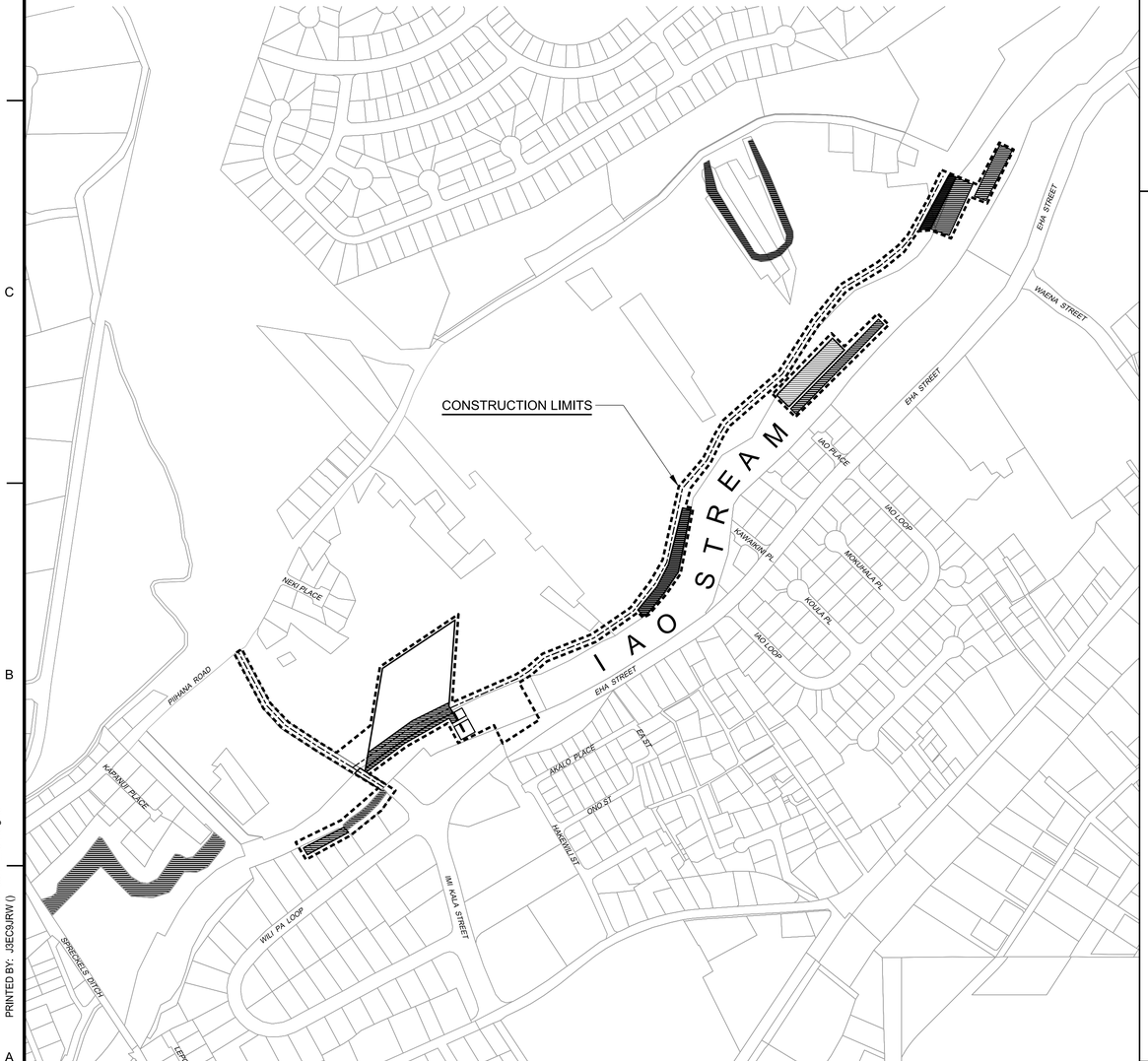
Iao Stream Flood Control Project, Wailuku, Maui, Hawaii
Matrix of the Proposed Alternatives for a Draft Environmental Assessment

Description of Alternative		Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F	Alternatives Removed from Consideration		
		No Action (retains existing project features)	Removal of Flood Control Improvements (unlined channel remains)	Roller Compacted Concrete (RCC) and Grouted Boulder Invert Channel Following Existing Alignment (RCC channel and low-flow channel replace existing channel)	Dual Stilling and Sedimentation Basins (RCC low-flow channel replaces existing stream features: 50:50 hardened and pseudo-natural, with design features mimic natural stream components)	RCC Channel with Grade Control Structures (RCC channel and low-flow channel replace existing stream features: fully lined, but includes a low-flow channel and some pools)	Floodplain Reconnection, Limited Upstream Bank Armoring and Channel Constriction (retains existing project features)	Rectangular and Compound Channel	Levee Toe Reconstruction (retains existing project features)	Trapezoidal Concrete-Lined Channel
Technical Feasibility (*Yes/No*)	**Completeness**	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Life Safety (Flood Risk) *(Yes/No)*		No	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Meets SPF Level of Flood Protection (within 20%) (*Yes/No*)	**Effectiveness**	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Utilization of Floodplain (*Yes/No*)		Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
Real Estate Requirements/Acquisition (*High, Medium, Low*)	**Acceptablility**	Low	Low	Medium	High	High	Medium	Medium	Low	Medium
Increases Erosion and Sediment Transport (Sedimentation Impacts) (*High, Medium, Low*)		Medium	High	Medium	Low	Medium	Low	High	Medium	High
Facilitates Aquatic Organism Passage (*Yes, No*)		Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Reduces Potential for Groundwater Recharge (*High, Medium, Low*)		Medium	Low	High	Medium	Medium	Medium	High	Medium	High
Level of Channel Hardening (*High, Medium, Low*)	**Efficiency**	Medium (45%)	Low (0%)	High (100%)	Medium (50%)	High (90%)	Medium (45%)	High (100%)	Medium (45%)	High (100%)
O&M Requirements/Ease of Maintenance (*High, Medium, Low*)		Medium	High	Low	Low	Low	Medium	Low	Medium	Low
Implementation Cost (real estate and environmental not included) (*High, Medium, Low*)		N/A	High	High	High	High	Low	N/A	N/A	N/A
Net Benefits (*Yes, No*)		N/A	No	No	No	No	Yes	N/A	N/A	N/A

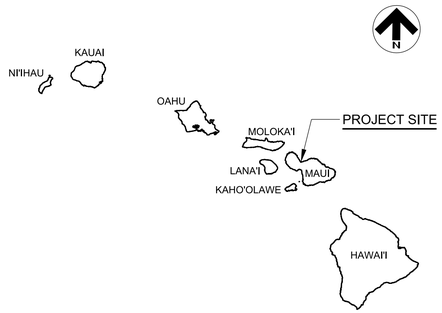
Appendix E:

Engineering Drawings

IAO STREAM
FLOOD CONTROL PROJECT
WAILUKU, MAUI, HI



3 GENERAL SITE PLAN
1" = 300'



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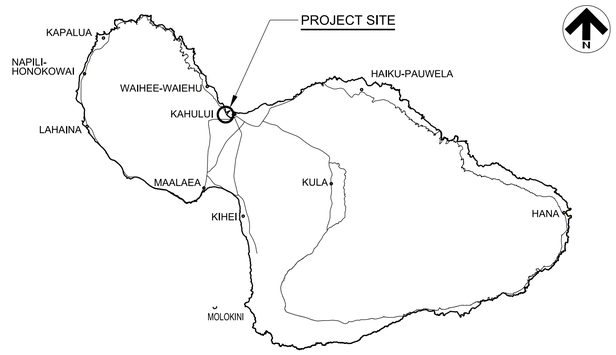
NOT TO SCALE



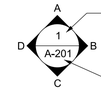
2 VICNITY MAP
NOT TO SCALE

ABBREVIATIONS

#	POUNDS
BOT	BOTTOM
CONC	COCRETE
℄	CENTERLINE
CY	CUBIC YARD
DIA	DIAMETER
DWG	DRAWING
EA	EACH
EL	ELEVATION
EXST	EXISTING
FT	FEET
HORIZ	HORIZONTAL
INV	INVERT
LB	LEFT BANK
LF	LINEAR FEET
MAINT	MAINTENANCE
MAX	MAXIMUM
MIN	MINIMUM
NO	NUMBER
OC	ON CENTER
RB	RIGHT BANK
S	SLOPE
SHT	SHEET
ST	STREET
STA	STATION
TYP	TYPICAL
VERT	VERTICAL

GENERAL SYMBOLS

ELEVATION



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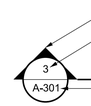
- DIRECTION
- NUMBER OF SHEET ON WHICH ELEVATION IS DRAWN

DETAIL



- DETAIL IDENTIFICATION NUMBER
- NUMBER OF SHEET ON WHICH DETAIL OF THE CONDITION IS DRAWN

SECTION



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- SECTION IDENTIFICATION NUMBER
- NUMBER OF SHEET ON WHICH SECTION IS DRAWN



DRAWING TITLE
SCALE
- DRAWING SCALE
- DRAWING TITLE NUMBER

INDEX OF DRAWINGS

SHEET ID	SHEET OF	SHEET TITLE	REV
		GENERAL	
G-001		TITLE SHEET, VICINITY MAP, PROJECT LOCATION, SITE LOCATION	
		CIVIL	
C-101		GENERAL SITE PLAN	
C-102		CONC DIVERSION WEIR PLAN	
C-201		LATERAL WEIR AND OVERFLOW CHANNEL PROFILES	
C-202		RAISED BERM PROFILE	
C-301		TYPICAL CROSS SECTIONS @ STA. 75+10 TO 74+71	
C-302		TYPICAL CROSS SECTIONS @ STA. 75+50 TO 75+10	
C-303		TYPICAL CROSS SECTIONS, OVERFLOW CHANNEL	
C-501		CIVIL DETAILS	
		STRUCTURAL	
S-101		WEIR PLAN & ELEVATION	
S-301		DIVERSION WEIR CROSS SECTION	
S-302		RETAINING WALL CROSS SECTION	

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MARK	DESCRIPTION	DATE	APPR.

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A-1			

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LOCATION NO.:
FILE NUMBER: FILE NUMBER
FILE NAME: FILE NUMBER

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
FT SHAFTER, HAWAII

MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

TITLE SHEET
INDEX OF DRAWINGS
GENERAL NOTES AND LOCATION

SHEET IDENTIFICATION
G-001
SHEET 0 OF 0

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ANSI D 22 x 34

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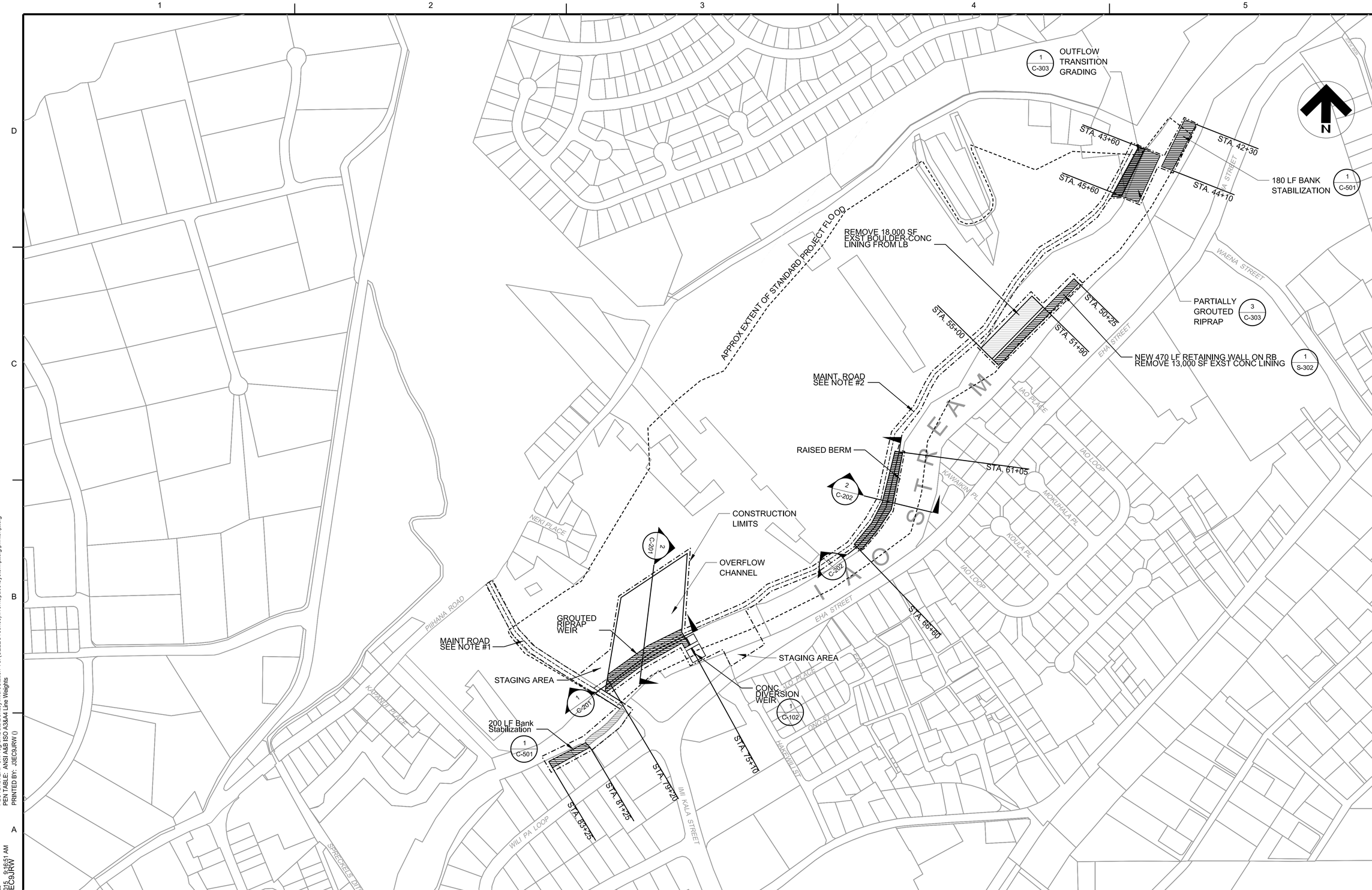

NOTES:
1. ACQUIRE PERMANENT EASEMENT RIGHTS FOR O&M ACCESS ALONG EXST ROAD.
2. CONSTRUCT PERMANENT O&M ROAD: 3" THICK GRAVEL ON GEOTEXTILE, 15' WIDE.

1 C-101 GENERAL SITE PLAN
1" = 200'

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SUBMITTED BY:
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LOCATION NO.:
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MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

GENERAL SITE PLAN

SHEET IDENTIFICATION
C-101
SHEET 0 OF 0

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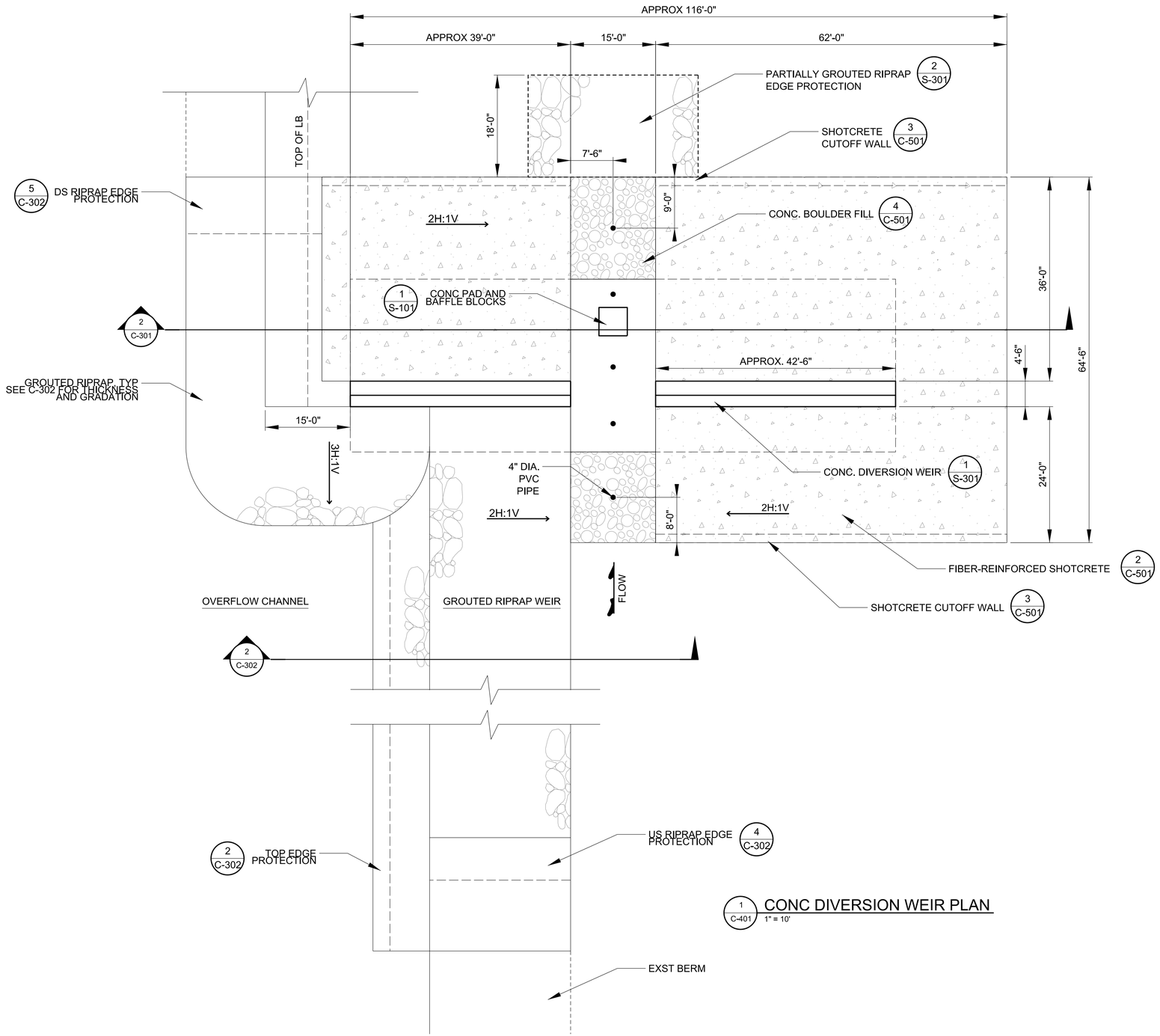

1 C-401 CONC DIVERSION WEIR PLAN
1" = 10'

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MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

WEIR SITE PLAN

SHEET IDENTIFICATION
C-102
SHEET 0 OF 0

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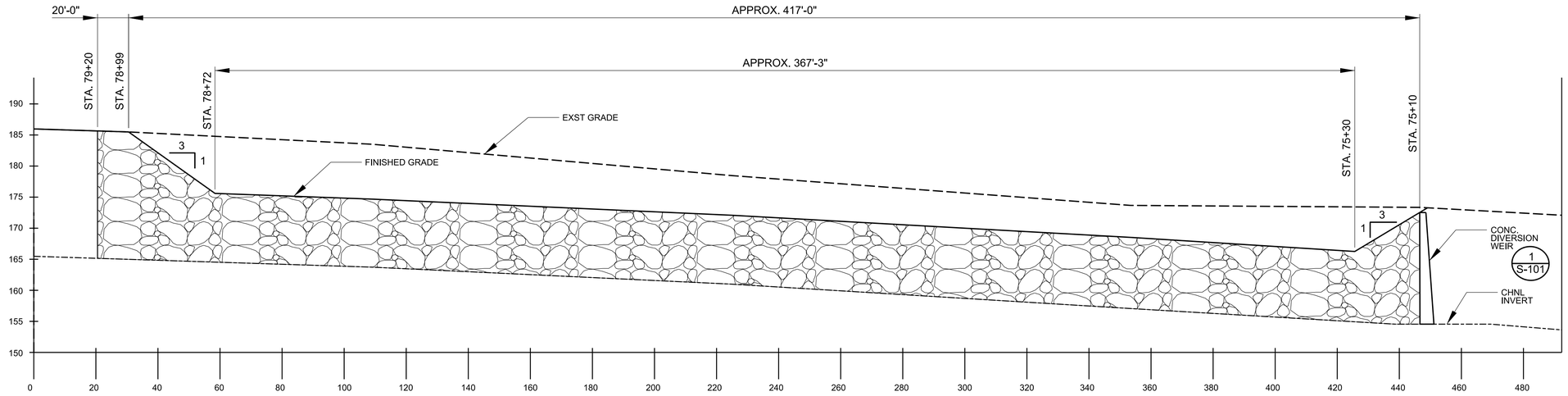
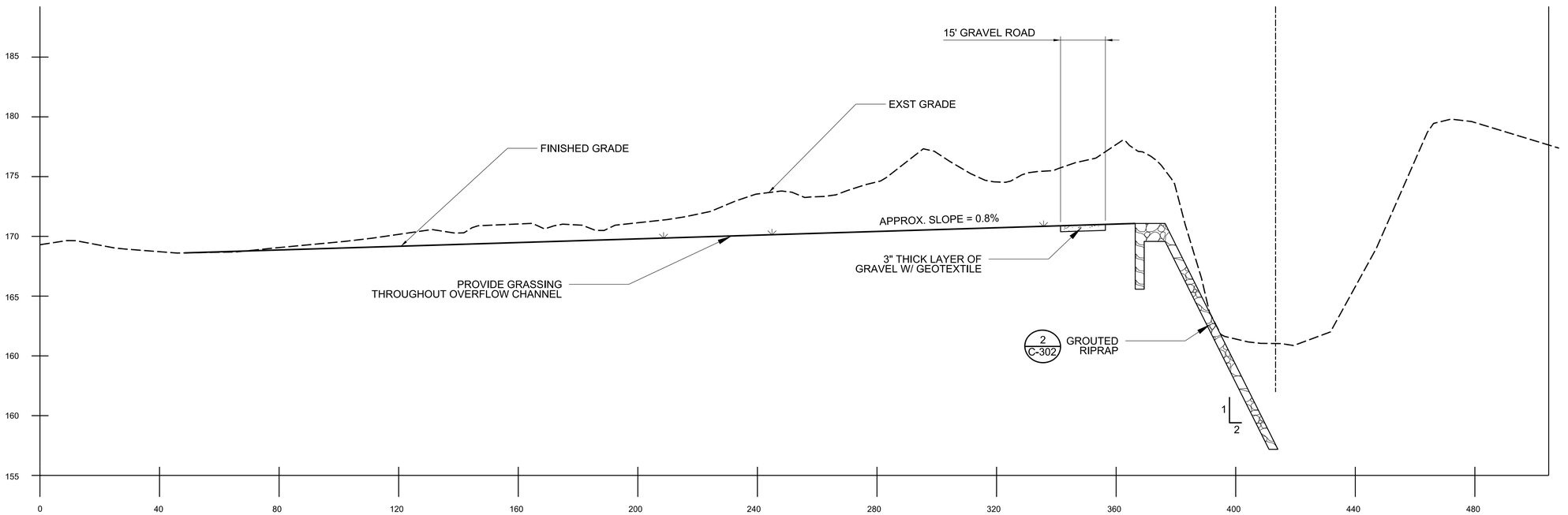


1 / C-201 **LB PROFILE, STA. 78+99 TO 75+10**
HORIZONTAL 1" = 10' VERTICAL 1" = 20'



2 / C-201 **OVERFLOW CHANNEL PROFILE**
HORIZONTAL 1" = 10' VERTICAL 1" = 40'

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MARK	DESCRIPTION	DATE	APPR.

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FILE NAME:

US ARMY CORPS OF ENGINEERS
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FT SHAFTER, HAWAII

MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

OVERFLOW CHANNEL
ELEVATION PROFILES

SHEET IDENTIFICATION
C-201
SHEET 0 OF 0

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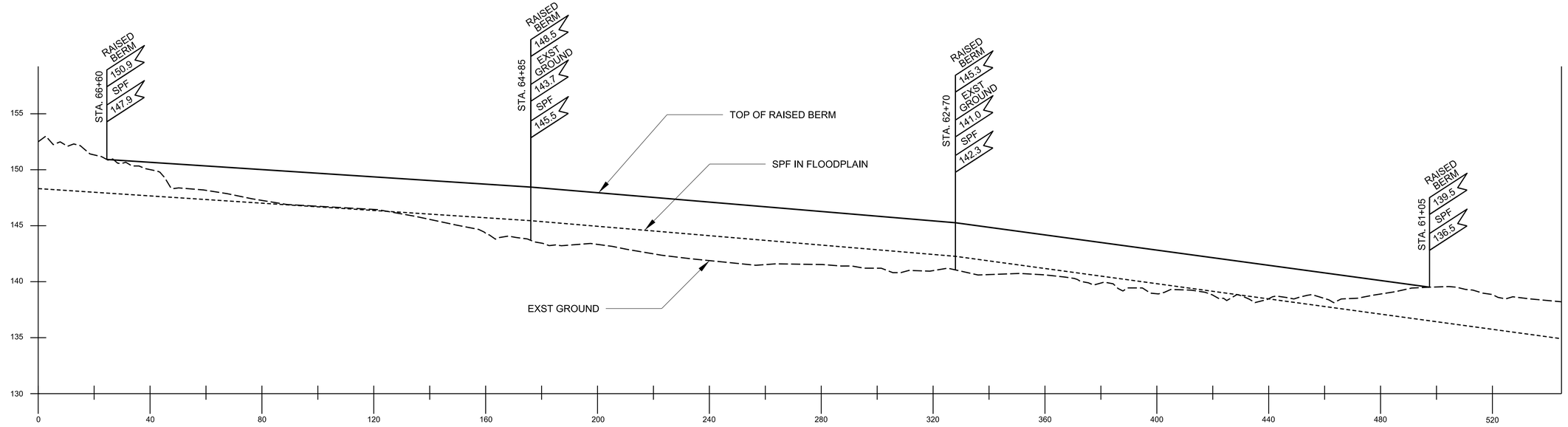
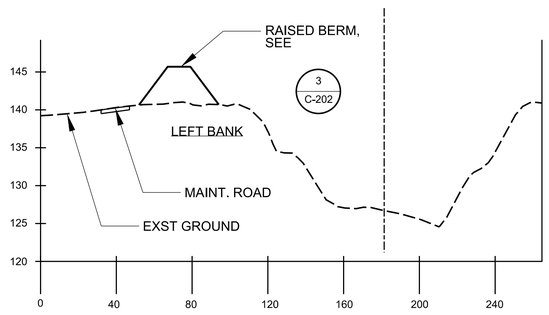
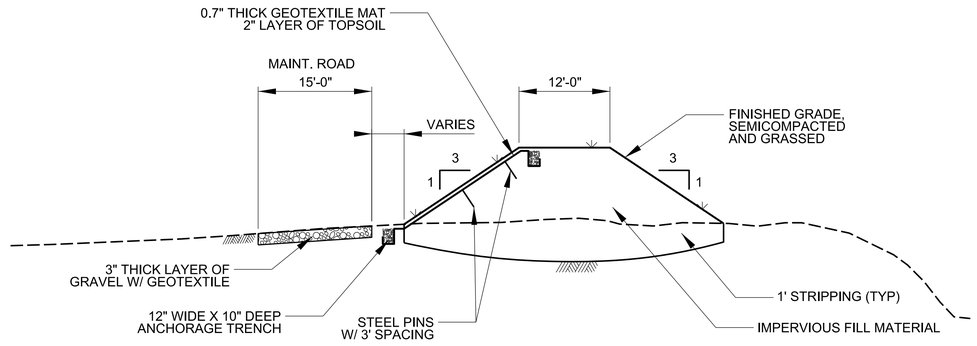


1 C-202 RAISED BERM PROFILE, STA. 66+60 TO 61+05
HORIZONTAL 1" = 20' VERTICAL 1" = 5'



2 C-202 CROSS SECTION, STA. 62+70
HORIZONTAL 1" = 40' VERTICAL 1" = 10'



3 C-202 RAISED BERM, TYP CROSS SECTION
HORIZONTAL 1" = 10' VERTICAL 1" = 5'

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CKD BY:
SUBMITTED BY:
PLOT SCALE: AS SHOWN
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SIZE:
FILE NAME:
ISSUE DATE:
SOLICIT./ CONTRACT NO.:
LOCATION NO.:
FILE NUMBER:

MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

RAISED BERM
PROFILE AND SECTION

SHEET IDENTIFICATION
C-202
SHEET 0 OF 0

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PEN TABLE: ANSI A&B ISO A3&A4 Line Weights
PRINTED BY: J3EC9JRW ()

ANSI D 22 x 34

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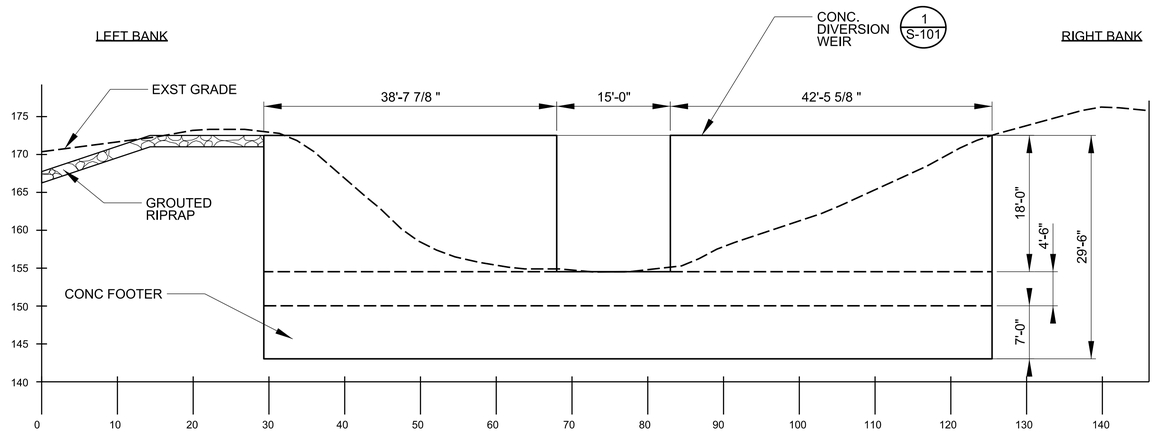
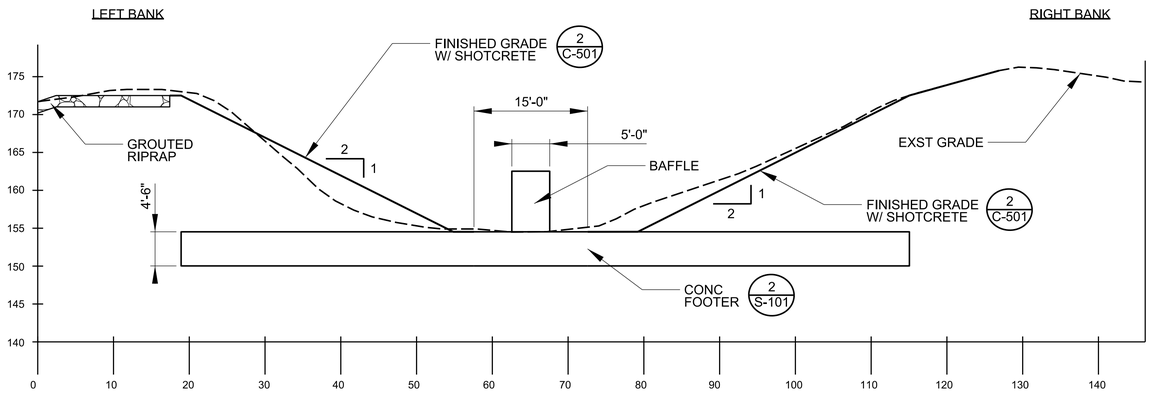


1 C-301 WEIR SECTION AT STA 75+10
1" = 10'



2 C-301 TYPICAL SECTION AT STA. 75+00
1" = 10'

US Army Corps of Engineers®
HONOLULU DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
FT SHAFTER, HAWAII

DESIGNED BY: JRW
DWN BY: JRW
CKD BY:
SUBMITTED BY:
PLOT SCALE: AS SHOWN
PLOT DATE:
SIZE:
FILE NAME:
ISSUE DATE:
SOLICIT./ CONTRACT NO.:
LOCATION NO.:
FILE NUMBER:

MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

TYPICAL CROSS SECTIONS
@ STA. 75+10 TO 74+71

SHEET IDENTIFICATION
C-301
SHEET 0 OF 0

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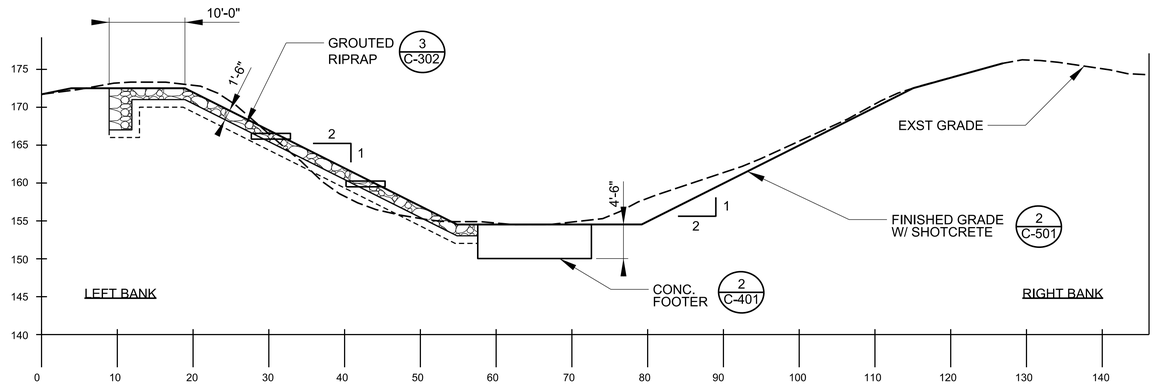
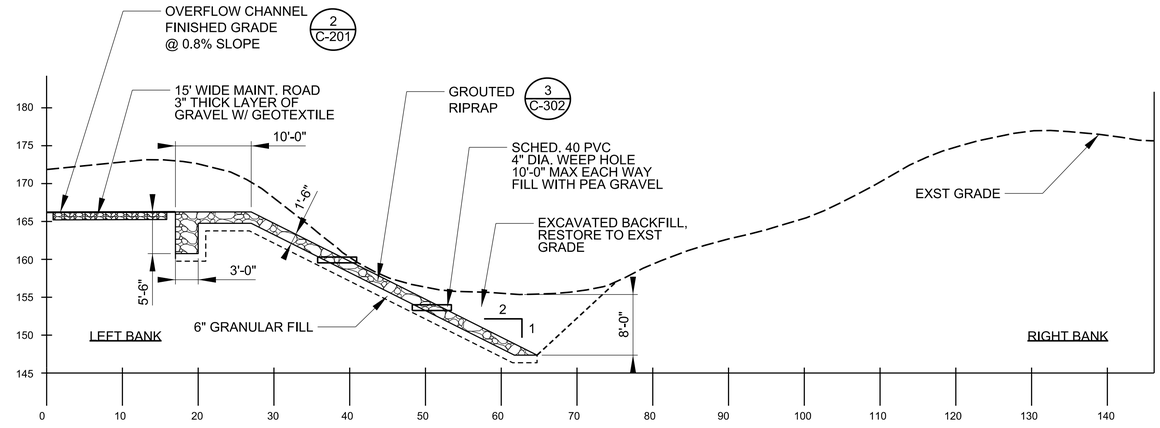
ANSI D 22 x 34

This project was designed by the Honolulu District of the U.S. Army Corps of Engineers. The initials or signatures and registration designations of individuals appear on these project documents within the scope of their employment as required by ER 1110-1-8152.



1 C-302 TYPICAL SECTION AT STA 75+15
1" = 10'



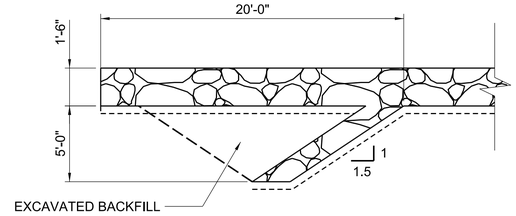
NOTES:

1. SUITABLE BOULDERS REMOVED DURING EXCAVATION FOR THE OVERFLOW CHANNEL MAY BE USED FOR THE GROUTED RIPRAP REVETMENT IF WITHIN THE ALLOWABLE WEIGHT RANGE.

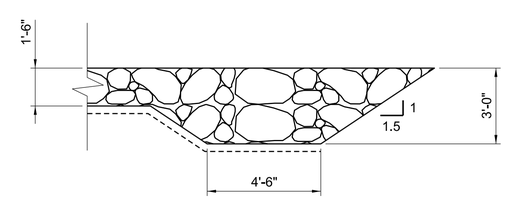
2 C-302 TYPICAL SECTION AT STA. 75+50
1" = 10'

% LIGHTER BY WEIGHT	LIMITS OF STONE WEIGHT IN POUNDS
100%	2,200
85%	600 - 1,000
50%	240 - 420
15%	62 - 180

3 C-302 RIPRAP GRADATION SCHEDULE



4 C-302 US RIPRAP EDGE PROTECTION



5 C-302 DS RIPRAP EDGE PROTECTION

US Army Corps of Engineers®
HONOLULU DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

ISSUE DATE:
SOLICIT./ CONTRACT NO.:
LOCATION NO.:
FILE NUMBER:
FILE NAME:
PLOT DATE:
PLOT SCALE: AS SHOWN
SIZE:
DESIGNED BY: JRW
DWN BY: JRW
CKD BY:
SUBMITTED BY:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
FT SHAFTER, HAWAII

MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

TYPICAL CROSS SECTIONS
@ STA. 75+50 TO 75+10

SHEET IDENTIFICATION
C-302
SHEET 0 OF 0

FILE: pw:\\POH-AP07FTS.poh.ds.usace.army.mil:poh-ap07fts\Documents\11 Other Locations\2 - Maui\Civil_Works\Iao Stream\01-Drawings\Civil\Typical Cross Sections
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PEN TABLE: ANSI A&B ISO A3&A4 Line Weights
LAST SAVED BY: J3EC9JRW
PRINTED BY: J3EC9JRW ()

ANSI D 22 x 34

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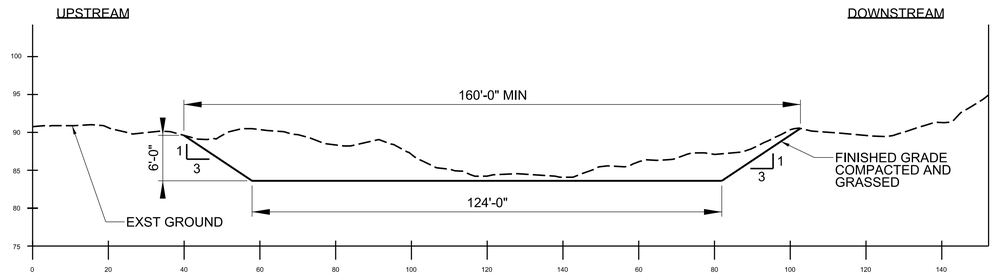
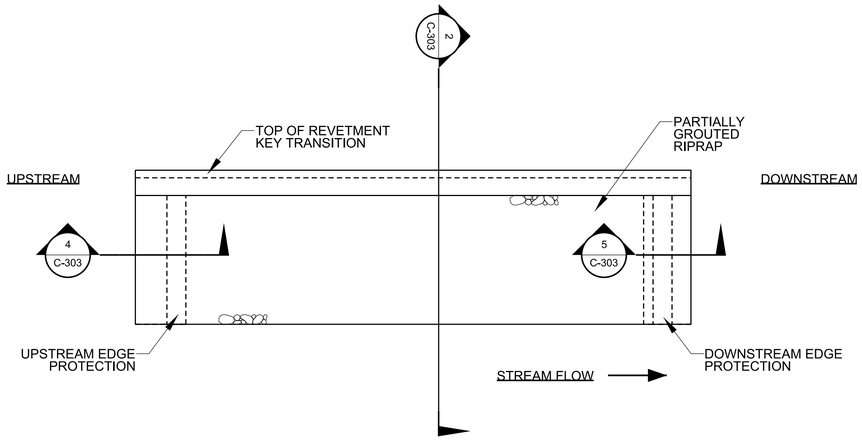


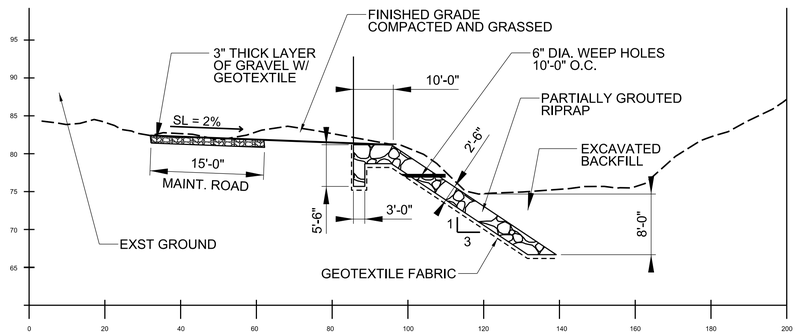
1 C-303 LEFT BANK PROFILE, STA 45+60 TO 43+60

HORIZONTAL 1" = 20' VERTICAL 1" = 10'



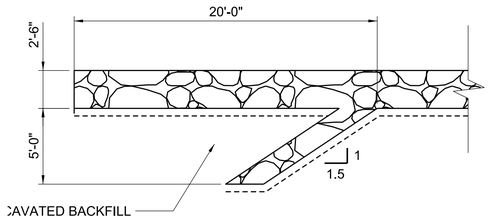
3 C-303 OUTFLOW REVETMENT PLAN

1" = 30'



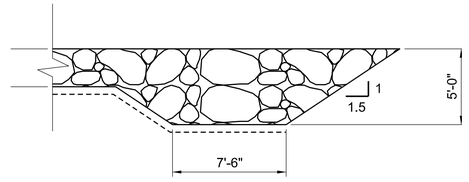
2 C-303 TYP OUTFLOW SECTION @ STA 44+55

HORIZONTAL 1" = 20' VERTICAL 1" = 10'



4 C-303 TYP UPSTREAM SECTION

1" = 5'



5 C-303 TYP DOWNSTREAM SECTION

1" = 5'

% LIGHTER BY WEIGHT	LIMITS OF STONE WEIGHT IN POUNDS
100%	2,200
85%	600 - 1,000
50%	240 - 420
15%	62 - 180

6 C-303 RIPRAP GRADATION SCHEDULE

US Army Corps of Engineers
HONOLULU DISTRICT

MARK	DESCRIPTION	DATE	APPR.
MARK	DESCRIPTION	DATE	APPR.

ISSUE DATE:
SOLICIT. / CONTRACT NO.:
LOCATION NO.:
FILE NUMBER:
PLOT DATE:
FILE NAME:
SIZE:

DESIGNED BY: JRW
DWN BY: JRW
CKD BY:
SUBMITTED BY:
PLOT SCALE: As shown

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
FT SHAFTER, HAWAII

MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

TYPICAL CROSS SECTIONS
FLOODPLAIN OUTFLOW

SHEET IDENTIFICATION
C-303
SHEET 0 OF 0

PLOTDRIVER: $PLTDRV$
PEN TABLE: $PENTBL$
PRINTED BY: $USER$

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DATE & TIME: $DATE$, $TIME$
LAST SAVED BY: $USER$

ANSI D 22 x 34

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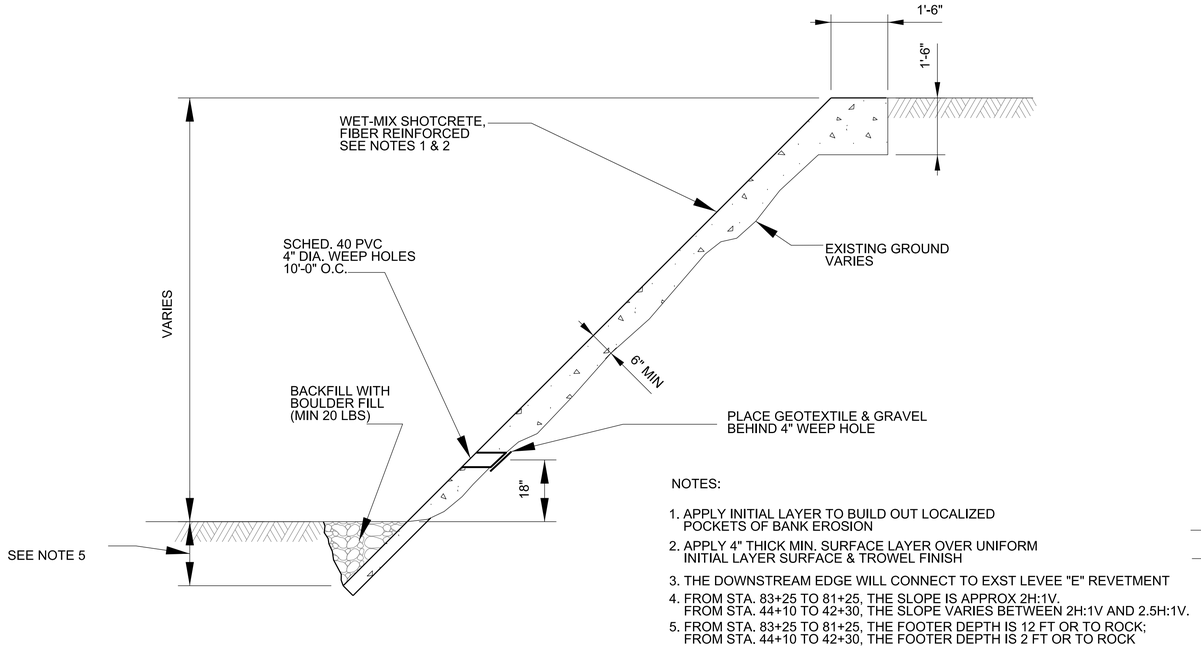
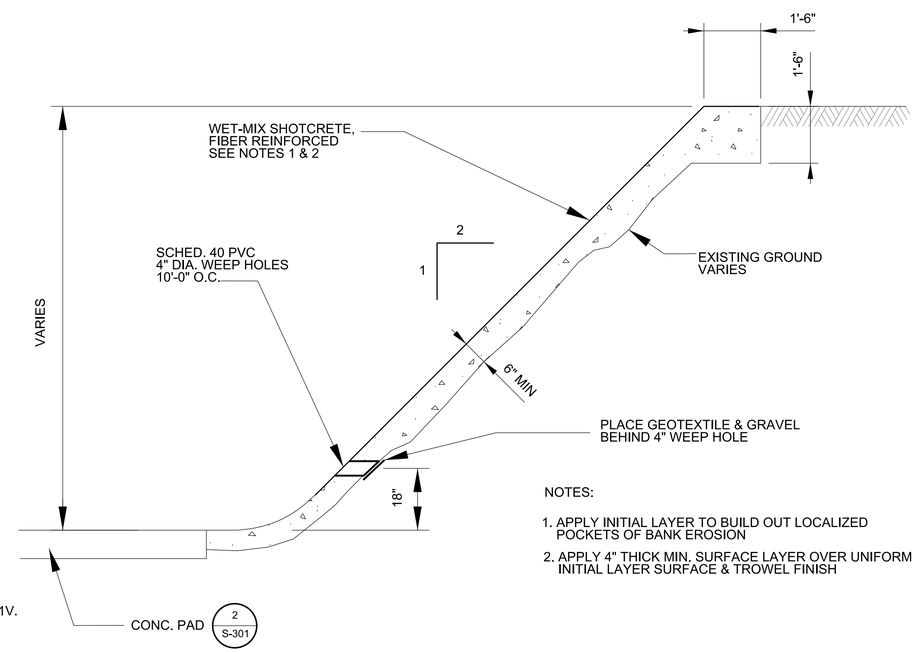


NOTES:

1. APPLY INITIAL LAYER TO BUILD OUT LOCALIZED POCKETS OF BANK EROSION
2. APPLY 4" THICK MIN. SURFACE LAYER OVER UNIFORM INITIAL LAYER SURFACE & TROWEL FINISH
3. THE DOWNSTREAM EDGE WILL CONNECT TO EXST LEVEE "E" REVETMENT
4. FROM STA. 83+25 TO 81+25, THE SLOPE IS APPROX 2H:1V. FROM STA. 44+10 TO 42+30, THE SLOPE VARIES BETWEEN 2H:1V AND 2.5H:1V.
5. FROM STA. 83+25 TO 81+25, THE FOOTER DEPTH IS 12 FT OR TO ROCK; FROM STA. 44+10 TO 42+30, THE FOOTER DEPTH IS 2 FT OR TO ROCK

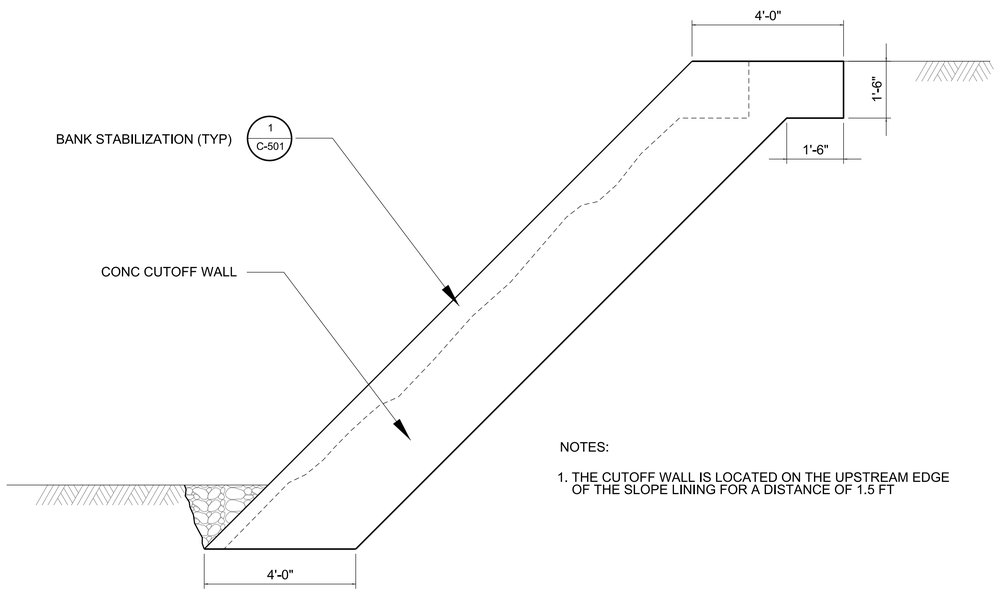
1 / C-501 BANK STABILIZATION (TYP)
1" = 2'



NOTES:

1. APPLY INITIAL LAYER TO BUILD OUT LOCALIZED POCKETS OF BANK EROSION
2. APPLY 4" THICK MIN. SURFACE LAYER OVER UNIFORM INITIAL LAYER SURFACE & TROWEL FINISH

2 / C-501 SLOPE LINING @ INLINE WEIR SITE
1" = 2'

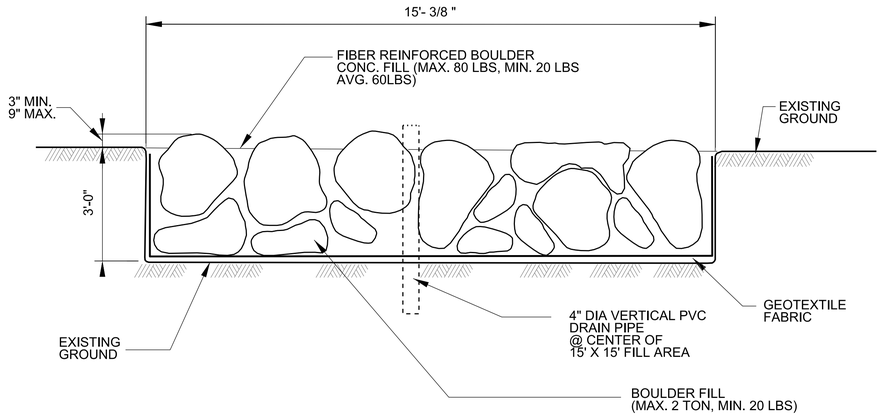


NOTES:

1. THE CUTOFF WALL IS LOCATED ON THE UPSTREAM EDGE OF THE SLOPE LINING FOR A DISTANCE OF 1.5 FT

3 / C-501 CONC CUTOFF WALL
1" = 2'

NOTES:
1. ONLY USE SMALL COMPACTOR
2. GEOTEXTILE SHALL HAVE CONTINUOUS OVERLAP OF 12" MIN.



4 / C-501 CONC. BOULDER FILL DETAIL
1" = 2'

US Army Corps of Engineers
HONOLULU DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JRW
DWN BY: WKP
SUBMITTED BY:
PLOT SCALE: AS SHOWN
SIZE:
ISSUE DATE:
SOLICIT. / CONTRACT NO.:
LOCATION NO.:
PLOT DATE:
FILE NUMBER:
FILE NAME:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
FT SHAFTER, HAWAII

MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

CIVIL DETAILS

SHEET IDENTIFICATION
C-501
SHEET 0 OF 0

FILE: pw:\POH-AP07FTS.poh.ds.usace.army.mil:poh-ap07fts\Documents\11 Other Locations\2 - Maui\Civil_Works\Iao Stream\01-Drawings\Civil\Civil Details
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PEN TABLE: ANSI A&B ISO A3&A4 Line Weights
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ANSI D 22 x 34

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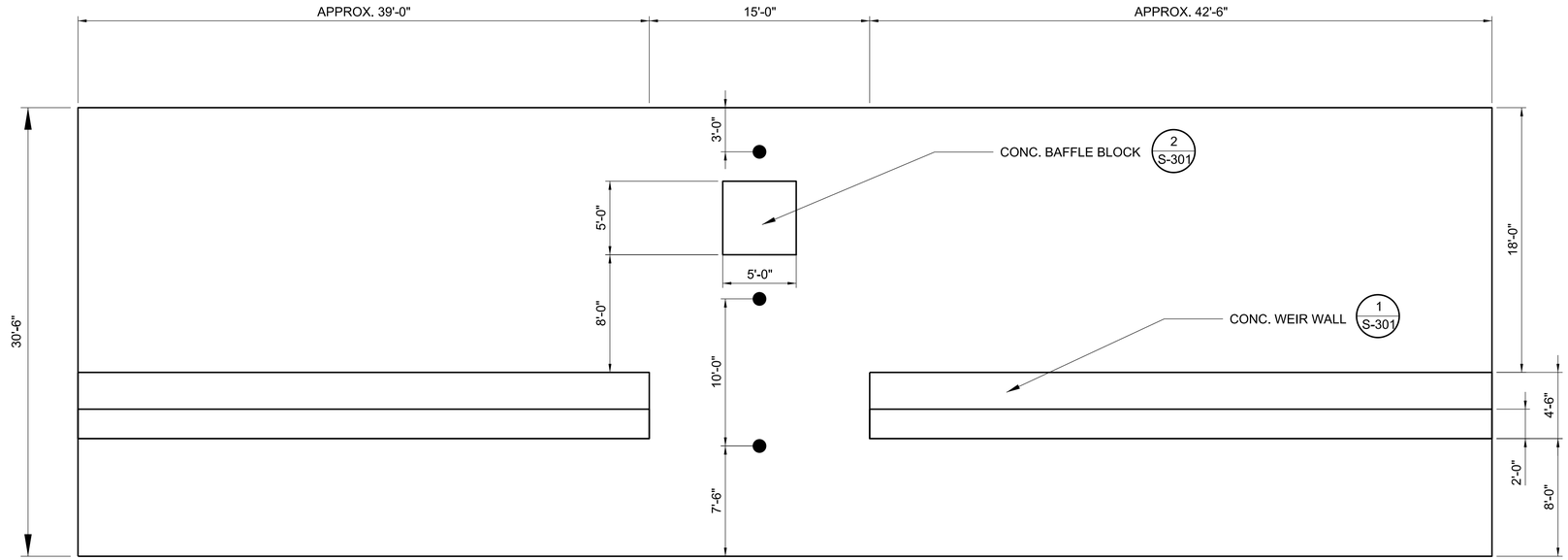
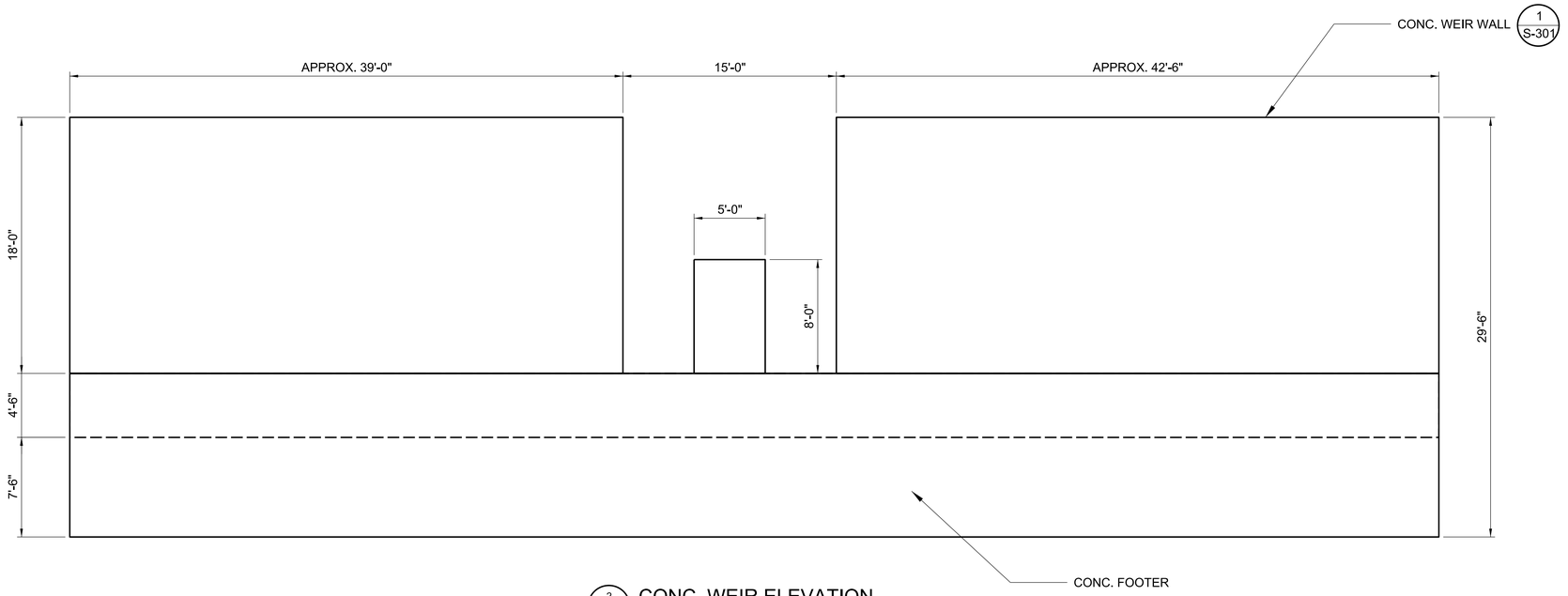


1 S-101 CONC. WEIR PLAN
1" = 5'



2 S-101 CONC. WEIR ELEVATION
1" = 5'

US Army Corps of Engineers®
HONOLULU DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

ISSUE DATE:
SOLICIT./ CONTRACT NO.:
LOCATION NO.:
FILE NUMBER:
DESIGNED BY:
DWN BY:
CKD BY:
SUBMITTED BY:
PLOT SCALE: AS SHOWN
PLOT DATE:
SIZE:
FILE NAME:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
FT SHAFTER, HAWAII

MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

WEIR PLAN
AND ELEVATION

SHEET IDENTIFICATION
S-101
SHEET 0 OF 0

FILE: pw:\\POH-AP07FTS.poh.ds.usace.army.mil:poh-ap07fts\Documents\11 Other Locations\2 - Maui\Civil_Works\Iao Stream\01-Drawings\Structural\Weir Plan and Elevation
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PRINTED BY: J3EC9JRW ()

ANSI D 22 x 34

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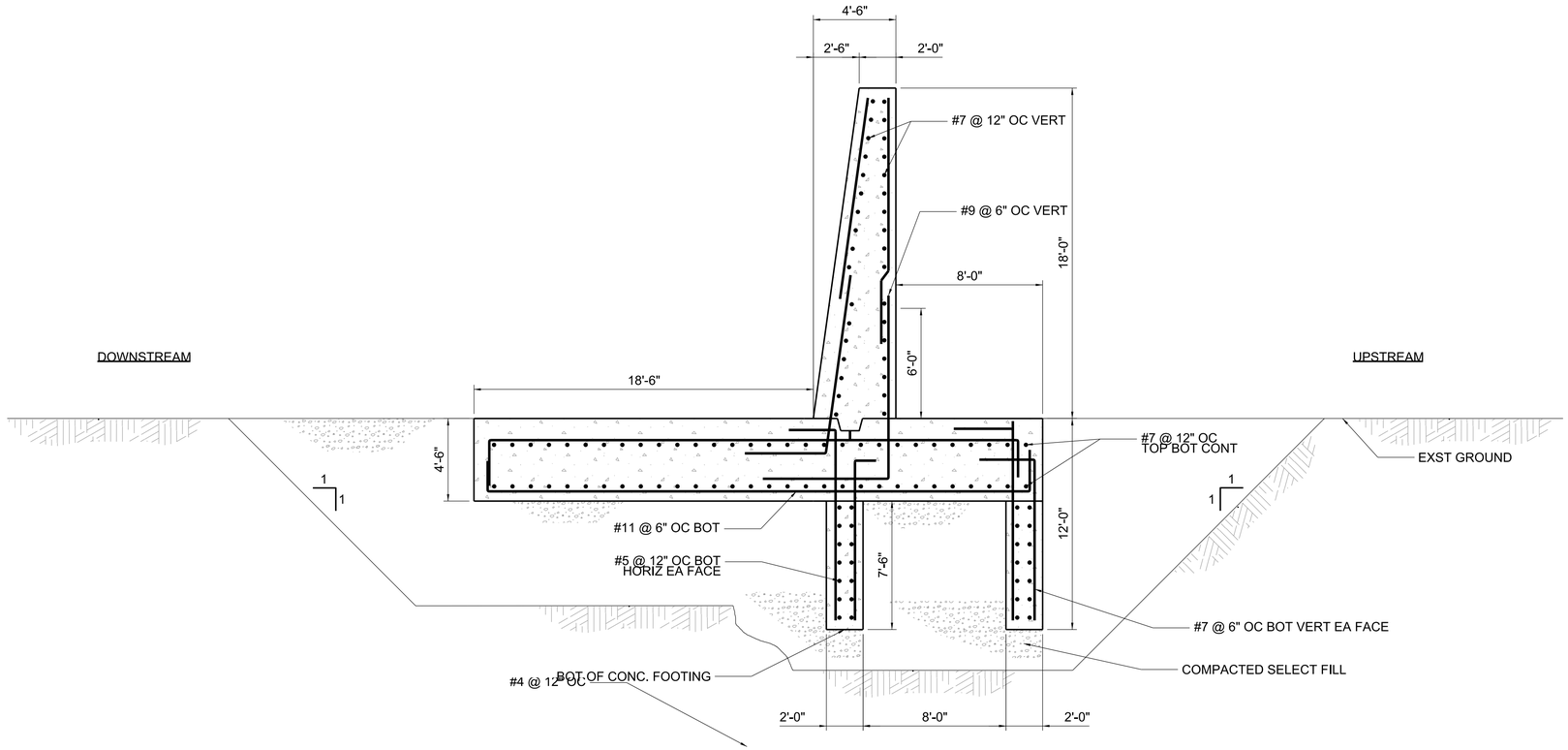

1 S-301 CONC. WEIR SECTION
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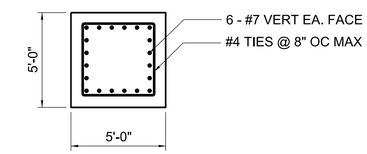
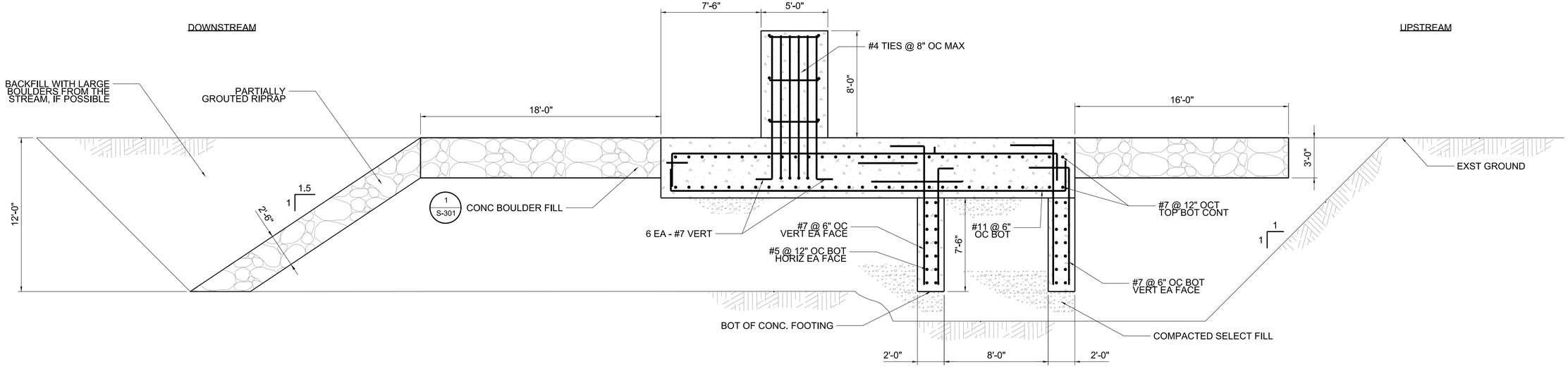


3 S-301 BAFFLE PLAN
NOT TO SCALE



2 S-301 CHANNEL AND BAFFLE SECTION
NOT TO SCALE

US Army Corps of Engineers®
HONOLULU DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

ISSUE DATE:
SOLICIT./ CONTRACT NO.:
LOCATION NO.:
FILE NUMBER:
DESIGNED BY: JRW
DWN BY: WKP
CKD BY:
SUBMITTED BY:
PLOT SCALE: AS SHOWN
PLOT DATE:
SIZE:
FILE NAME:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
FT SHAFTER, HAWAII

MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

WEIR AND BAFFLE
CROSS SECTION

SHEET IDENTIFICATION
S-301
SHEET 0 OF 0

FILE: pw:\\POH-AP07FTS.poh.ds.usace.army.mil:poh-ap07fts\Documents\11 Other Locations\2 - Maui\Civil_Works\Iao Stream\01-Drawings\Structural\Weir & Baffle Cross Section
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PEN TABLE: ANSI A&B ISO A3&A4 Line Weights
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ANSI D 22 x 34

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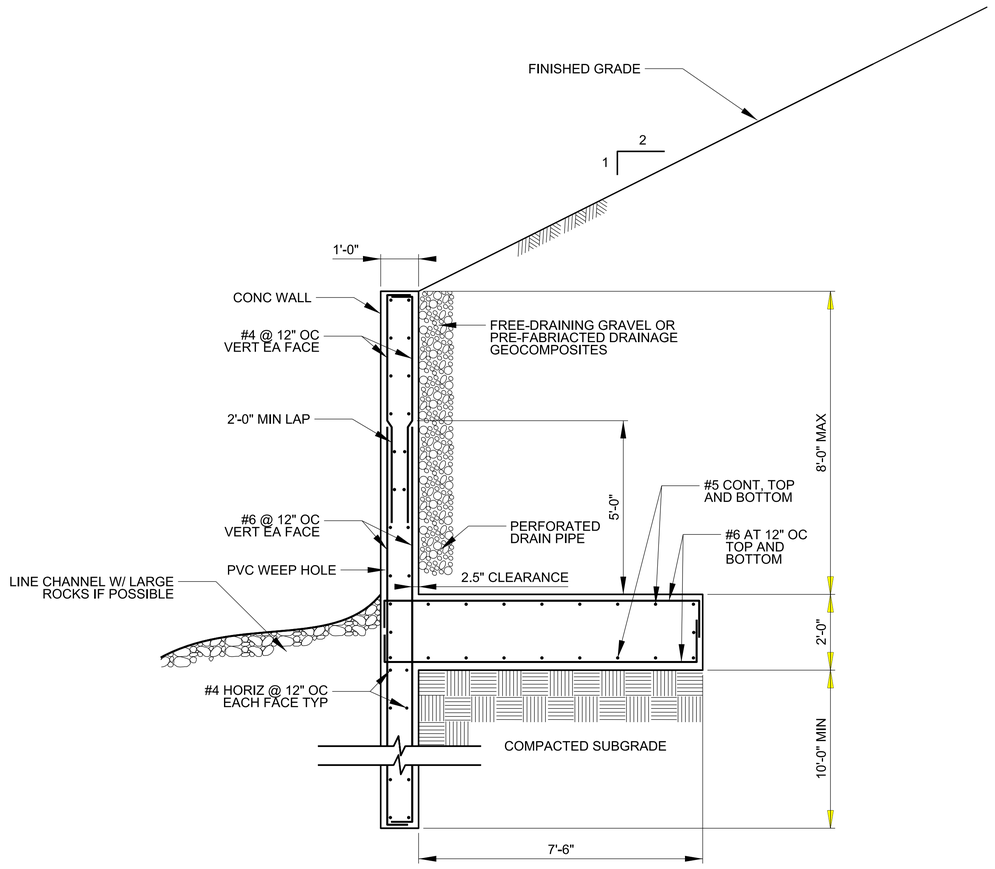

1 / S-302 RETAINING WALL AT REVETMENT X

1" = 1'

FILE: pw:\\POH-AP07TTS.poh.ds.usace.army.mil:poh-ap07tts\Documents\11 Other Locations\2 - Maui\Civil_Works\Iao Stream\01-Drawings\Structural\Retaining Wall at Revetment X
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LAST SAVED BY: JJECGJRW PRINTED BY: JJECGJRW ()

ANSI D 22 x 34

US Army Corps of Engineers
HONOLULU DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JRW
DWN BY: JRW
CKD BY:
SUBMITTED BY:
ISSUE DATE:
SOLICIT. / CONTRACT NO.:
LOCATION NO.:
FILE NUMBER:
PLOT SCALE: AS SHOWN
PLOT DATE:
SIZE:
FILE NAME:

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
FT SHAFTER, HAWAII

MODIFICATIONS TO THE
IAO STREAM FLOOD CONTROL PROJECT
ISLAND OF MAUI

TYPICAL CROSS SECTIONS
@ REVETMENT X

SHEET IDENTIFICATION
S-302
SHEET 0 OF 0

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Appendix F:

Agency Communication

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

March 29, 1996

Planning and Operations Division

Don Hibbard, Ph.D.
Deputy State Historic Preservation Officer
State Historic Preservation Division
Department of Land and Natural Resources
33 South King Street, 6th Floor
Honolulu, Hawaii 96813

Dear Dr. Hibbard:

The U.S. Army Corps of Engineers, Honolulu Engineer District has assessed the potential effects of proposed modifications to the Iao Stream Flood Control Project area at Iao Stream, Wailuku, Maui Island (enclosures). The entire proposed undertaking consists of concrete drainage channel modifications confined to instream sections of the drainage way. Previous Section 106 consultation between the U.S. National Park Service and the President's Advisory Council on Historic Preservation in 1974 resulted in the Bishop Museum's identification of 2 historic properties in the uppermost portion of Iao Stream. This report is referenced in your library under Connolly, Robert, 1974, *Phase I Archaeological Survey of Iao Valley Flood Control Project Area, Maui*, Bishop Museum Manuscript Report 100374. This initial assessment did not identify any surface historic properties at the present project location and subsequent construction of the Iao Stream flood control improvements did not discover any unanticipated historic properties within the entire stream flow channel. Currently designated historic properties consisting of the Wailuku Historic District, Halekii and Pihana heiau, the Wallace System Complex, and the North Terrace System Complex are not located within the project area, nor will they be directly or indirectly impacted by any activities associated with construction of the proposed undertaking (enclosure). We request your comments and concurrence in determining that pursuant to 36 CFR Sections 800.4 and 800.5 of the regulations of the President's Advisory Council on Historic Preservation this proposed undertaking for flood control channel modifications at Iao Stream, Wailuku, Maui Island, will have No Effect on any

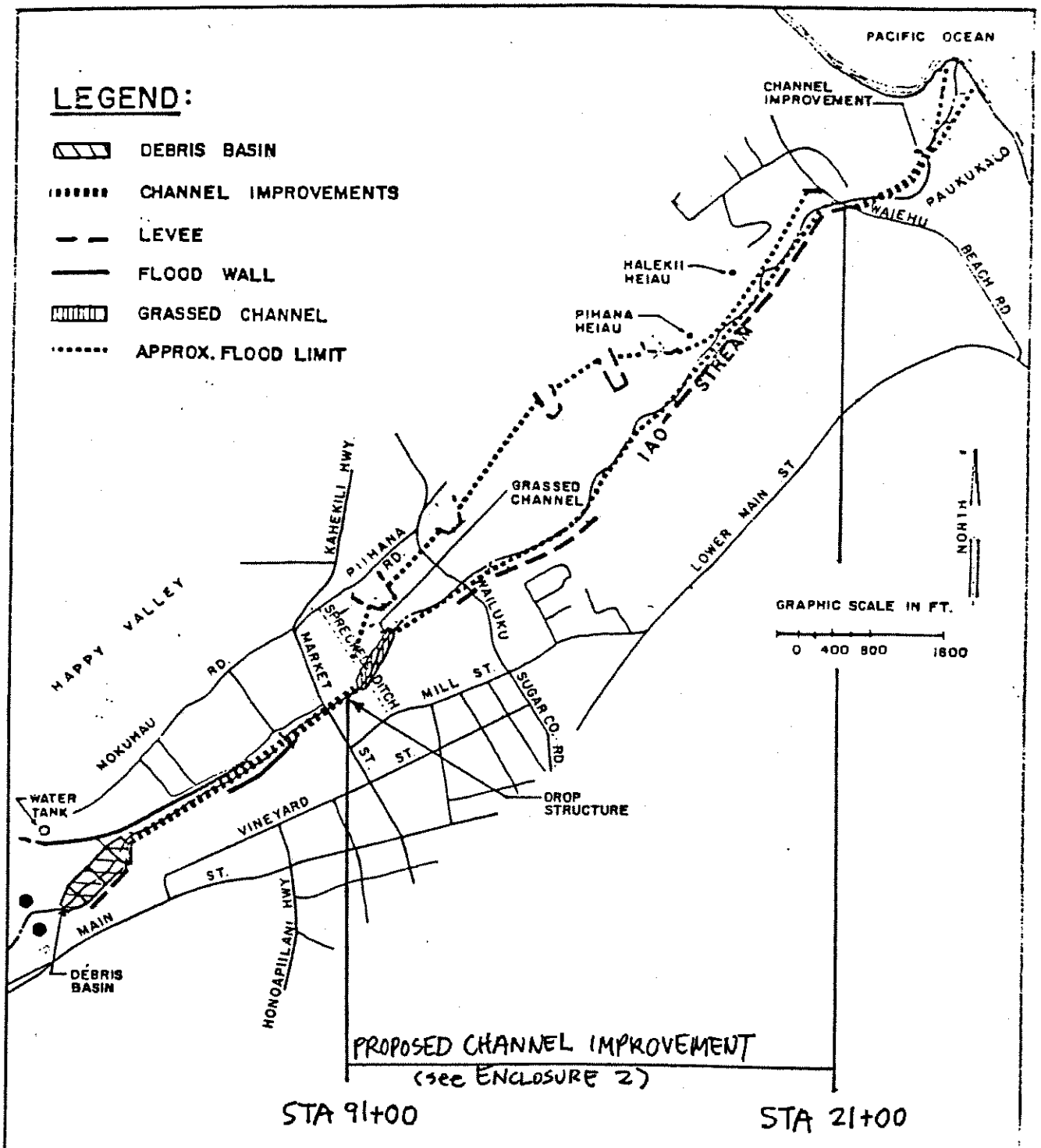
identified or potential historic properties.

Thank you for your timely response in order that we may proceed to finalize the supplementary dEA and dFONSI and complete the Section 106 compliance process. If you have any further questions or comments, please contact Mr. Farley K. Watanabe, Staff Archaeologist at 438-7007 of my Planning & Operations Division.

Sincerely,

Ray H. Jyo, P.E.
Director of Engineering
and Technical Services

Enclosures



FLOOD CONTROL AND ALLIED PURPOSES
IAO STREAM
MAUI, HAWAII

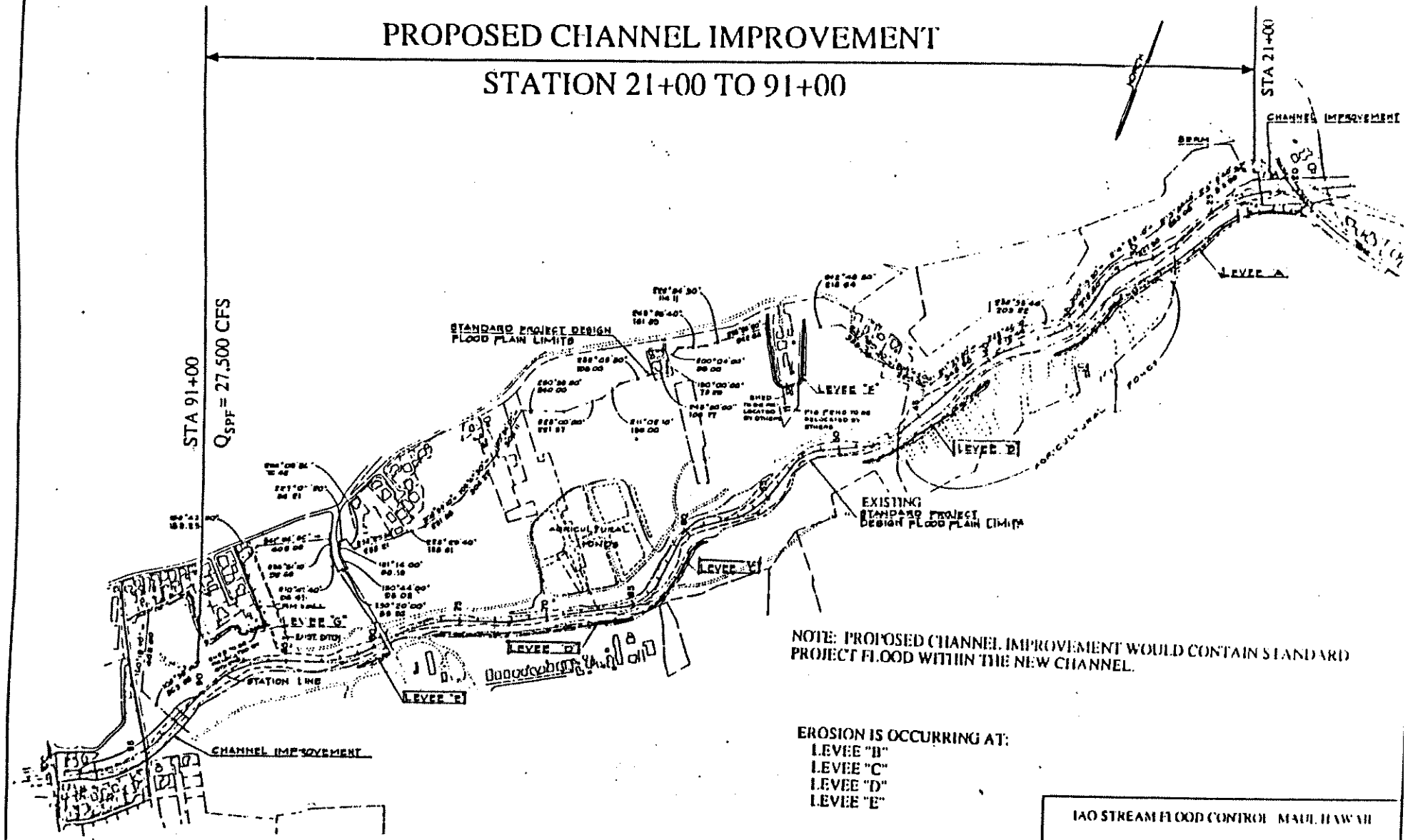
ORIGINAL PROJECT AREA,
ALTERNATIVE PLAN B

U.S. ARMY ENGINEER DISTRICT, HONOLULU
TO ACCOMPANY: DESIGN MEMORANDUM NO. 2

Enclosure 1.

Enclosure 2.

PROPOSED CHANNEL IMPROVEMENT
STATION 21+00 TO 91+00



NOTE: PROPOSED CHANNEL IMPROVEMENT WOULD CONTAIN STANDARD PROJECT FLOOD WITHIN THE NEW CHANNEL.

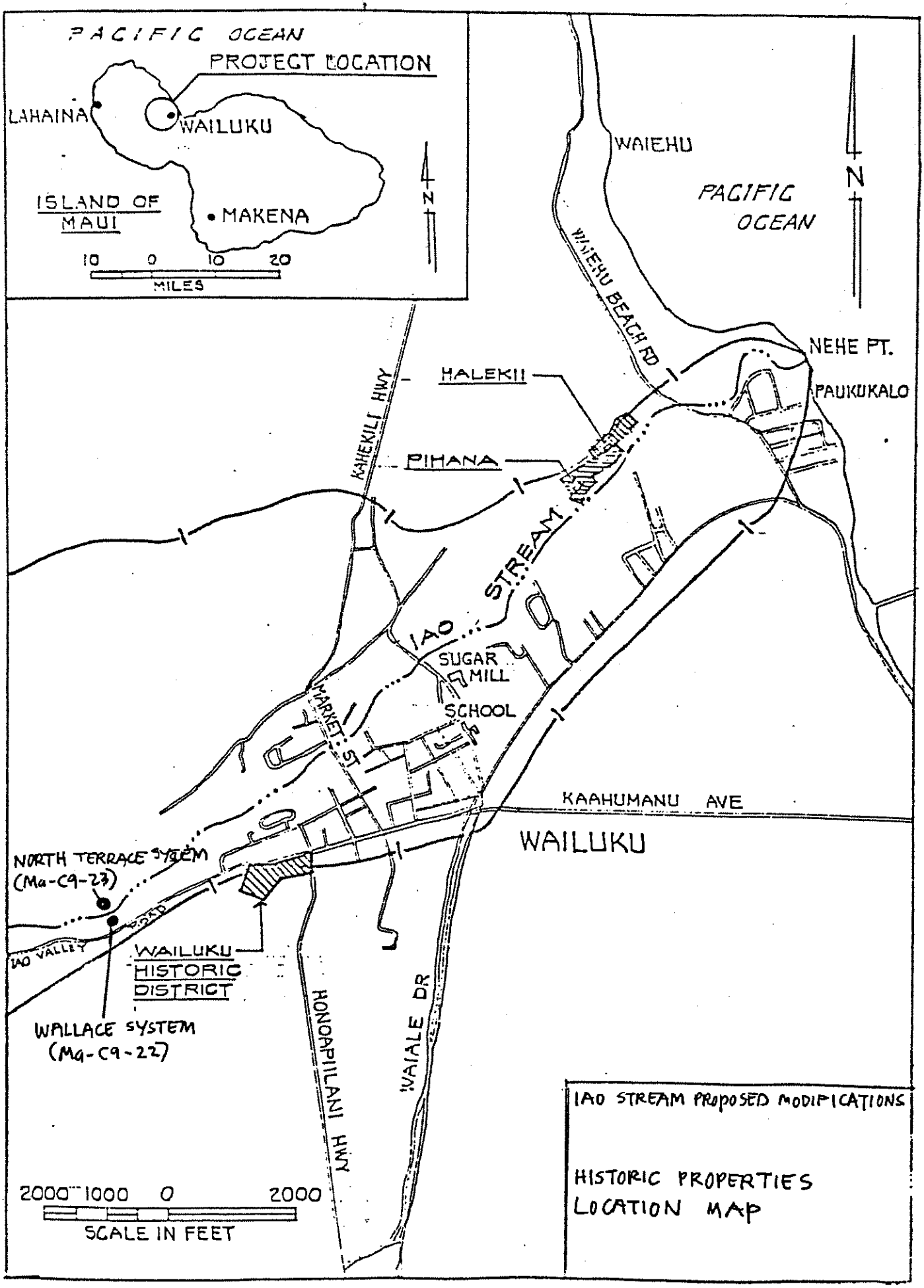
EROSION IS OCCURRING AT:
LEVEE "B"
LEVEE "C"
LEVEE "D"
LEVEE "E"

GRAPHIC SCALE

IAO STREAM FLOOD CONTROL MAUI HAWAII

SITE MAP

US ARMY ENGINEER DISTRICT HONOLULU


PACIFIC OCEAN
PROJECT LOCATION
LAHAINA
WAILUKU
ISLAND OF MAUI
MAKENA
10 0 10 20
MILES
N
WAIEHU
PACIFIC OCEAN
N
WAIEHU BEACH RD
NEHE PT.
PAUKUKALO
HALEKII
KAHEKILI HWY
PIHANA
IAO STREAM
IAO
SUGAR MILL
SCHOOL
MARKET ST
KAAHUMANU AVE
WAILUKU
NORTH TERRACE SYSTEM (Ma-C9-23)
IAO VALLEY ROAD
WAILUKU HISTORIC DISTRICT
WALLACE SYSTEM (Ma-C9-22)
HONOAPIILANI HWY
WAIALE DR
2000 1000 0 2000
SCALE IN FEET
IAO STREAM PROPOSED MODIFICATIONS
HISTORIC PROPERTIES LOCATION MAP

Enclosure 3.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT COLOMA-AGARAN

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

REF: HP-JEN

JUN 17 1996

Mr. Ray H. Jyo, Director of Engineering
Planning and Operations Division
Department of the Army
U.S. Army Engineer District, Honolulu
Ft. Shafter, Hawaii 96858-5440

LOG NO: 17189
DOC NO: 9606KD04

Dear Mr. Jyo:

SUBJECT: **National Historic Preservation Act, Section 106 Review of the Iao Stream Flood Control Project Modifications**
Wailuku, Wailuku District, Maui

The Corps of Engineers proposes to make improvements along sections of the existing Iao Stream channel, in an area between Market Street and Waiehu Beach Road in Wailuku. The improvements will be confined to the existing concrete channel area and are within the previously impacted zone of the Iao Flood Control Project.

As indicated in your letter, the proposed improvements will not occur within or near areas of known historic sites. We concur with your determination that the project will have "no effect" on historic sites.

Please contact Ms. Theresa K. Donham at 243-5169 if you have any questions.

Aloha,

Gilbert D. Coloma-Agaran
for MICHAEL D. WILSON,
State Historic Preservation Officer

KD:jen

OFFICE	ACTION	INSC
Dir of Engrg	Tech Svcs	JN
Deputy		
Secretary		
Const		
Constr		
Env		
Plng	L	19
Svcs		
Tech		

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

29 July, 2005

REPLY TO
ATTENTION OF
Environmental Technical Branch
Engineering and Construction Division

Mr. Clyde Namuo, Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Namuo:

The U.S. Army Engineer District, Honolulu (POH) is proposing to undertake a flood control project on the lower (makai) segments of Iao Stream (multiple TMK) in Wailuku, Maui Island (Figure 1). Five (5) alternatives are being considered as flood control measures and, for the most part, these measures are confined to the stream channel proper and certain areas of the northern banks of the stream in the upper (mauka) section of the project area. No modification is being envisioned along the banks of the stream in the lower portion (makai) of the project area, across from the area encompassing Halekii Heiau.

Typical cross-sections of the flood control measures are illustrated in Figures 2, 3, and 4. Alternative 1 will result in a trapezoidal concrete-lined channel. Alternative 2 will consist of a rectangular concrete-lined channel plus approximately 50-feet wide modification on the left (north) bank floodplain. Alternative 3 will have the channel concrete lined with boulder inverts and modifications to the left bank flood plain, again about 50 feet wide. Alternative 4 will consist of levee construction with toe repairs. The fifth alternative would leave the channel in its natural state with the removal of all existing flood control features.

Archaeologist from my Environmental Technical Branch visited the project area with the State Historic Preservation Office Maui Island staff archaeologist, Dr. Melissa Kirkendall. During the site visit, it was determined that potential significant subsurface cultural resources may be present in the floodplain banks along the upper sections of the project area. Proposed modification of the floodplain banks in these upper areas may potentially impact these buried significant cultural resources. It was determined that a program of archaeological monitoring during construction should ensure that these resources will not be adversely impacted by the flood control construction activities.

A cultural impact study (CIS) was also undertaken for this project. The CIS included personal interviews of a number of native Hawaiian cultural experts knowledgeable in the folklore of the project area and its surroundings. The study identified no areas of traditional importance within the project area; however, this conclusion is still in draft format and a copy of this report will be submitted to your office for review and comments. A copy of the final report will then be furnished to your office.

Based on the above information, POH has made the determination that the proposed Iao Stream Flood Control Project will have "no adverse effect on historic properties", provided a program of archaeological monitoring accompanies construction activities at the upper portion of the project area. Furthermore, an archaeological monitoring plan will need to be compiled for review and acceptance by your office prior to the start of any construction activities. Furthermore, the archaeological monitoring will be undertaken by a reputable archaeological firm with prolonged experience in Hawaiian archaeology. In compliance with the National Historic Preservation Act of 1966, pursuant to implementing regulations 36 CFR Part 800 (NHPA), your concurrence to this determination is being requested. POH is also requesting concurrence from the Hawaii State Historic Preservation Officer and the Central Maui Hawaiian Civic Club, in accordance with the NHPA.

Should you require any additional information, please contact Kanalei Shun at 438-7000.

Sincerely,

James L. Bersson
Chief, Engineering and
Construction Division

Enclosures (4)

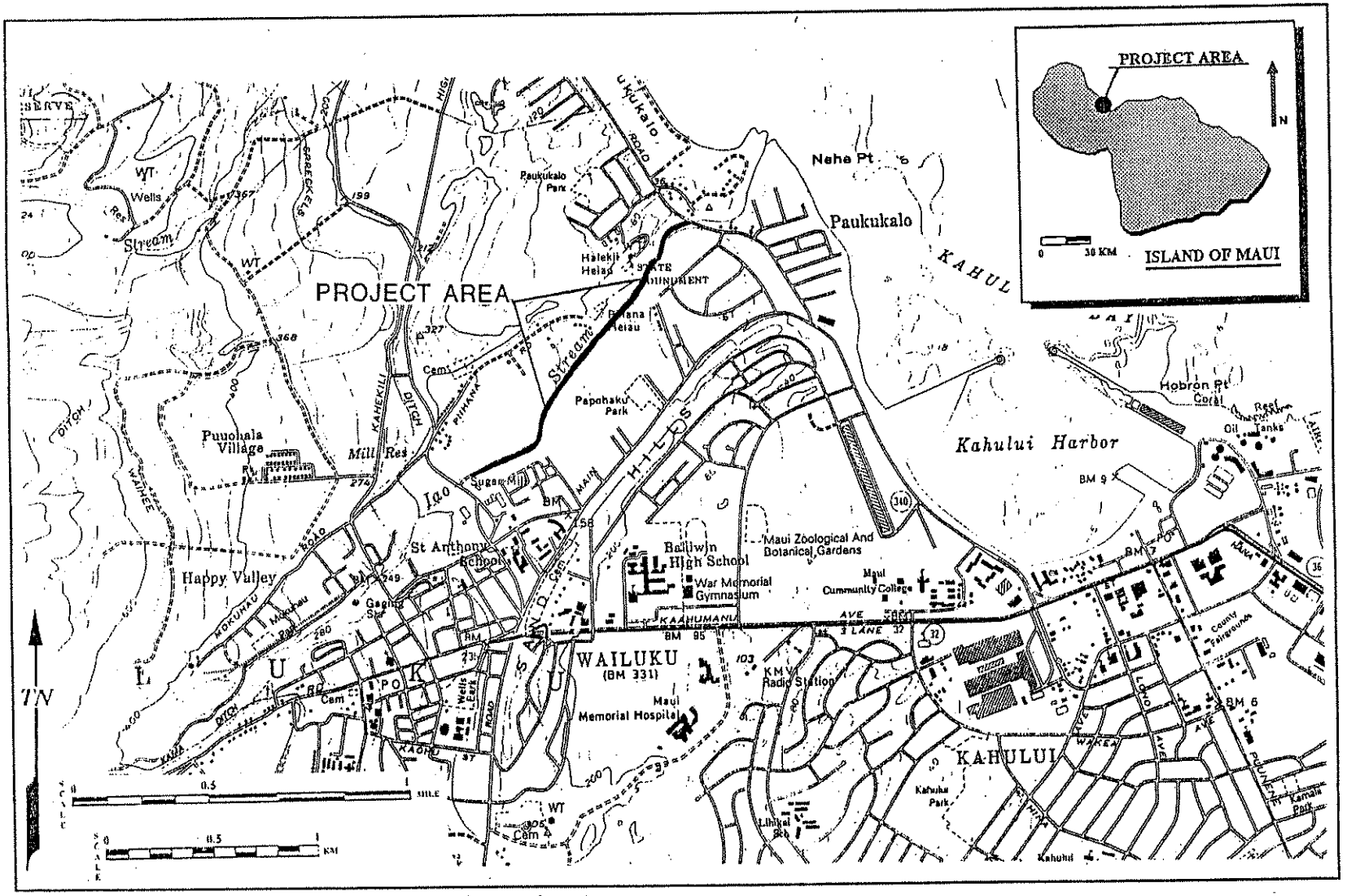


Figure 1: USGS Wailuku Quadrangle Showing Project Area.

FIG. 2

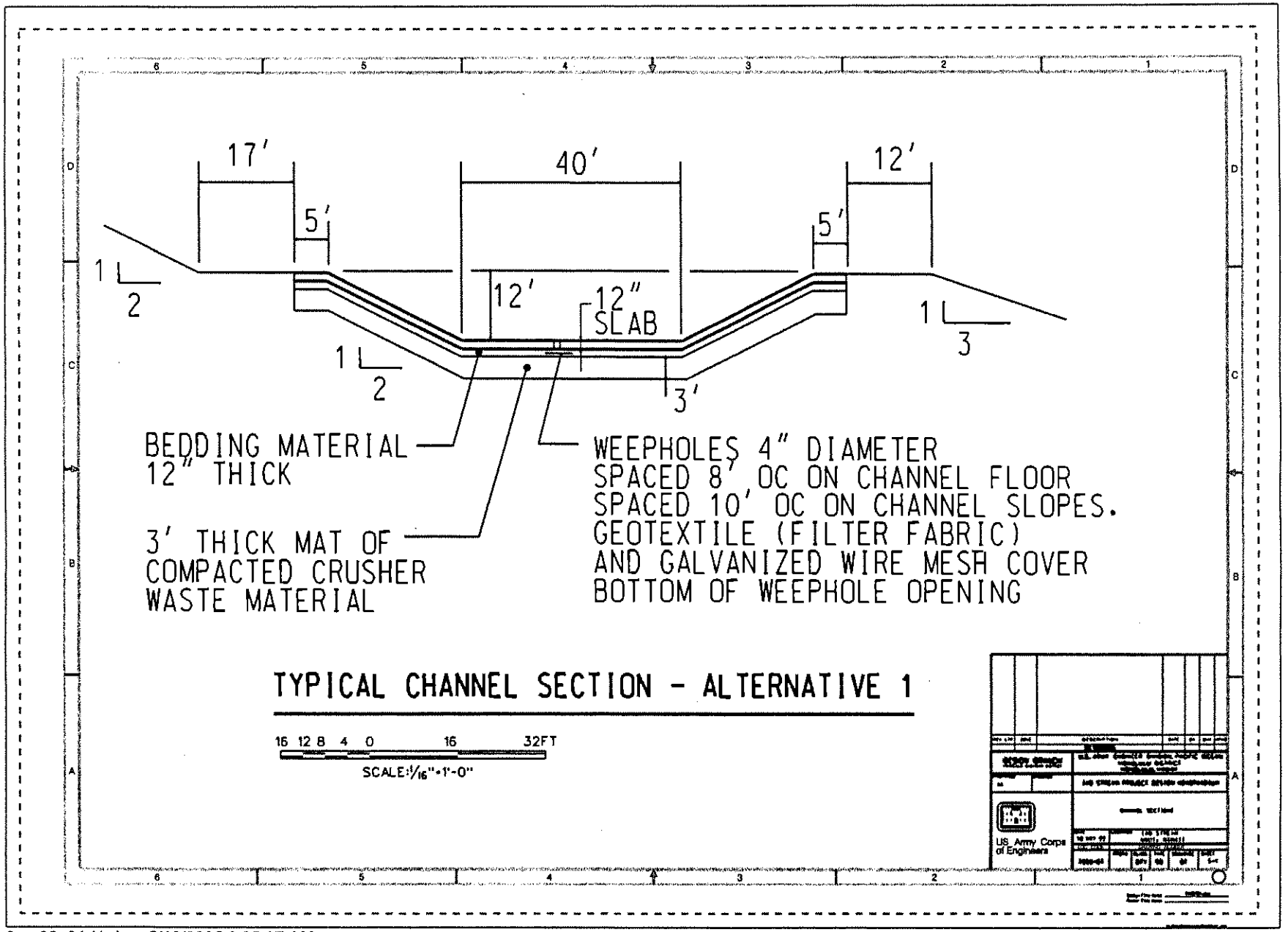


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FIG. 3

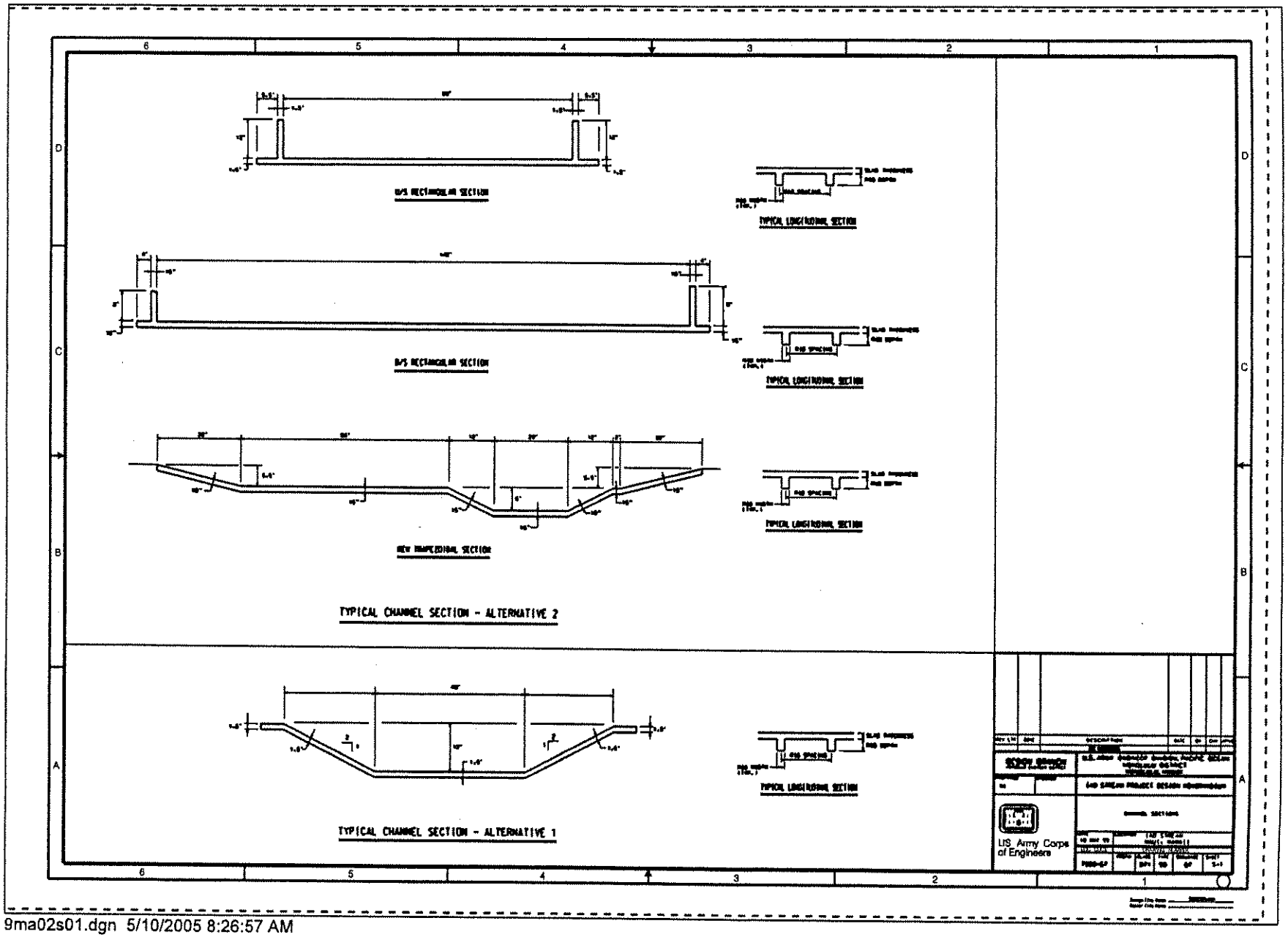

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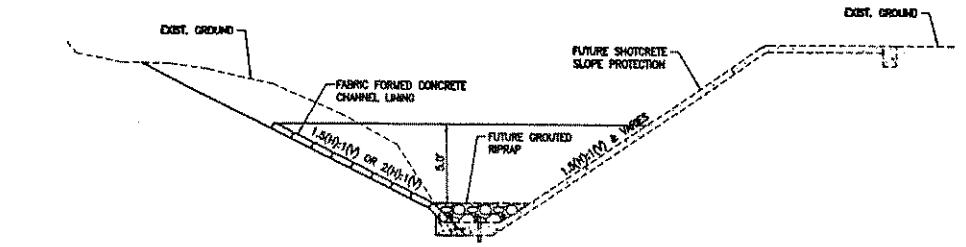
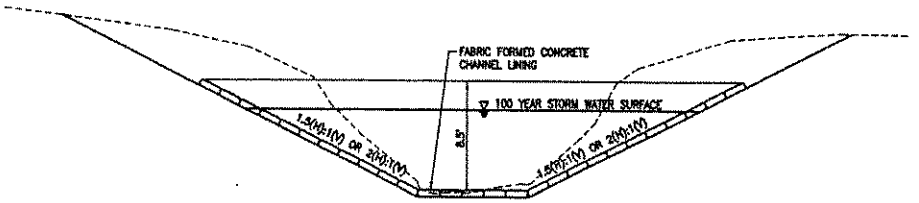
FIG. 4



A C4|C3 SECTION A



B C4|C3 SECTION B

*TYPICAL SECTIONS
NOT TO SCALE

US Army Corps of Engineers Honolulu District

TYPICAL SECTIONS

Sheet number: C-3

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

September 10, 2007

REPLY TO

Engineering and Construction Division

Mr. Clyde W. Namu'o
Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Namu'o:

The U.S. Army Engineer District, Honolulu (POH) is proposing to undertake a flood control project on the lower segments of Iao Stream (multiple TMK) in Wailuku, Maui Island (Figures 1, 2a, 2b, and 2c). The project area begins on the makai (east) end of Waiehu Beach Road The project was designed for Standard Project Flood (SPF) protection with a peak design discharge of 27,500 cubic feet/second (cfs) downstream at Station 22+00 and 26,000 cfs upstream at Station 92+02 (Figures 3-6). Five (5) alternatives are being considered for the flood control measures, and Alternative III has been proposed as the most viable based on engineering and cost benefits. A summary of the work under Alternative III is attached herein as Enclosure 1. Work proposed under Alternative III is an undertaking requiring consultation in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, pursuant to implementing regulations 36 CFR Part 800. The purpose of this letter is to initiate the Section 106 consultation process.

The area of potential effect (APE) of most of the work proposed under Alternative III is confined to the already highly disturbed stream channel. This work, listed under items 3-5, 7, and 9 in Enclosure 1, consists of modification to the existing channel. Such work should not affect any significant cultural resources as none is anticipated to be present within the stream channel itself.

The remaining work, listed under items 1, 2, 6, and 8, will entail new construction and/or construction excavations. A diversion levee in the form of a trapezoidal-shaped structure, 500 feet long, 65 feet wide, and 9 feet high, and a new ground water recharge basin are being proposed for construction at the upper end of the project area (see Figures 7a and 7b). Stream re-alignment and widening, anticipated to be no more than 30 feet wide, is being proposed between Stations 76+00 and 85+30 where the left (north) bank of the stream (see Figure 6) will be widen to reduce water surface profile to accommodate the County's proposed Imi Kala Bridge expansion construction. The areas of potential effect for this work is within the Iao Stream flood plain, and in the immediate vicinity of

the channel. Based on previous archaeological investigations and historical accounts, prehistoric remains, except for *auwai* to feed taro loi, would not be anticipated to be present this type of terrain. Visual inspection of the stream channel's north embankment in the Imi Kala bridge location found no evidence to indicate potential presence of an *auwai* system. Thus, a determination can be made that this new construction work will not affect potentially surface or subsurface historic sites. However, to ensure that such will remain the case, POH is recommending that a professional archaeological monitor be present during construction excavation activities associated with any work in this area. Lastly, the raising of the right bank levee in the area between stations 45+37 to 48+85 and 25+62 to 26+46 are add-ons to existing levee and should not impact any cultural resources.

Thus, POH has made the determination that the proposed modification actions to the floodplain banks and immediate adjacent areas of the existing Iao Stream channel will have no affect to historic sites. To ensure no adverse impact will result to potentially significant subsurface cultural resources from construction activities to the north embankment in the Imi Kala bridge area, a program of archaeological monitoring during construction is being proposed. An archaeological monitoring plan will be compiled for review and acceptance by your office prior to the start of any construction; the archaeological monitoring will be undertaken by a reputable archaeological firm with prolonged experience in Hawaiian archaeology. The proposed archaeological monitoring program should ensure that the Alternative III will result in a "no effect to historic properties" determination. In compliance with the National Historic Preservation Act of 1966, pursuant to implementing regulations 36 CFR Part 800 (NHPA), your concurrence to this determination is being requested. POH is also requesting concurrence from the Hawaii State Historic Preservation Office, the Maui County Cultural Resources Commission, and the Central Maui Hawaiian Civic Club, in accordance with the NHPA.

We are also forwarding a copy of this letter to Mr. Stanley Solamilo, Maui County Cultural Resources Commission Minute, Maui County Planning Department, 250 S. High Street, Wailuku, Hawaii 96793. If you require any additional information, please contact Mr. Kanalei Shun at 438-7000.

Sincerely,

Todd C. Barnes, P.E.
Chief, Engineering and
Construction Division

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

October 5, 2007

REPLY TO
ATTENTION OF:

Engineering and Construction Division

Ms. Laura H. Thielen
Interim Chairman and State Historic Preservation Officer
Department of Land and Natural Resources
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

Dear Ms. Thielen:

Enclosed for your review and comment is a copy of the Cultural Impact Assessment (CIA) report that was compiled as part of the U.S. Army Engineer District, Honolulu (POH) Iao Stream Flood Control Project. The study was conducted by our Small Business contractor, Social Research Pacific, Inc., for the Environmental Assessment (EA) being prepared by POH for the project in compliance with the National Environmental Policy Act (NEPA). The CIA study was performed in accordance with Chapter 343 of the Hawaii Revised Statute and with the "Guidelines for Assessing Cultural Impacts" adopted in 1977 by the Environmental Council of the State of Hawaii.

In our 5 September 2007 letter to your office, POH initiated consultation for the project with your office in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, pursuant to implementing regulations 36 CFR Part 800. We await your response to our letter.

A copy of this report is also being forwarded to the Office of Hawaiian Affairs, the Maui County Cultural Resources Commission, the Central Maui Hawaiian Civic Club, and the President of the Association of Hawaiian Civic Clubs for review and comment. If you require any additional information, please contact Mr. Kanalei Shun at 438-7000.

Sincerely,

Curtis I. Yokoyama, S.E., P.E.
Chief, Engineering and
Construction Division

Enclosure

PHONE (808) 594-1888

FAX (808) 594-1865

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

HRD07/3219B

October 30, 2007

Curtis Yokoyama. Chief
Department of the Army
U.S. Army Engineer District
Fort Shafter, Hawai'i 96858-5440

RE: Cultural Impact Assesment for 'Iao Stream Flood Control Project, Maui, Hawai'i.

Dear Mr. Yokoyama,

The Office of Hawaiian Affairs (OHA) is in receipt of your request for written comments regarding the Cultural Impact Statement (CIS) for the 'Iao Stream flood control project on Maui. We have the following comments:

OHA requests that the TMK number for this project be given so that we can determine whether this project will impact any of our ceded lands.

This CIS was sent to us separate from the environmental assessment (EA) for which it is to be incorporated into. OHA recognizes that this was done in order to begin the consultation process; however, it is not particularly useful to do so. It is difficult to review a CIS out of context form its associated project. Further, OHA understands that the EA for this CIS will be released soon and we will review it at that time. That being said, OHA wishes to make clear that we are always pleased to see an applicant working on a CIS and as such are happy to assist with its preparation. However, the review of the CIS as a stand-alone document is not the intent of the environmental review process and, as said, a bit difficult.

OHA also notes that the invitation to comment mentions that a Section 106 consultation was initiated by the U.S. Army Engineer District on September 5, 2007. However, our agency has no record of receiving this document and as such, does not recognize the initiation of the 106 process as of now.

In terms of the CIS, OHA appreciates that a number of sources were consulted in preparation of this document including archival searches, field studies, oral histories from kūpuna in the area, public scoping meetings and surveys. However, there are numerous lo'i, heiau, and other culturally significant sites in the area as well as constitutionally protected Native Hawaiian rights being practiced in the area. As such, OHA both compliments the research done for the CIS, while reserving the right to further comment for the EA.

Thank you for the opportunity to comment. If you have any further questions or concerns please contact Grant Arnold at (808) 594-0239 or granta@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

C: Thelma Shimaoka, Community Resource Coordinator
Office of Hawaiian Affairs, Maui Office
140 Ho'ohana St., Ste. 206
Kahului, Hawai'i 96732

From:	Shun, Kanalei POH
To:	Morgan.E.Davis@hawaii.gov; Jenny Pickett ARCHAEOLOGY
Cc:	Shimabuku, Lorayne P POH; Miya Akiba; Dennis Gosser
Subject:	Alt. F Iao Stream Flood Control Project - EOF report for AIS (UNCLASSIFIED)
Attachments:	image001.png image002.png image003.png image004.png Final EOF Report 13June2014.pdf

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Classification: UNCLASSIFIED
Caveats: NONE

Aloha Morgan and Jenny:

Attached, for you information, is the end-of-field report for an AIS, performed by the archaeological firm, Pacific Consulting Services, Inc. (PCSI). AIS was done for Alternative F of the Iao Stream Flood Control Project. WE did a site visit of the project area with Hinano early this year. Tell Hinano sour sup tree went, not sure where and how.

Anyway, no subsurface cultural deposits were identified in any of PCSI excavated trenches (10 in all). Based on PCSI's background research, we did not think there would be any remnants of loi terraces in that area as it was too susceptible to big time flooding. Currently, I am leaning toward a no effect to historic properties determination, unless we come across some other evidence showing otherwise. I would recommend to ensure no impact to significant cultural resources, a program of archaeological monitoring during construction.

If either of you think of other avenues we should pursue for evidence of other subsistence or land use pattern, let me know.

I will wait for the final report to make the final determination of effect.

Thank you and take care.

Kanalei

Classification: UNCLASSIFIED
Caveats: NONE

MINUTES OF MEETING

Project:	ʻĪao Stream Flood Control Project
Date:	September 17, 2014
Time:	13:00 – 14:30
Location:	United States Fish and Wildlife Service (USFWS) Pacific Islands Office-Main Conference Room 3-127
Attendees:	**United States Army Corps of Engineers (USACE) -** Nani Shimabuku, Athline Clark, Jessica Wiggs, Lynn Schneider, Michael Wong **USFWS -** Dan Polhemus, Tony Montgomery **United States Environmental Protection Agency (EPA) -** Wendy Wiltse **National Oceanic and Atmospheric Administration (NOAA) National-Marine Fisheries Service (NMFS) -** Danielle Jayewardene **State of Hawaiʻi Department of Land and Natural Resources (DLNR)-Division of Aquatic Resources (DAR) -** Skippy Hau **County of Maui (COM) -** Kristi Hirata (via teleconference) **GSI Pacific Inc (GSI) -** Sonia Shjegstad, Miya Akiba

DISCUSSION:

A meeting was held between the USACE, USFWS, EPA, NOAA-NMFS, DLNR-DAR, COM, and GSI to discuss the current status of the ʻĪao Stream Flood Control Project. The main focus of the meeting was to provide a technical overview of the preferred alternative (Alternative F) and to provide an opportunity for the group to raise any questions or concerns on the selected alternative. A brief summary of the major discussion elements are as follows:

1. USACE thanked the parties for attending the meeting and the opportunity for USACE to discuss the project with them. All parties briefly introduced themselves to the group.

2. USACE went over the current status of the project. The USACE is currently preparing the Engineering Documentation Report (EDR) that evaluates the new preferred alternative (Alternative F). The Environmental Assessment, which is included as an appendix to the EDR, evaluates the potential environmental impacts of Alternative F. During the course of developing Alternative F, USACE has met with this group of resource agencies to provide updates and has received comments that have been taken into consideration during the preparation of the draft EA. The EDR/EA is currently being reviewed internally within the Honolulu District. Following internal review, the documents will undergo Agency Technical Review (ATR), which is scheduled to take place next month. The draft EA is currently scheduled to be published for public review

early next year. The EA will be finalized following public review by Summer 2015. Designof the project will initiate shortly thereafter, pending receipt of funding.

3. EPA inquired whether an Environmental Impacts Statement (EIS) would be prepared for the project. USACE stated that while an EIS was initiated following the 2009 Draft EA, since Alternative F is much smaller in scope compared to the other alternatives evaluated in the past, and because the area of impact is relatively small, it was more appropriate to rescope the project from an EIS to an EA.

4. DLNR-DAR stated that stream waters will be restored based on the recent settlement of the Na Wai Eha case which will mandate an Interim Instream Flow Standard (IIFS) of 10 million gallons per day (mgd) below the first diversion, above Hawaii Nature Center (near Kepaniwai Park), and an IIFS of 5 mgd at or near the stream mouth. The team discussed what the conversion from mgd to cubic feet per second (CFS) would be to determine how much water would flow through the location of the proposed diversion weir (DLNR-DAR later confirmed that 10 mgd equates to 15.4722 cfs and 5 mgd equates to 7.736 cfs). DLNR-DAR stated that surveys for mapping the stream will be conducted in October. DLNR-DAR recommended that USACE check with the DLNR Commission on Water Resource Management on the exact date of the IIFS to be implemented.

5. USACE stated that restoration of stream waters has always been taken into consideration during project designs and that Alternative F takes into account that there will be continuous flow in the stream.

6. USACE gave an overview of the existing flood control features in the stream and presented the design features of the flood control structures that would be constructed under Alternative F. USACE explained that Alternative F is designed to reconnect the main channel with the existing floodplain on the left bank. Alternative F would reduce flood flows within the main channel; thereby reduce further erosion of the existing levees on the right bank reduce risks to properties on the right bank from flooding during large storm events. USACE stated that the main channel will be constricted by constructing a concrete diversion wall, approximately 18 feet (ft) high with a 15-ft wide opening to allow for fish passage and some flow to remain in the stream.

7. EPA inquired whether there is anything being done to lower the left bank to reconnect the main channel with the floodplain. USACE stated that an approximate length of 417 ft along the left bank would be lowered to allow for stream waters greater than a 10-year frequency event to enter the floodplain. USACE stated that materials that have been pushed against the left bank by illegal squatters that used to reside in the area in the past will be partially removed to accommodate this. USACE stated that excavated soil to lower the left bank at the diversion wall would be reused downstream to construct a raised berm intended to keep the diverted water within the floodplain.

8. USACE went over the detailed design features of the diversion weir to be constructed within the stream, including the dimensions and materials to be used. USACE stated that

water would flow through the opening during regular flow and would flow over the existing boulder stream bed upstream and downstream of the diversion wall.

9. USACE went over the different types of revetment to be used for features proposed under Alternative F. Fully grouted riprap would be used at the overflow channel section to accommodate high stream velocities and increased levels of turbulence as a result of changes in flow direction; partially grouted riprap would be used at the outflow section. Shotcrete would be used upstream of Imi Kala Bridge for bank protection. USACE added that the raised berm has been placed away from the main channel to avoid streambed lining at this section of the stream. USFWS noted their overall appreciation of the heterogeneity of the proposed stream bed modification in the area of the channel restriction and the fact that it would pose no impediments to fish passage.

10. EPA inquired whether any other alternatives have been considered for the project. USACE briefly went over the alternatives that were considered and explained why they were not carried forward for consideration. USACE explained that since no significant amount of channel hardening is involved with Alternative F, it was considered the most appropriate alternative in accomplishing the project objectives and recommended for implementation.

11. The project team discussed the current land uses of the floodplain. The USACE stated that the floodplain is currently classified as either designated floodplain or diversified agricultural land.

12. NOAA-NMFS inquired whether diversion of stream waters would result in any excess sediment/pollutants being carried into the stream from the floodplain. USACE stated that sediment/pollutants would settle out before the diverted water returns to the main channel and would not adversely affect the water quality of the stream.

13. EPA inquired whether there are any regulations within the floodplain to restrict the lessees from raising the land elevation or any regulations on storage of hazardous chemicals within the floodplain. EPA expressed their concerns about hazardous chemicals from machinery, fuel, or vehicles within the floodplain potentially being washed into the stream during large storm events. USACE stated that COM would be responsible for regulating land use practices and storage of hazardous chemicals/materials within the floodplain as part of the project cost-share agreement.

14. EPA inquired whether there would be any opportunities to include designs to place low-flow channels within the modified stretch of the stream bed (i.e., in the approximately 65 linear feet area of the proposed channel restriction) or to tilt the bottom of the stream to allow continuous flow during low-flow conditions. USACE stated that it would be possible to construct a low-flow channel within this stretch but it may become filled with sediment and lose its original intention over time. USACE asked if this low-flow channel would still be desired if there were a sufficient height of water flowing through the restriction. EPA stated that it would not be necessary if sufficient height of water is anticipated to flow through the channel restriction.

15. The team discussed the anticipated height of water that would flow through the opening of the diversion weir during regular flow following implementation of the new IIFS (5 mgd at the diversion weir location). USFWS and DLNR confirmed that they would like 4 inches at a minimum, or 6 inches preferably. USACE stated that the water flowing through the opening under base flow (5 mgd) should be at least 6 inches deep but stated that they will confirm the number.

    USACE later confirmed that although it is very difficult to confirm the water depth at such low flows, the calculated water depth is approximately 2 to 3 inches at 5mgd. Using a very simple HEC-RAS model, with 7.7 cfs (5 mgd) flow, the velocities near the diversion weir structure are approximately 2.2 to 2.8 ft/s. This would of course be affected by changes in the upstream and downstream natural channels, which would likely increase the channel roughness (with increased rocks and gravel) and slow the velocity (increasing water depth). Approximately 9 to 10 mgd would be needed for 4 to 6 inches of water at this location.

16. USFWS provided a brief update on the state of the offshore marine environment, as observed during their most recent field surveys. USFWS noted that despite a large amount of suspended sediment in the water, there was a tremendous amount of coral in the offshore area. USFWS and USACE noted that with implementation of Alternative F, there should be a net decrease in the amount of sedimentation coming from the stream and into the marine environment, which would be a benefit to the offshore coral reef ecosystem.

17. USFWS noted that they have previously submitted comments to USACE outlining some of their other concerns with the 1981 project, and that they still would like to see a path forward by the USACE on addressing those comments. The team discussed some of the measures proposed by USFWS to help restore the biological function of the overall stream, including areas outside of the project area of Alternative F. USACE stated that the Office of Hawaiian Affairs (OHA) has shown interest in stream ecosystem restoration and that they have consulted with the mayor regarding potential opportunities to implement any restoration projects.

18. USACE stated that funding may be available through their Continuing Authorities Program (CAP) program, particularly if matching funds were made available from another Federal partner such as fish restoration funding from USFWS. USACE stated that the local sponsor may partner with USACE for funding; however, that USACE currently does not have funding under Civil Works to correct design deficiencies from the past. CAP Section 1135 allows for environmental restoration of an existing Corps project. USFWS stated that they would like to keep the conversation open with the USACE so that efforts to correct previous design deficiencies and restore the biological function of the stream could be considered/incorporated into future projects.

19. NOAA-NMFS and USFWS agreed that Alternative F is a much preferred alternative compared to the other alternatives considered in the past.

Action Items

USACE will:

- Review these meeting minutes for accuracy and provide comments if needed.
- Continue to work with USFWS in completing the Section 7 consultation under the Endangered Species Act.

USFWS, EPA, NOAA-NMFS, DLNR-DAR, and COM will:

- Review these meeting minutes for accuracy and provide comments if needed.

GSI will:

- Draft minutes of the meeting and circulate for review.

This Minutes of Meeting memorandum is GSI's understanding of the items discussed during this meeting for the ʻĪao Stream Flood Control project. It is requested that all who were in attendance review this Minutes of Meeting for its content and accuracy. If there are no responses and/or comments to this Minutes of Meeting memorandum within ten (10) calendar days, GSI will assume that all information stated herein is correct and agreed upon by all who were in attendance.

Recorded by: Miya Akiba, GSI

cc:
USACE: Nani Shimabuku, Athline Clark, Jessica Wiggs, Lynn Schneider, Michael Wong
USFWS: Dan Polhemus, Tony Montgomery
EPA: Wendy Wiltse
NOAA-NMFS: Danielle Jayewardene
DLNR-DAR: Skippy Hau
COM: Kristi Hirata
GSI: Sonia Shjegstad

TELEPHONE 808 834 4631 FAX 808 356 0900
EMAIL INFO@GSI-COMPANIES.COM WEBSITE WWW.GSI-COMPANIES.COM
ADDRESS 181 SOUTH KUKUI STREET, HONOLULU, HAWAII 96813

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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

Rec'd 5/1/14
PP - original

In Reply Refer To:
CPA-12200-2011-CPA-061

APR 2 9 2014

Anthony J. Paresa, P.E.
Deputy District Engineer
Programs and Project Management
U.S. Army Corps of Engineers
Civil and Public Works Branch
Fort Shafter, Hawaii 96858-5440

April 22, 2014

Dear Mr. Paresa:

The U.S. Fish and Wildlife Service (Service) is providing this Planning Aid Letter (PAL) in response to your request, based on the substantial changes to the proposed Iao Stream flood Control Project in Wailuku, Maui, Hawaii. The proposed "Alternative F" has been tentatively selected by the Corps to most effectively address the needs of the local sponsor, County of Maui, Department of Public Works. This letter has been prepared under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 *et seq.*; 48 Stat. 401], as amended (FWCA); the Clean Water Act of 1977 [33 USC 1251 *et seq.*; 91 Stat. 1566], as amended; and the Endangered Species Act of 1973 [16 U.S.C. 1531 *et seq.*; 87 Stat. 884]. These comments are also consistent with the National Environmental Policy Act of 1969 [42 U.S.C. 4321 et seq.; 83 Stat. 852], as amended, and other authorities mandating the Service's review of projects and provision of technical assistance to conserve trust resources.

The FWCA provides the basic authority for the Secretary of the Interior, through the Service to assist and cooperate with Federal, state and public or private agencies and organizations in the conservation and rehabilitation of wildlife. The National Marine Fisheries Service (NMFS) provides similar assistance and cooperation for wildlife species under the management responsibilities of the Department of Commerce. Consultation under the FWCA is to be

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conducted with the Service, the State agency responsible for administering the wildlife resources of the jurisdiction involved (in this case the Hawaii Division of Aquatic Resources, or DAR), and NMFS as appropriate. The Service is the lead agency and has the responsibility of ensuring that concerns and recommendations of the other resource agencies are considered fully in FWCA reviews.

The proposed alternative project (Alternative F) involves modifications of an existing Iao Stream flood control project, located within the 10-square-mile Iao Stream drainage basin. The basin begins at the boundary between the Lahaina and Wailuku Judicial Districts and extends along the crests of the Kahoolewa and Kapilau Ridges to the Pacific Ocean. The project impact area consists of an approximately 417-foot-long overflow channel section located on the left bank of the Iao Stream lower midreach between river stations 79+00 and 75+12, and a channel constriction that will be created by a concrete diversion weir, located within the channel at the downstream end of the overflow section. These modifications will reduce flows in approximately 3,200 linear feet of streambed during flood stages, with potential impacts both up- and downstream of the project footprint. The revised project design, due to its emphasis on upland flood water retention and settlement as opposed to direct and accelerated conveyance to the ocean, appears to avoid and minimize impacts to the nearshore marine environment adjacent to the project.

Specifically, Alternative F as currently proposed consists of an overflow section located on the left bank of Iao Stream, and a channel constriction located within the channel at the downstream end of the overflow section. The purpose of the overflow section and associated constriction is to force flood flows to leave the main channel and enter the designated floodplain area on the left bank of the stream. The reduction in the main channel flow in this approximately 3,200-foot-long river reach will result in reduced erosion and lower water surface elevations. This will in turn result in increased reliability for the existing flood damage reduction system. Flow which enters the left bank near station 41+10 will remain separated from the main channel flows until it reenters the channel near river station 8+98. The overflow section involves a 417-foot- long diversion located on the left bank of Iao Stream between river stations 79+00 and 75+12 and a channel constriction by concrete diversion weir, located within the channel at the downstream end of the overflow section at station 75+10. Flood flows will leave the main channel then enter and remain on the designated floodplain area on the left bank of Iao Stream between stations 79+00 and 43+80. Flow which enters the left bank near station 75+12 will remain separated from the main channel flows until it re-enters the channel near river station 45+00. Bank protection will be provided by boulder concrete or shotcrete at this return location. A section of the left bank between stations 66+50 and 60+20 will be raised by an earthern berm approximately 4 feet high to contain the left bank overflow in the floodplain.

This alternative will change the probability of flooding on the left bank floodplain from approximately a 1-percent chance per year based on the current conditions to a 10-percent chance per year. The reduction in main channel flow in this approximately 3,200-foot-long river reach will result in reduced erosion and lower water surface elevations within the main channel. This will result in increased reliability to the existing flood damage reduction system. Additional right bank armoring upstream of river station 79+00 will be required to increase the reliability of existing levees. This work will consist of about 200 linear feet of shotcrete between stations 83+25 to 81+25. Other features of this alternative are the approximate 65 linear feet of boulder-concrete bank protection along both banks at the diversion weir and a 15-foot-wide gravel maintenance road in the floodplain along the left bank starting from Piihana Road and ending at station 45+00. Flood flows in the left bank floodplain will spread out and flow following the topographic gradient from the end of the overflow diversion channel to the return point. There is no designed channel in the left bank floodplain.

Background

This project already produced a Draft Environmental Assessment (DEA) in March 2009. The public review process for the DEA resulted in new concerns being raised regarding the project's potential ecosystem impacts, as well as concerns about the adequacy of the proposed mitigation to offset anticipated, unavoidable impacts. Alternatives and mitigation measures from the March 29, 2009 DEA were reanalyzed and modified, according to public input, resulting in the currently proposed Alternative F. The Service acknowledges that some of our earlier general recommendations (*e.g.*, reduce sediment input into the marine environment, minimize stream hardening, provide low flow channels and passage for native stream fauna) have been partially incorporated into the new design and commends the Corps for these improvements. However, some concerns still remain with the proposed Alternative F.

Following the release of the 2009 DEA, but prior the new proposal for Alternative F, the Service conducted a FWCA 2b survey along the length of the project footprint in May 2011. A report summarizing the findings and recommendations related to inland waters was provided to the Corps in July 2011, and a second report summarizing the findings and recommendations for associated nearshore marine systems was provided to the Corps in December 2011. The findings and recommendations contained in these reports form the basis for our current comments in regard to Alternative F.

The subsequent proposal of Alternative F by the Corps has required a Supplemental EIS, with associated re-evaluation of environmental impacts and renewed coordination with federal and state resource agencies. At the most recent meeting with the Service regarding this new

alternative on February 12, 2014, the Corps' took the position that Alternative F avoids and minimizes impacts to the aquatic environment more effectively than earlier proposed alternatives, and that mitigation should not be necessary or required. The Service does not entirely agree with this position due to 1) long-term permanent losses of aquatic habitat already resulting from earlier project phases; 2) the relationship of the proposed alternative to earlier work (the current proposals were developed to correct deficiencies in the earlier construction); and 3) because of existing and future watershed level impacts that could be rectified to conserve stream function to support native stream fauna. Several of the recommendations put forth by the Service and DAR on earlier renditions of the proposed project, contained in our July 2011 and December 2011 FWCA 2b reports and in response to the Draft Environmental Assessment, therefore remain relevant regardless of design changes.

Recommendations

The Service acknowledges that the Corps does not agree with the applicability of compensatory mitigation under the Clean Water Act (according to the 2008 Mitigation Rule) because the Corps asserts that the smaller project footprint in comparison to the earlier proposed alternatives alleviates the need to replace functional losses. Although the Service concurred that the proposed alternative is better (i.e., less environmentally damaging) than any other proposed to date, the Service disagrees that the project should go forward without any mitigating measures.

Cumulative project impacts, including past stream channelization and modifications, must be included within the scope of the overall project impact analysis. The Service disagrees with the Corps assertion that the scope of their authority for environmental review, and for rectifying earlier damage, is limited. However, it is understood that the Corps flood risk management authorities might limit the actual amount of "ecological restoration" funding or capability.

Long-term functional losses within the project area still need to be addressed both up- and downstream of the proposed footprint; these are well within the appropriate scope of impact analysis. Much of the impact to stream function has already occurred from earlier project elements and additional impacts are now proposed. It is the position of the Service that these should not be reviewed in a piecemeal, out-of-context approach.

The NEPA process was conducted to address a project design that corrects earlier project/construction deficiencies, and would therefore not be needed if not for problems that had arisen in regard to these earlier project elements. There is no reasonable basis under NEPA for segmenting review of the new work and excluding earlier impacts. The Corps' approach of narrowing the scope of the project to only a review of the environmental impacts of the new project, without analyzing cumulative impacts, and in the absence of a watershed context, is in conflict with both NEPA and with the Fish and Wildlife Coordination Act.

The Corps has noted for several years that the design has to consider the potential for flow to be restored to the stream. This has now become a salient consideration, given the recent settlement of the Na Wai Eha case, which will mandates an Interim Instream Flow Standard (IIFS) of 10 mgd in the reach from the Waikapu and Maniania Ditch intakes downstream to the Spreckles Ditch intake, and an IIFS of 5 mgd in the terminal reach downstream of Spreckles Ditch. Given that these IIFS flows will now permanent perennial connectivity throughout the length of the Iao Stream system, the Service maintains that all earlier recommendations to improve stream function and faunal passage are now imperative for the Corps to consider. The Service therefore contends that evaluation of project impacts for the new proposal must be considered in relation to, and not separate from, impacts that have already taken place, and in the context of the newly mandated base flow restoration.

Earlier proposals to replace certain stream function and habitat characteristics, such as increasing channel roughness to slow flow and to provide shelter for migrating stream fauna, included "stream baffle blocks" - structures cemented into the stream bed. Although the fill/concrete stream bed hardening that would necessitate these structures is no longer proposed in the reach involved with Alternative F, DAR and the Service continue to recommend that placement of appropriately sized boulders in certain locations would serve the same function. DAR notes that in the recent past boulders have been moved out of the stream channel (by the County of Maui) and placed in areas where they are not of any functional benefit to native stream fauna. These provide a source of boulders that should be replaced within the stream channel to provide benefits to stream species in terms of shelter and habitat complexity.

Additional design features that could help improve aquatic biological function in the stream include: 1) realignment and possible deepening of the low flow channels, specifically reconnecting the channels where they are bifurcated; 2) modifications of the Happy Valley Diversion weir to allow diadromous faunal passage, a DAR recommendation which the Service supports (see email from Dan Polhemus, March 3, 2014 follow-up regarding this recommendation); and 3) creating native stream faunal passage/structures or modifying existing vertical drop structures to better enable faunal passage.

Endangered Species

Finalize consultation. Based on analysis provided by the Corps, Alternative F flood waters will remain in the left bank natural flood plain for approximately 9 hours, at the longest, before returning to the stream channel. Although the Hawaiian Stilt might be attracted to the site for foraging, the design and duration of flood water retention at the site are unlikely to provide the physical and biological elements to be considered an attractive nuisance for nesting or long-term occupation. The Corps should follow up with the Service to complete consultation with Ian Bordenave of our Maui Island Office.

The Service appreciates the opportunity to work with the Corps during the planning phases of this project. If you have any questions regarding this letter, please contact Fish and Wildlife Biologist Dan Polhemus by telephone at (808) 792-9400 or by electronic mail at Dan_Polhemus@fws.gov.

Sincerely,

Loyal Mehrhoff
Field Supervisor

cc:
NMFS
EPA
DAR

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

DEC 0 5 2016

Environmental Programs Branch
Programs and Project Management Division

Mr. Lui K. Hokoana
Pelekikena
Central Maui Hawaiian Civic Club
P.O. Box 1493
Wailuku, Hawaii 96793

Dear Mr. Hokoana:

The Honolulu District, U.S. Army Corps of Engineers (Corps) is initiating official coordination and consultation with your office in compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and implementing regulations 36 U.S. Code of Federal Regulation Part 800, with respect to Alternative F as being proposed under the Environmental Assessment (EA) prepared for its Iao Stream Flood Control Project in Wailuku, Maui Island, Hawaii (Multiple Tax Map Keys (TMKs)). The EA evaluates six alternatives, including the No Action and an Alternative F, and concludes the latter as the preferred alternative.

Alternative F consists of features that would reconnect the main channel with the existing floodplain on the left bank to reduce damaging flows along the main channel and right bank levees. The reconnection would be accomplished by lowering the left bank approximately five to nine feet for an approximate length of 417 feet along the left bank and grading the overflow area to disperse flow into the floodplain. Revegetation (in the form of grass) would be provided throughout the approximately 116,060-square-foot overflow channel to prevent soil erosion during diversion of stream waters. The stream would be constricted by a concrete diversion wall that would force flood flows to leave the main channel and enter the existing designated floodplain area on the left bank. Flood flows entering the floodplain at the overflow channel would spread out and follow the natural topographic gradient until re-entering the main channel downstream at the outflow section. This alternative replicates to the extent practical, the natural hydrological pattern of an alluvial floodplain that existed within the area prior to modern development.

The Iao Stream Flood Control Project has been ongoing for more than 10 years. The Corps has conducted Section 106 consultation with your office for various alternatives, including the earliest letter we have on file, dated October 4, 2007, when roman numerals were used for each of the alternatives. Alternative F is a more recent

development in 2013, and discussion on its impact on significant cultural and archaeological resources has been ongoing.

The surface of the Alternative F project area consists of an active alluvial flat that has been subjected to many recent flooding episodes in the recent past that, in all likelihood, wiped out any and all past (historic and prehistoric) significant human surface material remains. An Archaeological Inventory Survey (AIS), however, was deemed best and necessary to identify potentially significant subsurface archaeological remnants that may still be present. Pacific Consultant Services, Inc., a cultural resource consulting firm based on the island of Oahu, Hawaii, was subsequently contracted by the Corps to conduct an AIS study and investigation to determine presence of any archaeological remnants within the Alternative F project area. The Final AIS in Support of the Modification to the Iao Stream Flood Control Project, Alternative F, Wailuku Ahupuaa, Wailuku District, Maui Island, Hawaii, TMK: [2] 3-4-032:001 [por.] documenting the results of the study is enclosed for your information and review.

The AIS includes archival and background research, subsurface excavations trenching methods and strategies, data results and analysis, and conclusion. The investigation identified no significant cultural deposits. However, based on the likelihood of the presence of certain types of potentially significant cultural remains such as human burial remains, and *ahu* or stone markers, the AIS recommends archaeological monitoring during project construction to ensure there are no adverse effect on any significant cultural remnants.

The Corps fully intends to follow the recommendation of the AIS during the construction phase of Alternative F. An Archaeological Monitoring Program (AMP) will be in place during construction activities associated with Alternative F, and it will be followed and adhered to. The program will ensure that a qualified archaeologist is present to monitor all construction activities, particularly those involving all new ground-breaking excavations by ground moving heavy machineries. The monitoring activities will be conducted in consultation with your office, including the review of an archaeological monitoring plan, significance assessment of any potentially significant cultural deposits (including human burial remains) located during the monitoring, and subsequent data recovery actions and plans.

With the AMP in place, the Corps makes the determination that construction of Alternative F will have a no adverse effect on historic properties. In compliance with Section 106 of the NHPA, the Corps seeks your review and comments. The Corps is also consulting with, and seeking comments from the State Historic Preservation Office, and other Native Hawaiian Organizations such as Office of Hawaiian Affairs, Hui

Malama I Na Kupuna O Hawaii Nei, and Maui/Lanai Islands Burial Councils.

For questions, please contact Mr. Kanalei Shun, Senior Archaeologist in my Environmental Programs Branch, at (808) 835-4097 or e-mail kanalei.shun@usace.army.mil.

Sincerely,

for Stephen N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosure

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

DEC 0 5 2016

Environmental Programs Branch
Programs and Project Management Division

Mr. Alan S. Downer, Ph.D.
Administrator
State Historic Preservation Office
Department of Land and Natural Resources
State of Hawaii
601 Kamokila Boulevard, Suite 555
Kapolei, Hawaii 96707

Dear Dr. Downer:

The Honolulu District, U.S. Army Corps of Engineers (Corps) is initiating official coordination and consultation with your office in compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and implementing regulations 36 U.S. Code of Federal Regulation Part 800, with respect to Alternative F as being proposed under the Environmental Assessment (EA) prepared for its Iao Stream Flood Control Project in Wailuku, Maui Island, Hawaii (Multiple Tax Map Keys (TMKs)). The EA evaluates six alternatives, including the No Action and an Alternative F, and concludes the latter as the preferred alternative.

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The Iao Stream Flood Control Project has been ongoing for more than 10 years. The Corps has conducted Section 106 consultation with your office for various

alternatives, including the earliest letter we have on file, dated October 4, 2007, when roman numerals were used for each of the alternatives. Alternative F is a more recent development from 2013, and discussion on its impact on significant cultural and archaeological resources has been ongoing since then, beginning with a 2013 field and on-site visit and discussion with all three members of your Maui Office staff at the time, Mr. Morgan Davies, Ms. Jenny Pickett, and Mr. Hinano Rodrigues.

The surface of the Alternative F project area consists of an active alluvial flat that has been subjected to many recent flooding episodes that, in all likelihood, wiped out any and all past (historic and prehistoric) significant human surface material remains. However, during the 2013 site visit with your staff members, an Archaeological Inventory Survey (AIS) was deemed best and necessary to identify potentially significant subsurface archaeological remnants that may still be present. Pacific Consultant Services, Inc., a cultural resource consulting firm based on the island of Oahu, Hawaii, was subsequently contracted by the Corps to conduct the AIS study and investigation. The Final AIS in Support of the Modification to the Iao Stream Flood Control Project, Alternative F, Wailuku Ahupuaa, Wailuku District, island of Maui, Hawaii, TMK: [2] 3-4-032:001 [por.] documenting the results of the study is enclosed for your information and review.

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The Corps fully intends to follow the recommendation of the AIS and will put in place an Archaeological Monitoring Program (AMP) to be followed and adhered to during the construction phase of Alternative F. The program will ensure that a qualified archaeologist is present to monitor all construction activities, particularly those involving all new ground-breaking excavations by ground moving heavy machineries. The monitoring activities will be conducted in consultation with your office, including the review of the archaeological monitoring plan, significance assessment of any potentially significant cultural deposits (including human burial remains) identified during construction monitoring, and subsequent data recovery actions and plans.

With the AMP in place, the Corps makes the determination that construction of Alternative F will have a no adverse effect on historic properties. In compliance with Section 106 of the NHPA, the Corps seeks your concurrence with this determination.

The Corps is also seeking review and comments on its determination from the Office of Hawaiian Affairs, and other Native Hawaiian Organizations such as the Maui Hawaiian Civic Club, Hui Malama I Na Kupuna O Hawaii Nei, and Maui/Lanai Islands Burial Councils.

Two additional copies of this letter and the AIS are provided to you for circulation and review for your History and Culture Branch and the Maui & Lanai Burial Council. They have participated in previous consultations for this project, and we would like to continue to receive their feedback as well.

For questions, please contact Mr. Kanalei Shun, Senior Archaeologist in my Environmental Programs Branch, at (808) 835-4097 or e-mail kanalei.shun@usace.army.mil.

Sincerely,

for Stephen N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

DEC 0 5 2016

Environmental Programs Branch
Programs and Project Management Division

Mr. Edward Halealoha Ayau, Esq.
Poo
Hui Malama I Na Kupuna O Hawaii Nei
P.O. Box 365
Hoolehua, Hawaii 96729

Dear Mr. Ayau:

The Honolulu District, U.S. Army Corps of Engineers (Corps) is initiating official coordination and consultation with your office in compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and implementing regulations 36 U.S. Code of Federal Regulation Part 800, with respect to Alternative F as being proposed under the Environmental Assessment (EA) prepared for its Iao Stream Flood Control Project in Wailuku, Maui Island, Hawaii (Multiple Tax Map Keys (TMKs)). The EA evaluates six alternatives, including the No Action and an Alternative F, and concludes the latter as the preferred alternative.

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The Corps fully intends to follow the recommendation of the AIS during the construction phase of Alternative F. An Archaeological Monitoring Program (AMP) will be in place during construction activities associated with Alternative F, and it will be followed and adhered to. The program will ensure that a qualified archaeologist is present to monitor all construction activities, particularly those involving all new ground-breaking excavations by ground moving heavy machineries. The monitoring activities will be conducted in consultation with your Hui, including the review of an archaeological monitoring plan, significance assessment of any potentially significant cultural deposits (including human burial remains) located during the monitoring, and subsequent data recovery actions and plans.

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Maui Hawaiian Civic Club, and Maui/Lanai Islands Burial Councils.

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Sincerely,

for Stephen N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosure

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

DEC 0 5 2016

Environmental Programs Branch
Programs and Project Management Division

Mr. Kamanaopono M. Crabbe, Ph.D.
Ka Pouhana
Office of Hawaiian Affairs
State of Hawaii
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813

Dear Dr. Crabbe:

The Honolulu District, U.S. Army Corps of Engineers (Corps) is initiating official coordination and consultation with your office in compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and implementing regulations 36 U.S. Code of Federal Regulation Part 800, with respect to Alternative F as being proposed under the Environmental Assessment (EA) prepared for its Iao Stream Flood Control Project in Wailuku, Maui Island, Hawaii (Multiple Tax Map Keys (TMKs)). The EA evaluates six alternatives, including the No Action and an Alternative F, and concludes the latter as the preferred alternative.

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Hui Malama I Na Kupuna O Hawaii Nei, and Maui/Lanai Islands Burial Councils.

For questions, please contact Mr. Kanalei Shun, Senior Archaeologist in my Environmental Programs Branch, at (808) 835-4097 or e-mail kanalei.shun@usace.army.mil.

Sincerely,

for Stephen N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosure

OFFICE OF PLANNING
STATE OF HAWAII

DAVID Y. IGE
GOVERNOR

LEO R. ASUNCION
DIRECTOR
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
Web: http://planning.hawaii.gov/

Ref. No. P-15623

June 2, 2017

Mr. Steve N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management
U.S. Army Corps of Engineers, Honolulu District
Building 230
Fort Shafter, Hawaii 96858-5440

Attention: Ms. Lorayne Shimabuku, Civil and Public Works Branch

Dear Mr. Cayetano:

Subject: Hawaii Coastal Zone Management (CZM) Program Federal Consistency Review for the Iao Stream Flood Control Project, Wailuku, Maui

The Hawaii CZM Program has completed the federal consistency review of the Iao Stream Flood Control Project, Wailuku, Maui. This CZM federal consistency review covers the proposed activity identified as "Alternative F" in the consistency determination and the Draft Environmental Assessment (EA) (June 2015), which was submitted as a supporting document for the consistency determination. It is our understanding that the intent of the proposed activity is to reconnect the main channel with the existing floodplain to reduce damaging flows along the main channel and right bank levees.

We concur with the U.S. Army Corps of Engineers determination that the proposed activity is consistent to the maximum extent practicable with the enforceable policies of the Hawaii CZM Program based on the following conditions.

1. The proposed activity, identified as "Alternative F," shall be implemented as represented in the CZM federal consistency determination and the Draft EA (June 2015). Any changes to the proposal shall be submitted to the Hawaii CZM Program for review and approval. Changes to the proposal may require a full CZM federal consistency review, including publication of a public notice and provision for public review and comment. This condition is necessary to ensure that the proposed activity is implemented as reviewed for consistency with the enforceable policies of the Hawaii CZM Program. Hawaii Revised Statutes (HRS) Chapter 205A Coastal Zone Management, is the federally approved enforceable policy of the Hawaii CZM Program that applies to this condition.

2. The mitigation measures and best management practices identified in the CZM federal consistency determination and the Draft EA (June 2015) shall be fully implemented. This condition is necessary to ensure consistency with the Hawaii CZM Program coastal

ecosystem policies in HRS Chapter 205A, which is a federally approved enforceable policy of the Hawaii CZM Program.

3. As stated in the U.S. Army Corps of Engineers federal consistency assessment form (p. 15): "a CWA Section 401 Water Quality Certification (WQC) and a National Pollutant Discharge Elimination System (NPDES) permit would be obtained prior to construction activities to establish and implement mechanisms intended to prevent potential discharge of pollutants to state waters." This condition is necessary to ensure consistency with State of Hawaii water quality standards and requirements pursuant to HRS Chapter 342D Water Pollution, Hawaii Administrative Rules (HAR) Chapter 11-54 Water Quality Standards, and HAR Chapter 11-55 Water Pollution Control, which are federally approved enforceable policies of the Hawaii CZM Program.

4. The proposed activity shall be in compliance with requirements of the State Historic Preservation Division. This condition is necessary to ensure consistency with HRS Chapter 6E Historic Preservation, which is a federally approved enforceable policy of the Hawaii CZM Program.

5. According to the Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) (memo, May 16, 2017), several protected species are present within the project vicinity and may be affected by the proposed activity. Based on recommendations by DOFAW (memo, May 16, 2017), the following measures shall be implemented to minimize impacts to the protected species.

    a. Hawaiian hoary bat, ʻŌpeʻapeʻa (Lasiurus cinereus semotus), is a State of Hawaii and federally listed endangered species that roost in both exotic and native trees. To minimize the potential for impacts to this species, site clearing shall be timed to avoid disturbance to breeding Hawaiian hoary bats. Woody plants greater than 15 feet (4.6 meters) tall shall not be disturbed, removed, or trimmed during the bat birthing and pup rearing season, June 1 through September 15.

    b. Hawaiian short-eared owl, Pueo (Asio flammeus sandwichensis), is a State of Hawaii listed endangered species that is most active during dawn and dusk twilights. Therefore, twilight pre-construction surveys prior to vegetation clearing shall be conducted. If Pueo nests are present, a buffer zone shall be established in which no clearing occurs until nesting ceases and DOFAW shall be notified immediately.

    c. Hawaiian waterbirds: State of Hawaii and federally listed endangered waterbirds, Hawaiian duck (Anas wyvilliana), Hawaiian stilt (Himantopus mexicanus knudseni), Hawaiian coot (Fulica alai), and Hawaiian moorhen (Gallinula chloropus sandvicensis), occur within the vicinity of the proposed activity. Therefore, surveys for waterbirds by a qualified biologist shall be conducted prior to any land clearing or excavation activities, and shall be repeated if these activities are delayed more than three days. If an endangered Hawaiian waterbird is present during ongoing activities

then all activities within 100 feet (30 meters) of the bird shall cease and the bird shall not be approached. Work may continue after the bird leaves the area of its own accord. If a nest is discovered at any point, DOFAW shall be contacted immediately.

d. Seabirds: State of Hawaii listed endangered and threatened seabirds that may pass through the project area at night can be adversely impacted by artificial lighting, which causes disorientation that can result in collision with objects or grounding. Therefore, if nighttime lighting is used, lights shall be fully shielded to minimize impacts.

These conditions are necessary to ensure that the proposed activity is consistent with the following federally approved enforceable policies of the Hawaii CZM Program: HRS Chapter 183D Wildlife; HRS Chapter 195D Conservation of Aquatic Life, Wildlife, and Land Plants; and HAR Chapter 13-124 Indigenous Wildlife, Endangered and Threatened Wildlife, Injurious Wildlife, Introduced Wild Birds, and Introduced Wildlife.

If the requirements for conditional concurrences specified in 15 CFR § 930.4(a), (1) through (3), are not met, then all parties shall treat this conditional concurrence letter as an objection pursuant to 15 CFR Part 930, subpart C.

CZM consistency concurrence does not represent an endorsement of the project nor does it convey approval with any other regulations administered by any State or County agency. Thank you for your cooperation in complying with the Hawaii CZM Program. If you have any questions, please call John Nakagawa of our CZM Program at 587-2878.

Sincerely,

Leo R. Asuncion
Director

cc: DLNR, Division of Forestry and Wildlife
DLNR, Historic Preservation Division
Department of Health, Clean Water Branch
County of Maui Planning Department

Appendix G:

Water Quality and Biological Survey

Water quality and biological surveys for the ʻĪao Stream Flood Control Project Wailuku River[1], Wailuku, Maui[2]

January 18, 2017 *AECOS* No. 1232B

Susan Burr and Eric B. Guinther
AECOS, Inc.
45-939 Kamehameha Hwy, Suite 104
Kāneʻohe, Hawaiʻi 96744
Phone: (808) 234-7770 Fax: (808) 234-7775 Email: sburr@aecos.com

Introduction

The purpose of the ʻĪao Stream Flood Control Project ("Project") on the southeastern side of West Maui mountain (Figure 1) is to correct various deficiencies in the existing flood control channel ("Project Area," Figure 2) constructed between 1968 and 1981. High stream flows (freshets) have eroded segments of the channel where the streambed is unmodified and portions of the right (south or east) and left (north or west) levees. Several residential, commercial, and historical structures are threatened by continuing bank erosion. Eroded segments have been partially repaired with concrete rubble masonry (CRM); however, these repairs are showing signs of failure.

On April 4, 2012, *AECOS*, Inc. biologists conducted water quality and biological surveys of Wailuku River (*AECOS*, 2012) for a Project Draft Environmental Assessment (DEA) prepared by GSI Pacific, Inc. for the US Army Corps of Engineers (USACE). On October 13, 2014, Wailuku Water Company and Hawaiian Commercial & Sugar reduced the amount of water the companies had been diverting from Wailuku River and Waikapū Stream—an August 12, 2012 stipulation from the Commission on Water Resource Management incorporated interim instream flow standards and the two companies agreed to restore up to 10 million gallons per day (MGD) to Wailuku River (HDLNR-CWRM, 2016). On

[1] On May 27, 2015, the Hawaiʻi Board on Geographic Names approved the name change of ʻĪao Stream to Wailuku River (HBGN, 2015).

[2] Report prepared for GSI Pacific Inc. for environmental entitlements. This report is expected to become part of the administrative and/or public record for the project.

November 9, 2016, a second water quality and biology survey was conducted by *AECOS* to ascertain if changes in biological resources and water quality of Wailuku River had occurred in the two years since the return of streamflow. Information from these surveys is to be included in the Final EA to be prepared by GSI Pacific.

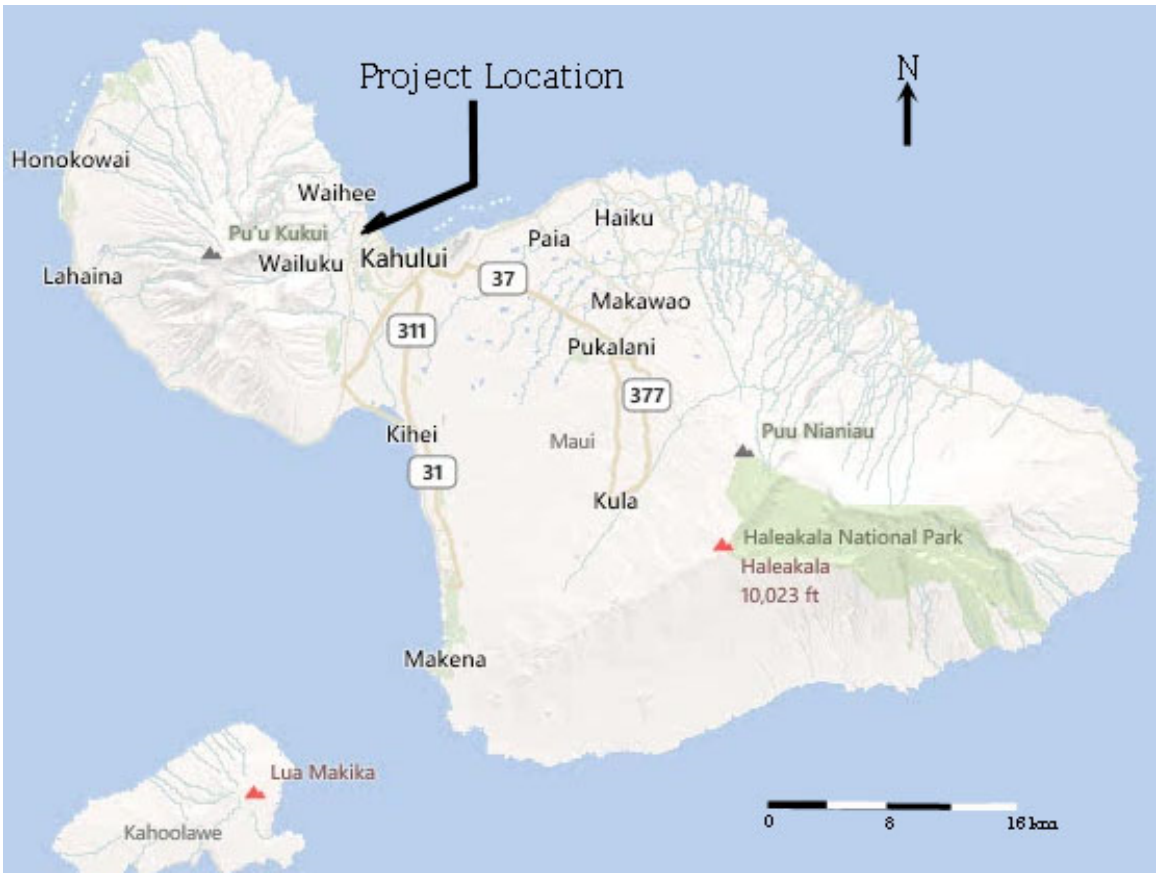

Figure 1. Map of Maui showing Project location on Wailuku River.

From September 11 to 13, 2016, approximately one month prior to the most recent survey, exceptionally heavy rains in the West Maui Mountain resulted in flash flooding of the Wailuku River. On September 13 at Puʻu Kukui, a peak 15-minute rainfall of 1.25 inches and a peak 1-hour total of 4.15 inches occurred (NOAA-NWS, 2016). A major disaster was declared for the area where the river overflowed its banks (FEMA, 2016).

At the time of our 2016 survey, "maintenance activities"—which included heavy equipment working in the stream—were occurring within the flood control channel (K. Ono, Maui County, pers. comm.). Water quality was affected by these activities and aquatic fauna were difficult to observe in the turbid water.

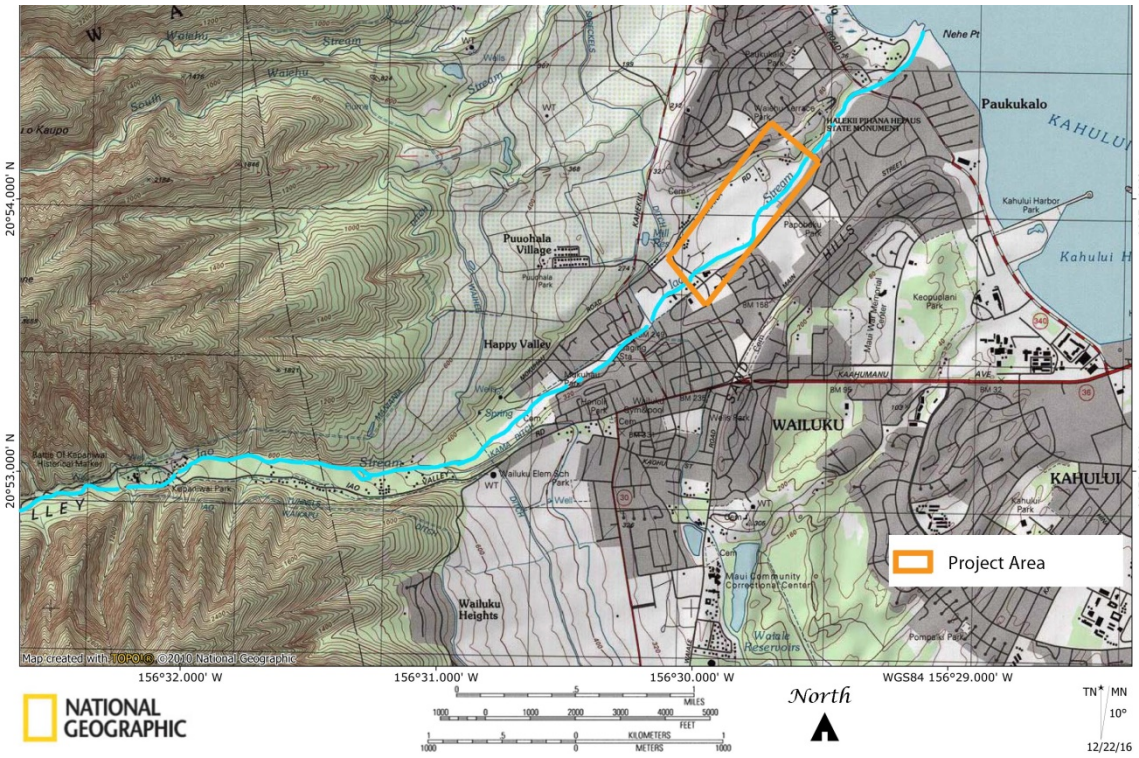

Figure 2. Location of flood control channel within Project Area.

Project Description

Modifications to the existing flood control channel are needed to prevent further property damage resulting from undermining of the stream bank and levees, and to protect Wailuku town from flood damage. In addition, levee certification that the completed project can withstand a 100-year frequency flood is required by the Federal Emergency Management Agency (FEMA); the levees in their present condition cannot be certified. Therefore, USACE has analyzed five alternatives and a no action alternative to modify the existing flood control channel to prevent further streambed erosion, and potential loss of life and property during stream freshets (USACE and Maui DPW, 2009; M. Akiba, GSI Pacific, pers. comm.).

Frequent repairs to the existing flood control channel have proved to be costly, both financially and environmentally, and have not adequately addressed problems of erosion, sedimentation, and degradation of native aquatic species populations. The Project includes measures to preserve natural ecosystems within the ʻĪao watershed. Planned engineering features should avoid or minimize potential impacts to native amphidromous[3] species and consider, where possible, restoring the stream and adjacent floodplain to more natural conditions.

The six alternatives considered for the Project are: (A) No Action Alternative; (B) Removal of Flood Control Improvements; (C) Roller Compacted Concrete (RCC) and Grouted Boulder Invert Channel Following Existing Alignment; (D) Grade Control Structures in Conjunction with Stilling Basins, Channel Realignment, and Erosion Protection (Wider Channel); (E) Grade Control Structures in Conjunction with Stilling Basins (Narrower Channel); and (F) Reconnect Main Channel with Flood Plain. Alternative F is the preferred alternative. These alternatives are described below:

Alternative A No Action - Alternative A is not to perform modifications to the existing flood control channel. Continuing severe erosion may be a result of the no action alternative, contributing to levee failure in multiple locations, which would eventually lead to flooding of parts of the Wailuku Stream drainage basin. A project failure could cause loss of life and extensive property damage.

Alternative B Removal of Flood Control Improvements – This alternative would include removal of all existing man-made improvements to the existing channel and returning the stream to its original, natural state. The community of Wailuku would be placed back into the flood plain, with no flood protection levees. A state-of-the-art flood-warning system would replace man-made flood control structures.

Alternative C Roller Compacted Concrete (RCC) and Boulder Invert Channel – This alternative was designed for standard project flood (SPF) protection with a peak design discharge of 27,500 cubic feet per second (cfs) downstream of Station 84+42 (0.5 miles upstream from the stream mouth) and 26,000 cfs downstream of Station 92+02. Typical stream stabilization improvements would include boulders in the low-flow channel and RCC bank protection in order to replicate a more natural stream invert. Design elements would be included into existing and planned channel segments to facilitate the movement of native fish and other aquatic organisms. Total project length

[3] Meaning they move between fresh and salt water during their life cycle.

extends from Station 22+00 to the debris basin (2.5 miles upstream from the ocean shore).

Alternative D Dual Silting and Sedimentation Basin – This alternative is to create two large stilling basins designed to dissipate the energy of large floods. The stilling basins would also act as debris traps and provide potential biological habitats and recreational areas. Alternative D also realigns the channel to minimize bends that cause erosion at the levee toe.

Alternative E Roller Compacted Concrete (RCC) Channel with Grade Control Structures – This alternative is similar to Alternative C, with the addition of small grade control structures that slow stream velocities and provide biological habitats within the channel. Alternative E also realigns the channel to avoid toe erosion at bends.

Preferred Alternative F Reconnect Main Channel with Flood Plain – This alternative will reduce damaging flows along the main channel and right bank levees by reconnecting the main channel with the flood plain. Modifications are described in more detail as follows:

- Lower left (north) bank between river station (RS) 79+20 and 75+10;
- Grade overflow area to disperse flow onto the flood plain;
- Constrict the main channel with a concrete diversion wall to force flood flows to leave the main channel and enter the existing flood plain on the north side of the stream;
- Raise left bank between RS 66+60 and 61+05 to contain overflow within the flood plain and lower the left bank between RS 45+60 and 43+60 to allow overflow to return to the main channel;
- Stabilize right bank between RS 83+25 and 81+25 and between RS 44+10 and 42+30 to prevent further erosion; and
- Reconstruct existing revetment between overflow channel and outflow return location.

This alternative would achieve project objectives and is considered to be feasible from both engineering and cost perspectives.

Stream Description

Total area of the ʻĪao watershed (Department of Land and Natural Resources-Division of Aquatic Resources watershed code no. 62009) is estimated at 30.8 km^2 (11.9 mi^2; HDLNR-DAR, 2008). Wailuku River, a third order stream, extends approximately 42.1 km (26.2 mi) from near the top of West Maui Mountain down to the Pacific Ocean. The longest tributaries, Poʻonāhoahoa

Stream and Nākalaloa Stream, originate at the western extent of ʻĪao Valley at approximately 300 and 600 m (1000 and 2000 ft) above sea level (ASL). Within ʻĪao Valley State Monument, four other tributaries (Ae, Kinihāpai, Puʻulio, and Māniania streams) join the main branch of Wailuku River. The headwaters and upper reaches (segments greater than 200 m above sea level) of Wailuku River, including all six tributaries, account for almost 80% of the length of the stream channel (HDLNR-DAR, 2008).

The headwaters (segments greater than 750 m above sea level) and upper reaches (segments between 200 m and 750 m above sea level) of Wailuku River are unmodified, although ʻĪao Tunnel and Maniania Ditch divert some of the stream flow from the upper reach. At Kepaniwai Park, just downstream from ʻĪao Valley State Monument, the floodplain is terraced and several *auwai* divert water through *loʻi kalo* (taro pondfields). Downstream from the park, the stream channel has been straightened, but the stream bed remains natural. A large debris basin and concrete debris fence have been constructed in the stream channel near Mokuhau Park (Figure 2a). This basin is maintained by dredging on a regular basis. Downstream from Mokuhau Park, for much of the remaining stream length, Wailuku River is confined to a large, concrete-lined channel and disconnected from the floodplain by walls and levees (see Figure 2b). The stream discharges into the Pacific Ocean at Nehe Point just northwest of Kahului Bay.

Wailuku River is included in the Hawaiʻi Stream Assessment (as ʻĪao Stream), which purports to list all perennial[4] streams in Hawaiʻi (HCPU, 1990). Prior to the return of flow in 2014, Wailuku River was an interrupted stream—flow was discontinuous in the middle and lower reaches largely due to diversions in the middle and upper reaches.

Various best management practices (BMPs) have been constructed within the ʻĪao Stream Flood Control Project limits and upstream in an attempt to support biological resources in the stream. A simple passage channel has been constructed at the ʻĪao Tunnel and Maniania Ditch diversion, to allow native amphidromous organisms to migrate past the diversion structure (Figure 3). A concrete-lined low flow channel (see Fig. 2b), which concentrates flow that would otherwise dissipate over a flat concrete bottom of the channel, is present for almost the entire length of the hardened channel from Mokuhau Park to Waiehu Beach Road. Gaps in the channel (Figure 4a) reduce its effectiveness as a pathway for migrating amphidromous animals and, prior to the return of flow to the stream, the low-flow channel may not have always contained flowing

[4] A perennial stream has year-round, continuous flow in at least part of its bed; flow need not be continuous from upper reaches to the sea.



Figure 2a (upper). Debris basin in 2012 (note biologist in white shirt for scale). Figure 2b (lower). Concrete channel of Wailuku River in 2012 showing low-flow channel.

water. Some parts of the flood control channel have boulders embedded in the bottom of the concrete channel to add rugosity to the feature and some parts of the channel remain unlined (Figure 4b), although it appears the bed and banks are regularly maintained (boulders removed from channel are stacked on banks) with heavy equipment. No attempts have been made to improve conditions for riparian vegetation or shading for the stream within the ʻĪao Stream Flood Control Project limits.



Figure 3. Fish passage channel at ʻĪao Tunnel intake on Wailuku River.

Survey Methods

Water Quality Survey

On November 9, 2016, *AECOS* biologists measured selected parameters and collected water samples at three locations on Wailuku River to characterize water quality (Figure 5). An additional sample for turbidity and TSS was collected a short distance upstream from Sta. 3 (Sta. 3up) because the biologists

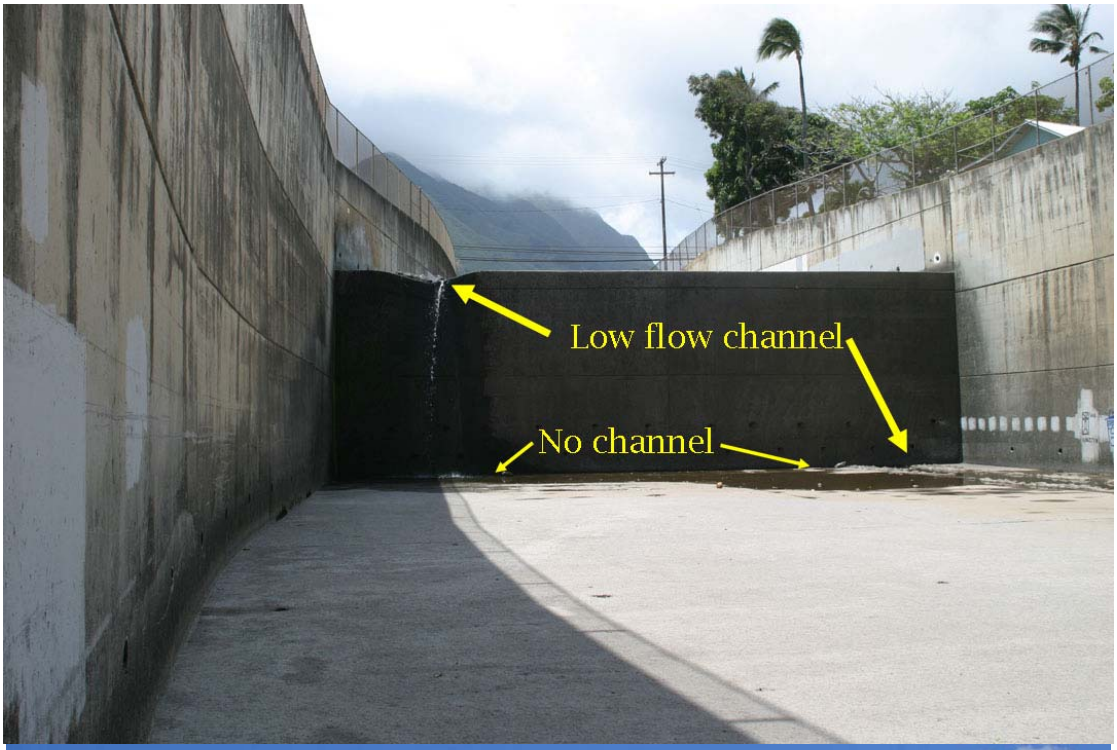



Figure 4a (upper). In places, the low-flow channel is not continuous.
Figure 4b (lower). An unlined stream section in the Project vicinity.

noted water clarity was impaired at the time of sampling of Sta. 3 due to heavy equipment working within the stream channel. In the intervening 20+ minutes between sample collection at Sta. 3 and Sta. 3up, the water clarity improved substantially. Sampling locations are the same as were sampled on April 4, 2012 (*AECOS*, 2012). Also shown in Fig. 5 is a point labeled, "2009 stations," which is the general location of three closely-spaced points sampled in 2009 for a project at Waiehu Beach Road (*AECOS*, 2011).

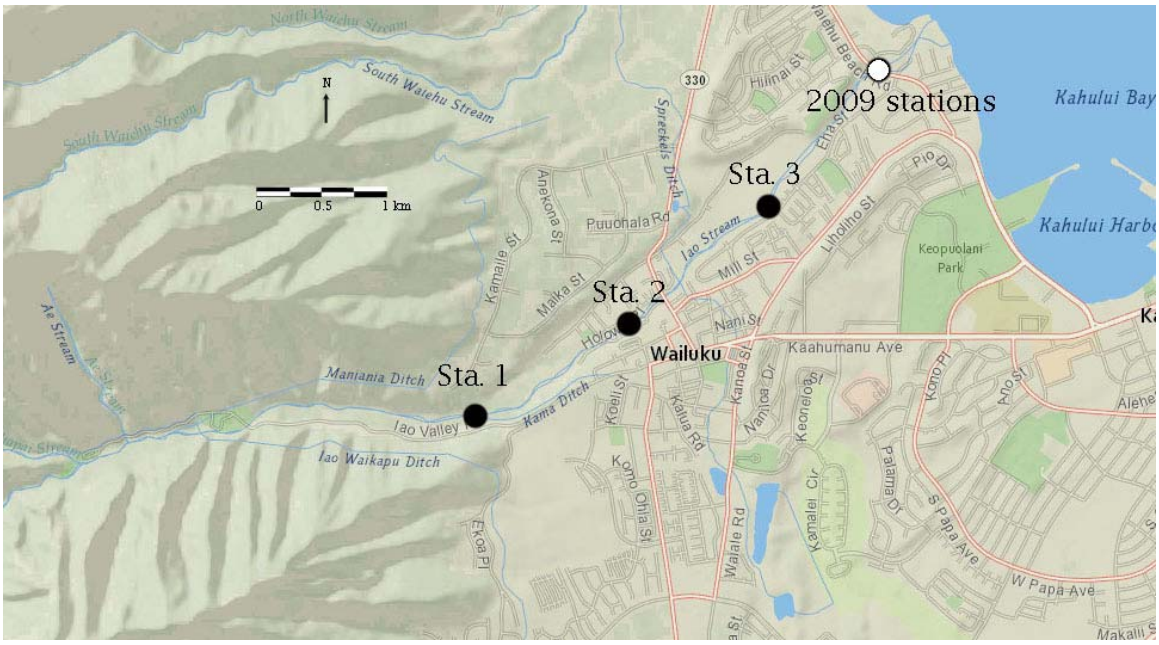

Figure 5. Three water quality stations sampled on November 9, 2016 and April 4, 2012 (Sta. 1, 2, and 3) and general location of three stations sampled on December 4, 2009 (2009 stations).

Field measurements (temperature, pH, and dissolved oxygen) were made and water samples collected for analyses (conductivity, turbidity, total suspended solids, and nutrients) in the laboratory. Samples were collected from just below the water surface. In 2012, Sta. 2 samples were collected from presumed "spring" flow (flow beneath the concrete bed) upwelling from pressure relief pipes in the concrete bottom.

Samples were placed on ice and taken to the *AECOS* Laboratory in Kāneʻohe for analyses (*AECOS* Laboratory Log No. 28124 [2012] and 33169 [2016]). Table 1 lists the instruments and analytical methods used in the field and laboratory to analyze this set of samples.

Table 1. Analytical methods used for November 9, 2016 and April 4, 2012 water quality analysis of Wailuku River.

Analysis	Method	Reference
Temperature	thermister calibrated to NBS. Cert. thermometer/ SM 2550 B	SM (1998)
Conductivity	SM 2510-B	SM (1998)
pH	SM 4500 H+	SM (1998)
Dissolved Oxygen	SM 4500-O G	SM (1998)
Turbidity	EPA 180.1 Rev 2.0	USEPA (1993)
Total Suspended Solids	SM 2540 D	SM (1998)
Nitrate + Nitrite	EPA 353.2 Rev 2.0	USEPA (1993)
Total Nitrogen	persulfate digestion/ EPA 353.2	Grasshoff et al. (1986)/ USEPA (1993)
Total Phosphorus	persulfate digestion/ EPA 365.1 Rev 2.0	Grasshoff et al. (1986)/USEPA (1993)

Botanical Survey

In both 2012 and 2016, the botanist covered the survey area on foot and noted plant species occurring within the channel and along the face and tops of the banks as the plants were encountered. As the survey progressed, notes were made on the relative abundances of each species (e.g., rare, common, abundant). Photographs were taken, or specimens collected for closer inspection, of any plants not readily identifiable in the field. The survey area was limited to the stream channel and banks between the waterfall at Mokuhau Park above the debris basin (upper end), and the end of concrete near the Waiehu Beach Road bridge (lower end).

Aquatic Biota Survey

In 2012 and 2016, the aquatic biologist made observations and used hand nets to collect aquatic organisms for closer inspection from Wailuku River. In 2012, Hawaiʻi Division of Aquatic Resources (DAR) biologist, Skippy Hau, accompanied the biologist. As the survey progressed, the biologists made notes on the relative abundances of each species (e.g. rare, common, abundant). Algal specimens and mollusks were collected in 2012 for identification in the laboratory. The potential for migration of native amphidromous animals and the distribution of naturalized organisms throughout the stream was assessed.

Results

Water Quality Survey

Water quality results for the 2016 and 2012 sampling event are summarized in Table 2. The mean values from data collected from the three stations near Waiehu Beach Road in 2009 are also included in Table 2. The 2016 and 2012 samples were collected on sunny days without rain. The 2009 samples were collected during a freshet (above normal flow event).

Table 2. Physical and chemical water quality results for Wailuku River, April 4, 2012 and November 9, 2016 (Stas. 1-3), and December 4, 2009 (Waiehu Beach).

Station	Time	Temp. (°C)	Conductivity (μmhos/cm)	pH	DO (mg/l)	DO sat. (%)
Sta. 1 (2012)	1455	21.3	112	8.02	9.46	95
Sta. 1 (2016)	1047	21.6	91	7.64	8.76	99
Sta. 2 (2012)	1520	21.8	154	7.17	6.82	78
Sta. 2 (2016)	1015	21.7	99	7.37	8.35	97
Sta. 3 (2012)	1540	24.2	139	7.73	6.78	81
Sta. 3 (2016)	0925	21.3	97	7.50	9.04	102
Sta. 3up (2016)	0947	---	---	---	---	---
Waiehu Beach Road (2009)	---	22.9†	112†	7.96†	6.80†	79†

Station	Time	Turbidity (ntu)	TSS (mg/l)	NO_3+NO_2 (μg N/l)	Total N (μg N/l)	Total P (μg P/l)
Sta. 1 (2012)	1455	0.46	0.8	<9	107	49
Sta. 1 (2016)	1047	1.58	3.8	64	102	16
Sta. 2 (2012)	1520	2.00	5.1	268	321	58
Sta. 2 (2016)	1015	2.10	5.6	91	108	18
Sta. 3 (2012)	1540	0.52	0.3	90	226	77
Sta. 3 (2016)*	0925	128	518	64	102	36
Sta. 3up (2016)	0947	8.32	33.3	---	---	---
Waiehu Beach Road (2009)	---	1.14‡	1.1‡	91‡	161‡	17‡

* - Heavy equipment working in stream above sampling point.
† - Arithmetic mean of three samples.
‡ - Geometric mean of three samples.

Temperature, dissolved oxygen (DO), and pH measured at all three stations in 2016 are typical of a swiftly flowing stream. Temperature ranged from 21.3 to 21.7°C and DO ranged from 8.35 to 9.04 mg/L, resulting in 97% to 102% saturation. pH ranged from 7.37 to 7.64. Conductivities were low (91 to 99 µmhos/cm) at all sampled locations, including the 2009 event near the river mouth, sampled during a freshet. At Sta. 1, 2016 values for these parameters matched closely those measured in 2012. In 2012, Sta. 3 had minimal flow; measured in the afternoon revealing high water temperature (24.2˚C) and consequent moderately reduced DO saturation (81%). The average temperature of the samples collected in 2009 was 22.9˚C, higher than expected for a freshet flow but reflective of the heat gained by the water traversing the long concrete channel.

Particulates (turbidity and total suspended solids or TSS) were low at Stas. 1 and 2 in both 2016 and 2012, though the slightly elevated values at Sta. 2 (turbidity of 2.00 ntu and TSS of 5.1 mg/l in 2012) might be the result of algae dislodged from the channel bottom when collecting the sample. The elevated particulates measured at Stas. 3 and 3up in 2016 reflect material suspended in the water from construction activity.

In 2016, nitrogen (nitrate+nitrite and total nitrogen) concentrations were low at all three stations. In 2012, nitrogen concentrations were low at Sta. 1, and elevated at Stas. 2 and 3. Total phosphorus (TP) was low at all three stations in 2016, but increased steadily downstream in 2012, starting out at Sta. 1 somewhat elevated at 49 µg P/l as TP. The 2009 Waiehu Beach Road means were generally similar to our 2012 and 2016 Sta. 3 samples with respect to nitrogen compounds, although much lower in total phosphorus. The high proportion of inorganic nitrate+nitrite at Sta. 2 in 2012 and 2016 bolsters the inference that spring water coming from beneath the concrete lining is a significant contribution to flow at this station. In 2012, this large amount of inorganic nitrogen contributed to the high total nitrogen (TN) on that sampling date.

Botanical Survey

A checklist of plants recorded from Wailuku Stream channel and banks on November 9, 2016 and on April 4, 2012 is presented as Table 3. Relative abundance values (under ”Site”) are for stream channel, banks, and levees. The next column, marked “Area”, shows—by an “x” indicating present—those species of trees or shrubs common in undeveloped or landscaped areas adjacent to the stream, somewhat beyond the “bank.” An “o” in this column shows presence in an area indicated on Project plans on the left bank as staging and potential overflow channel areas.

Table 3. Checklist of plant species observed along middle and lower Wailuku River, Wailuku, Maui.

Species listed by family	Common name	Status	Abundance	Site - Area	Notes
FERNS AND FERN ALLIES					
BLECHNACEAE					
Blechnum appendiculatum Willd.	---	Nat	R		<1>
NEPHROLEPIDACEAE					
Nephrolepis multiflora (Roxb.) F.M. Jarrett ex C.V. Morton	---	Nat	R		<1>
PTERIDACEAE					
Adiantum raddianum C. Presl.	---	Nat	R		<1>
Adiantum sp.	maidenhair fern	Nat	R		<1>
Pteris vitata L.	ladder brake	Nat	R		
THELYPTERIDACEAE					
Christella sp.	wood fern	Nat	R		<1>
FLOWERING PLANTS					
DICOTYLEDONES					
ACANTHACEAE					
Asystasia gangetica (L.) T. Anderson	Chinese violet	Nat	R		
Thunbergia fragrans Roxb.	sweet clock-vine	Nat	R		
AMARANTHACEAE					
Alternanthera pungens Kunth	khaki weed	Nat	U		
Amaranthus spinosus L.	spiny amaranth	Nat	R		
ANNONACEAE					
Spondias dulcis Parkinson	*wī*	Orn	-	o	
APOCYNACEAE					
Plumeria rubra L.	graveyard flower	Orn	-	o	
ARALIACEAE					
Schefflera actinophylla (Endl.) Harms	octopus tree	Nat	-	x	
ASTERACEAE (COMPOSITAE)					
Ageratum conyzoides L.	*maile hohono*	Nat	R		
Bidens pilosa L.	beggartick	Nat	R		
Calyptocarpus vialis Less.	---	Nat	R		
Conyza bonariensis (L.) Cronq.	hairy horseweed	Nat	R		
Eclipta prostrata (L.) L.	false daisy	Nat	R		
Emilia fosbergii Nicolson	Flora's paintbrush	Nat	R		
Pluchea carolinensis (Jacq.) G. Don	sourbush	Nat	O	o	
Sonchus oleraceus L.	sow thistle	Nat	R		
Sphagneticola trilobata (L.) Pruski	wedelia	Nat	R		

Table 3 (continued).

Species listed by family	Common name	Status	Abundance Site	Abundance - Area	Notes
ASTERACEAE (continued)					
Tridax procumbans L.	coat buttons	Nat	R		
Verbesina encellioides (Cav.) Bernth. & Hook.	golden crown-beard	Nat	U	o	
Vernonia cinerea (L.) Less.	little ironweed	Nat	R		
Xanthium strumarium L.	*kīkānia*	Nat	R		
BIGNONIACEAE					
Spathodea campanulata P. Beauv.	African tulip	Nat	-	x	
BORAGINACEAE					
Carmona retusa (Vahl.) Masam.	Fukien tea	Nat	-	x	
Cordia subcordata Lam.	*kou*	**Pol**	R		
Heliotropum currasavicum L.	*kīpūkai*	**Ind**	R	o	
Heliotropum procumbans Mill.	---	Nat	U		
BRASSICACEAE					
Lepidium virginicum L.	pepperwort	Nat	R		
BUDDLEIACEAE					
Buddleia asiatica Lour.	dog tail	Nat	R		<1>
CHENOPODIACEAE					
Chenopodium carinatum R.Br.	---	Nat	U		
COMBRETACEAE					
Terminalia catappa L.	false kamani	Nat	R		<1>
CONVOLVUlACEAE					
Ipomoea obscura (L.) Ker Gawl.	---	Nat	-	o	
Ipomoea triloba L.	little bell	Nat	R		
EUPHORBIACEAE					
Aleurites moluccana (L.) Willd.	*kukui*	**Pol**	-	x	
Euphorbia albomarginata Torr. & A. Grey	rattlesnake weed	Nat	R		
Euphorbia hirta L.	garden spurge	Nat	R		
Euphorbia hypericifolia L.	graceful spurge	Nat	R		
Euphorbia prostrata Aiton	prostrate spurge	Nat	R		
Phyllanthus debilis Klein ex Willd.	nuiuri	Nat	U		
Ricinus communis L.	castor bean	Nat	U	x	
FABACEAE					
Albizia saman F. Muell.	monkeypod	Nat	-	x	
Alysicarpus vaginlis (L.) DC.	Alyce clover	Nat	O		
Canavalia cathartica Thouars	maunaloa	Nat	R		
Chamaecrista nictitans (L.) Moench.	partridge pea, *laukī*	Nat	-	o	
Crotalaria cf. *assamica* Benth.	---	Nat	R		<4>

Table 3 (continued).

Species listed by family	Common name	Status	Abundance Site	Abundance Area	Notes
FABACEAE (continued)					
Crotalaria cf. *incana* L.	fuzzy rattlepod	Nat	R		<4>
Desmodium incanum DC.	Spanish clover	Nat	U		
Indigophera hendecaphylla Jacq.	prostrate indigo	Nat	U		<2>
Leucaena leucocephala (Lam.) de Wit	*koa haole*	Nat	-	x	
Macroptilium atropurpureum (DC.) Urb.	---	Nat	O		
Macroptilium lathyroides (L.) Urb.	wild bean, cow pea	Nat	R	o	
Medicago polymorpha L.	bur clover	Nat	R		
Pithecellobium dulce (Roxb.) Benth.	*ʻopiuma*	Nat	-	x,o	
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	*kiawe*	Nat	-	x	
Tamarindus indica L.	tamarind	Orn	-	o	
GOODENACEAE					
Scaevola sericea Vahl	*naupaka kahakai*	**Ind**	R		
LAMIACEAE					
Hyptis pectinata (L.) Poit.	comb hyptis	Nat	R		
Leonotis nepetifolia (L.) T. Br.	lion's ear	Nat	U		
MALVACEAE					
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	Nat	-	o	
Hibiscus tiliaceus L.	*hau*	**Ind**	-	x	
Malvastrum coromandelianum (L.) Garcke	false mallow	Nat	R		
Sida rhombifolia L.	---	Nat	R	o	
MORACEAE					
Artocarpus altilis (Z.) Fosberg	*ʻulu*, breadfruit	**Pol**	-	o	
Ficus microcarpa L. fil.	Chinese banyan	Nat	R	o	
Morus alba L.	white mulberry	Nat	-	o	
MORINGACEAE					
Moringa oleifera Lam.	horseradish tree	Orn	-	o	
MYRTACEAE					
Psidium cattleianum Sabine	strawberry guava	Nat	-	x	
Syzygium cumini (L.) Skeels	Java plum	Nat	-	x	
NYCTAGINACEAE					
Boerhavia coccinea Mill.	false alena	Nat	U		
OXALIDACEAE					
Oxalis corniculata L.	yellow wood sorrel	**Pol**	R		
PAPAVERACEAE					
Argemone mexicana L.	Mexican poppy	Nat	U		

Table 3 (continued).

Species listed by family	Common name	Status	Abundance Site - Area		Notes
POLYGALACEAE					
Polygala paniculata L.	bubblegum plant	Nat	R		
RUTACEAE					
Citrus maxima (J. Burm.) Merr.	pummelo	Orn	-	o	
SAPOTACEAE					
Chrysophyllum oliviforme L.	---	Nat	-	o	
SOLANACEAE					
Nicotiana glauca R.C. Graham	tree tobacco	Nat	-	o	<3>
Solanum lycopersicum var. *cerasiforme* (Dunal) Spooner	cherry tomato	Nat	R		
URTICACEAE					
Pilea microphylla (L.) Liebm.	artillery plant	Nat	R		
VERBENACEAE					
Verbena litoralis Kunth	*ōwī*	Nat	R		
	MONCOTYLEDONES				
AGAVACEAE					
Cordyline fruticosa (L.) A. Chev.	*ki*, ti	**Pol**	-	o	
Yucca gloriosa L.	Spanish bayonet	Orn	-	x	<4>
ARACEAE					
Syngonium cf. *podophyllum* Schott	nephthytis	Nat	R		
ARECACEAE					
Cocos nucifera L.	*niu*, coconut	Nat	-	x,o	<4>
Livistona chinensis (Jacq.) R. Br. ex Mart.	Chinese fan palm	Nat	-	o	
Dypsis lutescens (H. Wendl.) Beentje & Dransfield	areca palm	Orn	-	x	
CYPERACEAE					
Cyperus involucratus Roxb.	umbrella sedge	Nat	R		<1>
Fimbristylus cymosa R. Br.	*mauʻu ʻakiʻaki*	**Ind**	R		
POACEAE					
Axonopus fissifolius (Raddi) Kuhlm.	nrw-lvd carpet grass	Nat	U		
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	Nat	U		<2>
Cenchrus ciliaris L.	bufflegrass	Nat	O		<2>
Cenchrus echinatus L.	sandbur	Nat	O		<2>
Chloris barbata (L.) Sw.	swollen fingergrass	Nat	O		
Chloris virgata Sw.	feather fingergrass	Nat	U		
Coix lachryma-jobi L.	Job's tears	Nat	R		
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat	U		
Digiteria ciliaris (Retz.) Koeler	Henry's crabgrass	Nat	R		
Digiteria insularis (L.) Mez ex Ekman	sourgrass	Nat	U		

Table 3 (continued).

Species listed by family	Common name	Status	Abundance Site - Area	Notes
POACEAE (continued).				
Echinochloa crus-galli (L.) P. Beauv.	barnyard grass	Nat	R	
Eleusine indica (L.) Gaertn.	wiregrass	Nat	R	
Eragrostis amabilis (L.) Wight & Arnott	Japanese lovegrass	Nat	R	
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	Nat	R	
Megathyrsus maximus (Jacq.) B.K Simon & W.L. Jacobs	Guinea grass	Nat	O	x,o
Melinus repens (Willd.) Zizka	Natal redtop	Nat	U	
Setaria verticillata (L.) P. Beauv.	bristly foxtail	Nat	O	
Cenchrus purpureus (Schumach.) Marrone	elephant grass	Nat	O	
indet. non-native grass (2012)	---	Nat	R	

Legend to Table 3.

STATUS = distributional status for the Hawaiian Islands:

Ind = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.

Nat = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.

Pol. = Polynesian introduction before 1778.

ABUNDANCE = occurrence ratings for plants by area:

R – Rare; seen in only one or as few locations.

U – Uncommon; seen in several locations.

O – Occasional; seen with some regularity.

NOTES:

<1> Seen only in area immediately above debris basin and below waterfall.

<2> Common to abundant in limited part of entire survey area.

<3> Present in small numbers in this location.

<4> Specimen(s) encountered lacked fruit or flowers; determination uncertain.

A total of 110 species of ferns and flowering plants were observed and recorded as growing in the Project area combining the two surveys. Of this number, 81 species occur within the stream channel (on banks and levees), compared with 60 noted in 2012. Presumably, not all 81 species are extant at any one time, so the total number is not necessarily a large increase over the previous survey results. With but a few exceptions, all of these plants are non-native species, and most are common weedy species that have established on the highly disturbed banks (regularly maintained by mowing or herbicide spraying) and sand/mud bars that form in the concrete channel. The nine native or early Polynesian introduced species include three trees observed near the stream (*kukui*, *kou*,

and *hau*) and one (ʻ*ulu*) observed in the overflow area, two planted shrubs (*ki* and *naupaka kahakai*), a sedge (*Fimbristylis cymosa*), and two low growing herbs (wood sorrel or *ʻihiʻai* and *kīpūkai*). All are common and widespread species in the Hawaiian Islands.

The vegetation in the project area is essentially dominated by ruderal species (plants adapted to disturbed areas). Outside the channel banks, the area is urban or, in a limited part, "agricultural." The latter includes lands beyond the left bank in the lower reach of the stream, including the overflow area surveyed in 2016. The overflow area is mostly an open field with evidence of use as horse pasturage with scattered trees that appear to have been planted at some time in the past. Forested areas occur opposite Mokuhau Park on the right bank and upstream of the park on the left bank.

Aquatic Biota Survey

Table 4 is a listing of aquatic species identified in Wailuku River. The table includes observations made on November 9, 2016, and also includes earlier observations in this stream by *AECOS* (*AECOS*, 2011, 2012), U.S. Fish and Wildlife Service (USFWS, 2011), and those species reported in Wailuku River by the Hawaiʻi Watershed Atlas (HDLNR-DAR, 2008).

Visibility was too poor during our field survey in 2016 to warrant a survey of the estuary downstream of the flood control channel, but observations in 2012 indicate typical estuarine fishes such as mullet (*Mugil cephalus*), *ʻāholehole* (*Kuhlia xenura*), *kūpīpī* (*Abudefduf sordidus*), and dusky frillgoby (*Bathygobius fuscus*) inhabit the estuarine reach downstream from the Project area. Two endemic mollusks—*hīhīwai* (*Neritina granosa*) and *hapawai* (*Neritina vespertina*)—also inhabit the estuary (USFWS, 2011; Hau, 2007). *Hīhīwai* and *hapawai* are amphidromous animals that require stream flow for reproductive success. *Hīhīwai* also inhabit lower and middle reaches of streams, but they migrate slowly and, prior to 2014, the diversions in Wailuku River made it nearly impossible for the juvenile snails to migrate upstream beyond the flood control channel (Hau, 2007). In 2012, we found a single *hīhīwai* shell near the debris basin (Fig. 2a) in the middle reach of the stream. Prior to the return of flow to Wailuku River, HDLNR-DAR implemented a program to collect *hīhīwai* from the estuary and release them in a continuously flowing segment of stream at ʻĪao Valley State Monument (Hau, 2007).

In 2016, we observed numerous *ʻoʻopu nākea* (*Awaous stamineus*), a native amphidromous goby, in the flood control channel. Total lengths (TL) of most *ʻoʻopu nākea* were less than 5 cm (Figure 6), but some were up to 10 cm long. Other *ʻoʻopu* species may have been present in the flood control channel, but

Table 4. Checklist of aquatic species found in Wailuku River.

PHYLUM, CLASS ORDER, FAMILY Species	Common name	Status	Abundance
	MONERA		
CYANOPHYCOTA, CYANOPHYCEAE	cyanobacteria		
NOSTOCALES, RIVULARIACEAE			
Dichothrix sp.		**---**	P (2)
NOSTOCALES, OSCILLATORIACEAE			
Schizothrix sp.		**---**	P (2)
	ALGAE		
CHLOROPHYTA, CHLOROPHYCEAE	green filamentous algae		
CHAETOPHORALES, CHAETOPHORACEAE			
Cloniophora sp.			P (2)
Stigeoclonium sp.		**Ind**	P (2, 3)
CHAETOPHORALES, CHARACEAE			
Chara sp.		Nat	O (2)
CHLOROPHYTA, ZYGNEMATOPHYCEAE			
ZYGNEMATALES, ZYGNEMATACEAE			
Spirogyra sp.		**Ind**	P (2)
	INVERTEBRATES		
PLATYHELMINTHES, TRICLADIDA			
DUGESIIDAE			
Dugesia sp.	flatworm	Nat	O (2)
ANNELIDA, CLITELLATA			
Unidentified Oligochaeta	earthworm	Nat	P (4)
ANNELIDA, HIRUDINEA			
Unidentified Hirudinea	free-living leech	Nat	O (2)
ARTHROPODA, INSECTA			
DIPTERA			
unidentified Diptera	midge	---	P (4)
DIPTERA, CANACEIDAE			
Procanace sp.	surf fly	---	P (4)
DIPTERA, CHIRONOMIDAE	midges		
unidentified Chironomidae	larvae	---	O (2), P (4)
Telmatogeton sp.		---	P (4)
Telmatogeton torrenticola (Terry, 1913)	Hawaiian chironomid	End	P (4)
ODONATA			
unidentified Odonata	naiad	---	R (3)

Table 4 (continued).

PHYLUM, CLASS ORDER, FAMILY Species	Common name	Status	Abundance
ODONATA, LIBELLULIDAE	dragonflies		
Crocothemis servilia (Drury, 1773)	scarlet skimmer, adult	Nat	O (1,2)
Orthemis ferruginea (Fabricius, 1775)	roseate skimmer, adult	Nat	O (2)
ODONATA, COENAGRIONIDAE	damselflies		
Megalagrion sp.		**End**	P (4)
Megalagrion blackburni McLachlan, 1883	Blackburn's Hawaiian damselfly	**End**	P (4)
Megalagrion hawaiiense (McLachlan, 1883)	Hawaiian upland damselfly	**End**	P (4)
Megalagrion nigrohamatum nigrohamatum (Blackburn, 1884)	blackline Hawaiian damselfly	**End**	P (4)
TRICHOPTERA	caddisflies		
unidentified Trichoptera	larvae	Nat	P (4)
TRICHOPTERA, HYDROPSYCHIDAE	net-spinning caddisflies		
Cheumatopsyche analis (Banks, 1903)		Nat	P (4)
Cheumatopsyche pettiti Banks, 1908		Nat	P (4)
TRICHOPTERA, HYDROPTILOIDAE	micro-caddisflies		
unidentified Hydroptiloidae		Nat	O (2)
Hydroptila arctia Ross, 1938		Nat	P (4)
Hydroptila potosina Bueno-Soria, 1984		Nat	P (4)
ARTHROPODA, MALACOSTRACE			
DECAPODA, ATYIDAE			
Atyoida bisulcata J.W. Randall, 1840	*ʻōpae kalaʻole*	**End**	7.38/yd^2 Upper† (4)
DECAPODA, CAMBARIDAE			
Procambarus clarkii (Girard, 1852)	red swamp crayfish	Nat	R (2, 3)
DECAPODA, PALAEMONIDAE			
Macrobrachium lar (J.C. Fabricius, 1798)	Pacific prawn	Nat	C (1) 0.02/yd^2 Mid (4)
ISOPODA			
unidentified Isopoda	isopod	Nat	P (4)
MOLLUSCA, GASTROPODA	snails		
unidentified Gastropoda		Nat	P (4)
BASOMMATOPHORA, LYMNAEIDAE			
unidentified Lymnaeidae	pond snail	Nat	P (4)
BASOMMATOPHORA, PHYSIDAE			
Physa sp.	pouch snail	Nat	R (2), 0.63/yd^2 Mid 0.63/yd^2 Upper (4)

Table 4 (continued).

PHYLUM, CLASS ORDER, FAMILY Species	Common name	Status	Abundance
BASOMMATOPHORA, PLANORBIDAE			
Planorbella duryi (Wetherby, 1879)	ramshorn snail	Nat	R‡ (2)
NEOTAENIOGLOSSA, THIARIDAE			
Melanoides tuberculatus (Muller, 1774)	red-rim melania	Nat	R (1), O (2)
NERITOPSINA, NERITIDAE			
Neritina granosa Sowerby, 1825	*hīhīwai*	**End**	R‡ (2), R (5)
Neritina vespertina Sowerby, 1849	*hapawai*	**End**	R (5)
VERTEBRATES			
CHORDATA, ACTINOPTERYGII	fishes		
CLUPEIFORMES, ENGRAULIDAE			
Encrasicholina purpurea (Fowler, 1900)	*nehu*	**End**	O (3) (estuary)
MUGILIFORMES, MUGILIDAE			
Mugil cephalus Linnaeus, 1758	*ʻamaʻama*	**Ind**	O (3), P (4) (estuary)
PERCIFORMES, CICHLIDAE			
Tilapia sp.	tilapia	Nat	P (4)
PERCIFORMES, KUHLIIDAE			
Kuhlia sp.	*ʻāholehole*	**Ind**	0.21/yd^2 Low (4)
Kuhlia xenura (Jordan and Gilbert, 1882)	*ʻāholehole*	**Ind**	R (2) (estuary)
PERCIFORMES, ELEOTRIDAE			
Eleotris sandwicensis (Vaillant and Sauvage, 1875)	*ʻoʻopu akupa*	**End**	P (4)
PERCIFORMES, GOBIIDAE			
unidentified Gobiidae			P (4)
Awaous stamineus (Eydoux & Souleyt, 1850)	*ʻoʻopu nākea*	**Ind**	O (1), R (2), 0.26/yd2 Mid (4)
Bathygobius fuscus (Rüppell, 1830)	*dusky frillgoby*	**Ind**	R (1) (estuary)
Lentipes concolor (Gill, 1860)	*ʻoʻopu ʻalamoʻo*	**End**	R (2), 0.02/yd2 Mid 0.07/yd2 Upper (4)
Sicyopterus stimpsoni (Gill, 1860)	*ʻoʻopu nopili*	**End**	R (2), 0.18/yd2 Mid (4)
Stenogobius hawaiiensis Watson, 1991	*ʻoʻopu naniha*	**End**	P (4)
PERCIFORMES, POMACENTRIDAE			
Abudefduf sordidus (Forsskål, 1775)	*kūpīpī*	**Ind**	R (2)

Table 4 (continued).

PHYLUM, CLASS ORDER, FAMILY Species	Common name	Status	Abundance
CYPRINODONTIFORMES, POECILIIDAE			
unidentified Poeciliidae		Nat	C (1) 7.75/yd^2 Mid 0.1/yd^2 Upper (4)
Gambusia affinis (Baird and Girard, 1853)	mosquitofish	Nat	0.49/yd^2 Mid 0.07/yd^2 Upper (4)
Poecilia reticulata Peters, 1859	guppy, rainbowfish	Nat	C (2), 1.66/yd^{2}Mid 5.25/yd^2 Upper (4)
Poecilia sp. hybrid complex (*salvatoris/mexicana* group)	liberty/Mexican molly	Nat	C(2), P (5)
Xiphophorus helleri Heckel, 1848	green swordtail	Nat	C(2), 0.54/yd^2 Mid 0.03/yd^2 Upper (4)
CHORDATA, AMPHIBIA	amphibians		
ANURA , BUFONIDAE	toads		
Rhinella marina (Linnaeus, 1758)	cane toad, eggs	Nat	C(2)
Rhinella marina (Linnaeus, 1758)	cane toad, tadpole	Nat	C(2)
Rhinella marina (Linnaeus, 1758)	cane toad, adult	Nat	R (2) ‡, R (3), 0.03/yd^2 Mid (4)
ANURA , RANIDAE	frogs		
Lithobates catesbeianus (Shaw, 1802)	American bullfrog, egg	Nat	A (2)
Lithobates catesbeianus (Shaw, 1802)	American bullfrog, adult	Nat	0.54/yd^2 Mid (4)

Key to Table 4

Status:
- Nat - naturalized. An introduced or exotic species;
- **Ind** - indigenous. A native species also found elsewhere in the Pacific;
- E**nd** - endemic - A native species found only in the Hawaiian Islands.

Abundance categories:
- P - present; abundance unknown;
- R - rare; only one to three individuals seen;
- O - occasional; three to twelve individuals seen;
- C - common; many individuals seen;
- A - abundant; numerous.

Notes:
- †- average density reported for reach
- ‡ - molt, shell, or dead specimen
- (1) – Observed in the present survey;
- (2) – Reported in *AECOS* (2012)
- (3) - Reported in *AECOS* (2011);
- (4) - Reported in HDLNR-DAR (2008);
- (5) - Reported in USFWS (2011).

poor underwater visibility due to construction activities causing turbid water limited our observations. Small, indeterminate poeciliid fishes (top-minnows) were present in the slower moving side pools. Pacific prawn (*Macrobrachium lar*) were seen crawling among boulders and debris on the bottom of the flood control channel (Figure 7).



Figure 6. Small *ʻoʻopu nākea* resting on the bottom in Project Area.

Prior to the return of stream flow to Wailuku River in 2014, high temperatures (e.g. 32.6˚C on April 4, 2012) and minimal shelter and food resources made life difficult for aquatic organisms in the Flood Control Channel project limits. Insect larvae, snails, and amphibians were able to take advantage of these seemingly uninhabitable places and constituted the aquatic fauna found in the Flood Control Channel.



Figure 7. Pacific prawns were seen throughout Project Area.

In 2012, we observed three *ʻoʻopu* species (*Awaous stamineus*, *Sicyopterus stimpsoni*, and *Lentipes concolor*) in the middle and upper reaches of the stream in a plunge pool upstream from Mokuhau Park (Figure 8) and within ʻĪao Valley State Monument (Figure 9). Total length (TL) estimates of the *ʻoʻopu* observed on April 4, 2012 are as follows: *ʻoʻopu nākea* (8 cm, 15 cm), *ʻoʻopu nopili* (5 cm, < 5 cm—both male), *oʻopu ʻalamoʻo* (4.5 cm—female). Two other *ʻoʻopu* species, *Stenogobius hawaiiensis* and *Eleotris sandwicensis*, have been reported from the stream (HDLNR-DAR, 2008), although perhaps erroneous as to location (upper reach) because these fishes are typically found in the estuary and lower reaches of streams. The endemic ʻ*ōpae kalaʻole* (*Atyoida bisulcata*) has been reported in Wailuku River (HLDNR-DAR, 2008).

Low densities (0.07 to 0.46 $yd^{-2,}$ respectively; HDLNR-DAR, 2008) of *ʻoʻopu* have been reported for the middle and upper reaches of Wailuku River. Far greater densities of poeciliid fishes are present (5.45 to 10.44 yd^{-2}; HDLNR-DAR, 2008).

High densities of *ʻōpae kalaʻole* (7.38 yd^{-2}) have been reported from the upper reach of Wailuku River (HDLNR-DAR, 2008).

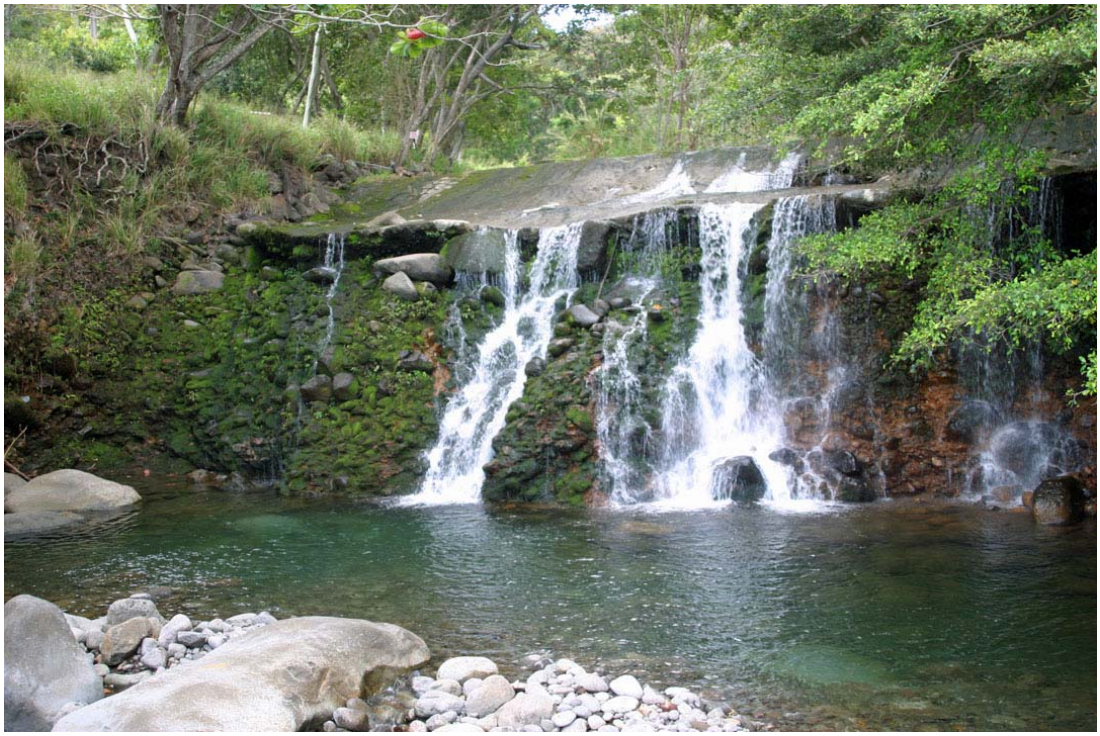

Figure 8. Plunge pool in which an *ʻoʻopu* was observed in 2012 is a short distance upstream from Mokuhau Park.

The Hawaiʻi Watershed atlas (DLNR-DAR, 2008) also lists at least three endemic damselflies (*Megalagrion blackburni*, *M*. *hawaiiense*, and *M*. *nigrohamatum nigrohamatum*) as present in the stream vivinity. An unidentified *Megalagrion* species is reported from the lower, middle, and upper reach; *M*. *blackburni* is reported from the middle and upper reach; and *M*. *hawaiiense* and *M*. *nigrohamatum nigrohamatum* are reported from the upper reach.

Assessment

Water Quality

As listed in Hawaiʻi water quality standards, Wailuku Stream is a Class 2 inland water body, except for a small segment of stream contained in ʻĪao Valley State



Figure 9. Upper reach of Wailuku Stream in which *ʻoʻopu* were observed in 2012.

Monument that is a Class 1 inland water. Wailuku Stream is listed (as Iao Stream) on the Hawaiʻi Department of Health (HDOH) 2014 list of impaired waters in Hawaiʻi, prepared under Section 303(d) of the Clean Water Act (HDOH, 2014a). The "impaired" listing is based upon visual observations made from 2001 to 2004. The HDOH listing indicates that ʻĪao Stream may not meet water quality standards for turbidity and trash, but the stream is designated as a "Category 3" water body, meaning that insufficient data exist to make a use support determination. ʻĪao Stream and has been assigned a TMDL priority code of "medium."

Wailuku Stream discharges into Kahului Bay, which is considered a Class A embayment (HDOH, 2014b). "Kahului Harbor (Bay)" is a station listed on the HDOH 2014 list of impaired waters (HDOH, 2014a). The "impaired" listing is based upon data collected from Sta. HIW00105 that indicates Kahului Harbor (Bay) does not meet Hawaiʻi water quality standards for turbidity, chlorophyll α (chl α), and ammonia (NH_4). Kahului Harbor (Bay) is also listed as a "Category 3" water body and as "Category 5" water body, meaning that available data

and/or information indicate that at least one or more designated uses is not being supported or is threatened, and a total maximum daily load (TMDL) is needed. Kahului Harbor (Bay) has been assigned a TMDL priority code of "low."

State water quality standards pertaining to streams are given in Table 6. The criteria for temperature and pH are based on deviations from ambient conditions and not applicable here. Criterion for dissolved oxygen (DO) saturation is a minimum value; and conductivity is based upon a not-to-exceed value. Criteria for turbidity and nutrients are based on geometric means and values not to be exceeded 10% and 2% of the time.

Table 6. Selected state of Hawaiʻi water quality criteria for streams (HAR §11-54-5.2; HDOH, 2014b).

Parameter	Geometric Mean value not to exceed this value	Value not to be exceeded more than 10% of the time	Value not to be exceeded more than 2% of the time
Total Nitrogen (µg N/l)	250.0 *180.0*	520.0 *380.0*	800.0 *600.0*
Nitrate+Nitrite (µg N/l)	70.0 *30.0*	180.0 *90.0*	300.0 *170.0*
Total Phosphorus (µg P/l)	50.0 *30.0*	100.0 *60.0*	150.0 *80.0*
Total Suspended Solids (mg/l)	20.0 *10.0*	50.0 *30.0*	80.0 *55.0*
Turbidity (NTU)	5.0 *2.0*	15.0 *5.5*	25.0 *10.0*

Upper values are for the wet season (November 1 through April 30).
Lower *italicized* values are for the dry season (May 1 through October 31).

Other applicable "standards":

- pH units shall not deviate more than 0.5 units from ambient conditions and not lower than 5.5 nor higher than 8.0
- Dissolved oxygen shall not decrease below 80% of saturation.
- Temperature shall not vary more than 1C^{o} from ambient conditions.
- Specific conductance shall not be more than 300 µmhos/cm.

The purpose of the water quality measurements presented in this report is to characterize existing aquatic environments, not to establish compliance with water quality standards. In fact, the criteria for turbidity, TSS, and nutrient measurements require making comparisons with geometric mean values, so a minimum of three separate sampling events per location would be required to generate a proper statistic for comparison with a criterion. Ideally, multiple samplings would encompass a "typical" range of conditions for the location. These standards may be used, together with "baseline" data collected from a series of preconstruction sampling events, to develop decision rules as part of the data quality objectives (DQO) process in an applicable monitoring and assessment program (AMAP) developed in accordance with a Clean Water Act Section 401 Water Quality Certification, if required.

Wailuku Stream does not appear to be much degraded in terms of either suspended sediments or nutrients. Neither the 2012 nor the 2016 samples in Wailuku Stream show high turbidity levels (except a temporary increase due to construction at Sta. 3 and 3up in 2016) as indicated by the impaired listing and we did not observe much trash within the stream channel during either sampling event. The land use of the watershed (68% conservation, 20% urban and rural, and 12% agricultural; HDLNR-DAR, 2008) is likely responsible for the relative low suspended sediments in the stream. Preferred Alternative F will reconnect a portion of Wailuku Stream to the floodplain, resulting in the beneficial deposition of some sediment on land instead of in Kahului Bay.

Inorganic nitrogen appears to be high in the groundwater of the watershed, as is often the case with groundwater in Hawaiʻi. Exceedances of water quality standards may occur when additional groundwater infiltrates into the stream. Restoring floodplain connectivity through Preferred Alternative F will allow for some additional nutrient cycling within the watershed prior to discharge into Kahului Bay.

In 2012, the greatest water quality problems faced in the ʻĪao Stream Flood Control Channel was the low base flow over a concrete channel bed, but this issue has been rectified somewhat by the enhanced stream base flow (HDLNR-CWRM, 2016). Dissolved oxygen (essential to all aquatic life) content is reduced with an increase in temperature. Many *ʻoʻopu* are temperature sensitive (Timbol and Maciolek, 1978) and high temperatures experienced in the concrete-lined channel may have exceeded the tolerances of the native aquatic organisms. The temperatures resulting from low base flow are tolerable by many introduced fishes and mollusks. An increase in *ʻoʻopu* observations within the Flood Control Channel in 2016 was concomitant with an increase of flow.

Botanical Resources

All of the plant species recorded within the Project area are common, widespread species; most are common weedy species. None of the plant species recorded is endemic (unique to the Hawaiian Islands) and none is listed as endangered or threatened or proposed for inclusion as a listed species by federal or state governments (HDLNR, 1989; USFWS, 2008, 2016).

A portion of the upper watershed has been designated as critical habitat for at least 45 threatened or endangered species of plants (USFWS, 2016b). However, this designated area is not within the boundaries of the Project or even close. Dispersal of plant propagules via the stream is in one direction only: downstream. Project activities can disperse weedy plants on equipment from location to location, but all of this project is well downslope of native plant communities, so spreading of weedy or potentially invasive plants to sensitive areas is not an issue.

Enhancing stream side vegetation and instream vegetation through providing more stable, nonconcrete-lined banks and more natural channel bottom substrates are the only clearly direct ways that riparian conditions beneficial to the ecology of Wailuku River can be achieved. Presently, vegetation is largely excluded from the channel within the project area. Benefits to the stream and general watershed of a functional riparian vegetation can be realized only to the extent that limitations imposed by engineering requirements can be modified or directed towards improving the growth of plants within the flood channel.

Aquatic Biota

No aquatic species protected by State of Hawaiʻi Administrative Rules (HDLNR, 1989, 2014, 2015), nor federally endangered or threatened species (USFWS, 2015a) were observed in Wailuku Stream within the Project area. The native stream macrofauna are diadromous: eggs are laid in the stream and the larvae that hatch from these eggs move downstream and out into the ocean where they develop for a time before migrating back into freshwater to grow to maturity (Ford and Kinzie, 1982; Kinzie, 1988). Prior to return of stream flow to the middle reach of Wailuku Stream, HDLNR-DAR transported *hīhīwai* and *ʻoʻopu* from the estuary to suitable habitats upstream of the flood control project to avoid dewatered segments of the stream (Hau, 2007 and S. Hau, DLNR-DAR, pers. comm.). The return of stream flow has allowed these animals to freely migrate throughout the stream and they are now inhabiting the Project Area.

Maintaining stream flow in the middle and lower reach of Wailuku River is essential to continue to allow migration of amphidromous animals. Preferred Alternative F is designed to maintain a minimum 5 million gallons per day (mgd) discharge at the mouth of the stream with a flow of 7.7 cubic feet per second (cfs). This flow will be adequate for migrating amphidromous animals. Preferred Alternative F will not have a negative effect on native aquatic animals within the Project area and, therefore, will not have a negative effect on a watershed scale.

However, inclusion of "pools" within the concrete channel bottom architecture would be a significant improvement to the aquatic environment. In many places, the low-flow channel provides a connection but does not itself provide suitable habitat. Pools should be designed as slightly deeper and wider portions of the low-flow channel, breaking up the distance between the engineered runs where the flow would slow down and, with added boulders on pool bottoms, enhance refuge habitat for organisms. Our Fig. 4a provides an excellent example of a location where a pool at the base of the steep drop would greatly enhance a more "natural" configuration for the stream. One could easily imagine that, under extremely high flows, a pool here would become tucked away behind the developing waterfall, providing refuge for stream fauna and preventing animals from being washed out by the freshet.

Shading of the stream by riparian trees would reduce thermal stress to stream fauna and installation of "passage channels" at all diversion structures within Wailuku Stream would allow unimpeded migration. Riffle and pool complexes, such as those present within and upstream of the ʻĪao Stream Flood Control Project are important because they help maintain good water quality, provide habitat diversity, and maintain water holding capacity. These complexes have been designated as Special Aquatic Site in the Clean Water Act (USC, 1972). These complexes should be maintained by preferred Alternative F.

Watershed impacts

Flood control projects for streams always must balance enhancements of flood protections (preventing freshets from accessing the watershed, especially the adjacent floodplain where present) against degradations of the natural interactions between a stream and its watershed. In the natural processes, the upper reaches of a stream are erosional: removing and transporting material down slope. The lower reaches are mostly depositional, depositing material outside or beyond the natural banks, or pass through, discharging material beyond the mouth of the stream. The ʻĪao Stream Flood Control Project is confined to the lower reach located within a mostly urbanized (32% including agricultural areas) portion of the watershed. The primary purpose of the

original engineering approaches to flood control in this stream reach was to separate, as completely as possible, the stream at all flow stages from the rest of the watershed and thereby prevent overland flooding. The flood that occurred in September 2016 suggests a failure of sorts of this approach, although in fairness to the design, there will likely always be a storm that generates runoff in excess of that which can be handled by the engineered channel. A concern must be that the September 2016 storm could be an indication of a trend in increasing severity of storms at this location related to global climate change.

Considering the several Project options (see pages 4-5), Alternative F best recognizes the unpredictability of future storm events by providing the opportunity (admittedly within a limit area) for the stream to return to a natural process of spreading out across the floodplain during particularly severe freshets. Of course, the most beneficial approach for enhancing the watershed would be to significantly widen the distance separating the left and right banks, but this approach is not practical within the urban environment. In the main, allowing the stream greater latitude through the lower watershed is the most improvement one can expect if the important focus of preventing loss of life and property are to be realized. Otherwise, realizing benefits to the watershed ecology are mostly limited to improvements in the channelized environment as discussed above under biological resources.

The subject project, no matter the alternative eventually implemented, is essentially incremental to the original flood control project. Thus, cumulative effects on the watershed derive from those already experienced since the project was initially constructed between 1977 and 1981. Proposed improvements (except Alternatives A and B) are designed to lessen adverse flooding impacts on the urban environment of Wailuku town. Overall, impacts are designed to improve flood control and enhance natural ecosystems in the upper and lower watershed by improving biological connectivity through Wailuku town. Alternative F (preferred alternative) will transform a portion (approximately 2.5 ac or 1 ha) of the lower watershed back to a flood plain, resulting in a broadening of restrictions on use of this presently vacant land, while ensuring continuation of the open space this land presently represents.

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Appendix H:

Fish and Wildlife Coordination Act (FWCA) Report Addendum

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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

In Reply Refer To:
12200-2010-CPA-0194

DEC 2 9 2011

Anthony J. Paresa, P.E.
Deputy District Engineer
Programs and Project Management/Civil Works
U.S. Army Corps of Engineers
Building 230
Fort Shafter, Hawaii, 96858-5440

Subject: Phase 1 Marine Habitat Characterization Fish and Wildlife Coordination Act Report Addendum for Iao Stream Flood Control Project, Wailuku, Maui

Dear Mr. Paresa:

The Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 et seq.; 48 Stat. 401], as amended (FWCA), was established to provide a basic procedural framework for the orderly consideration of fish and wildlife conservation measures to be incorporated into Federal water resources development projects. In coordination with your staff, the U.S. Fish and Wildlife Service (Service) is providing this Phase 1 Marine Habitat Characterization FWCA 2(b) Report Addendum for the proposed Iao Stream Flood Control Project. This addendum was prepared by the Service in coordination with the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), and the Department of Land and Natural Resources, Hawaii Division of Aquatic Resources (HDAR). This report has been prepared under the authority of and in accordance with provisions of FWCA; and the Federal Clean Water Act of 1977 [33 U.S.C. 1251 et seq.; 62 stat. 1155], as amended (CWA). These comments are also consistent with the National Environmental Policy Act of 1969 [42 U.S.C. 4321 et seq.; 83 Stat. 852], as amended, and other authorities mandating the Service's review of projects and provision of technical assistance to conserve trust resources.

The purpose of the proposed project is to correct deficiencies in the Iao Stream Flood Control Project that was constructed in 1979-1981. The Corps' March, 2009, Draft Environmental Assessment (DEA) evaluated several alternatives that entailed additional hardening of stream banks to control erosion, straightening the stream channel, and raising levee heights to contain potential flood waters.

The Service provided technical assistance, detailed in a January, 2006 Draft, 2(b) FWCA report as well as in an August, 2011 Draft, 2(b) FWCA report. The enclosed Phase 1 Marine Habitat Characterization FWCA Report Addendum includes results from mapping surveys in the coastal

area of Iao Stream mouth as well as an in-depth review of existing datasets and information from the area. The report addendum also provides recommendations to minimize the impact to marine resources from the proposed project.

We appreciate the opportunity to provide input on the proposed project. If you have questions regarding our FWCA investigation and report, please contact Coastal Conservation Program Coordinator Dan Polhemus (Dan_Polhemus@fws.gov or 808-792-9400), Fish and Wildlife Biologist Paula Levin (Paula_Levin@fws.gov or 808-792-9417), or Marine Biologist Tony Montgomery (Tony_Montgomery@fws.gov or 808-792-9456).

Sincerely,

For Loyal Mehrhoff
Field Supervisor

cc:
NMFS-PIRO, Honolulu
HDAR-DLNR, Honolulu
USEPA-Region IX, Honolulu
CZM, Honolulu
DOH-CWB, Honolulu
CWRM, Honolulu

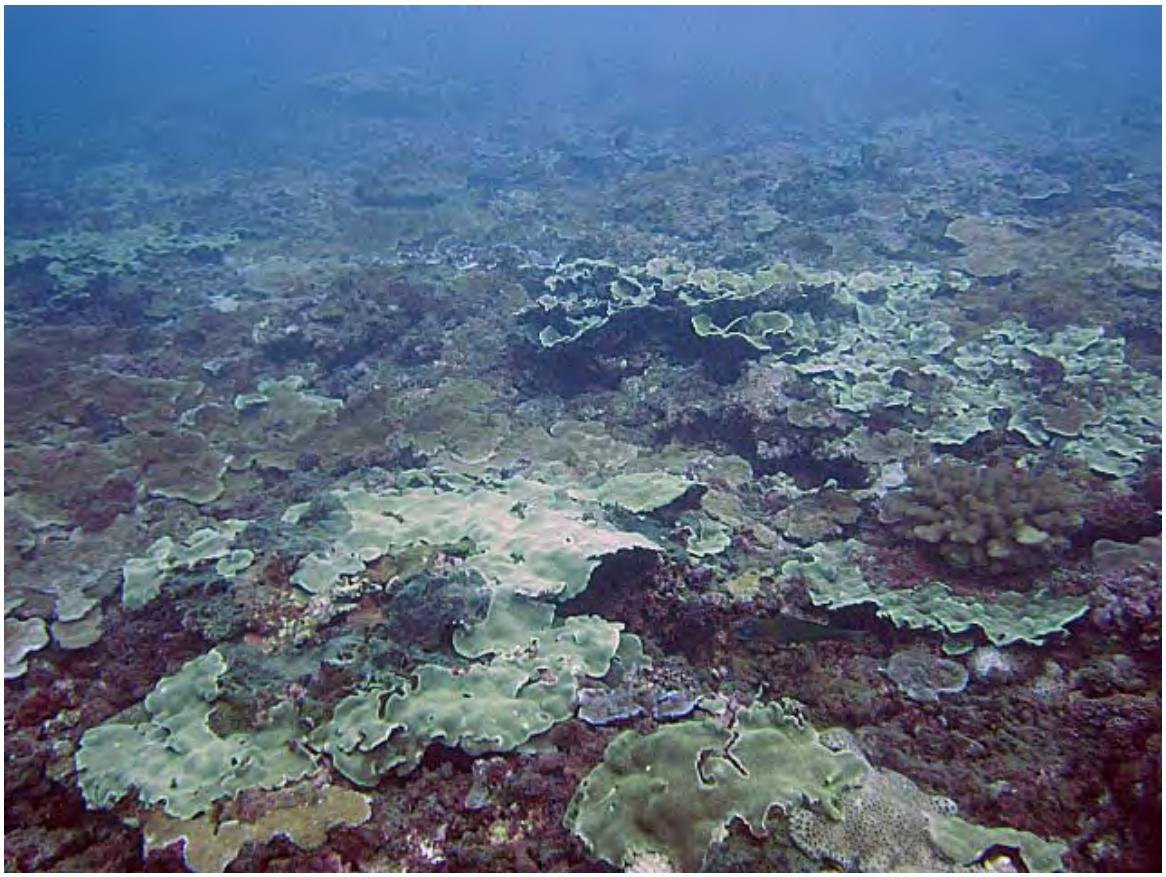

Photo: G. Smith, USFWS

FINAL
FISH AND WILDLIFE COORDINATION ACT REPORT ADDENDUM

PHASE 1 MARINE HABITAT CHARACTERIZATION
IAO STREAM FLOOD CONTROL PROJECT,
WAILUKU, MAUI, HI

DECEMBER 2011

FINAL
FISH AND WILDLIFE COORDINATION ACT REPORT ADDENDUM

PHASE 1 MARINE HABITAT CHARACTERIZATION
IAO STREAM FLOOD CONTROL PROJECT,
WAILUKU, MAUI, HI

Prepared by

Anthony Montgomery
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, HI

Prepared for

U.S. Army Corps of Engineers
Honolulu, HI

December 2011

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INTRODUCTION

Authority, Purpose and Scope

This Phase 1 Draft report is prepared in accordance with the August 26, 2010, U.S. Fish and Wildlife Service's (Service) Planning Aid Letter (PAL), Scope of Work (SOW) and Budget for assisting the U.S. Army Corps of Engineers (Corps) with the Environmental Impact Statement (EIS) for the Iao Stream Flood Control Project in Wailuku, Maui, Hawaii. This addendum describes the results of a Phase 1 marine habitat characterization survey of the marine coastal area within the vicinity of the mouth of Iao Stream. The proposed project is sponsored by the County of Maui, Department of Public Works, in partnership with the Corps. This report has been prepared under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 *et seq*.; 48 Stat. 401], as amended (FWCA); the Clean Water Act of 1977 [33 USC 1251 *et seq*.; 91 Stat. 1566], as amended; the Endangered Species Act of 1973 [16 U.S.C. 1531 *et seq*.; 87 Stat. 884], as amended; and other authorities mandating the Service to provide technical assistance to conserve trust resources.

The FWCA provides the basic authority for the Secretary of the Interior, through the Service, to assist and cooperate with Federal, State and public or private agencies and organizations in the conservation and rehabilitation of aquatic wildlife. The National Marine Fisheries Service (NMFS) provides similar assistance and cooperation for wildlife species conservation under the management responsibilities of the Department of Commerce. Phase 1 consultation under the FWCA regarding analysis of the proposed project's impacts on marine resources were conducted with the NMFS, and the Hawaii Division of Aquatic Resources (HDAR), the State agency responsible for administering the wildlife resources of the State. The Service is the lead agency and has the responsibility of ensuring that concerns and recommendations of the other resource agencies are considered fully in FWCA reviews. Collectively, the Service, NMFS, and HDAR are referred to as Resource Agencies.

The Corps produced a Draft Environmental Assessment (DEA) for this project in March 2009. The public review process for the DEA resulted in new concerns being raised regarding the project's potential ecosystem impacts as well as concerns about the adequacy of the proposed mitigation to offset anticipated, unavoidable impacts. The Corps is re-analyzing and modifying proposed alternatives and mitigation measures described in the March 29, 2009, DEA and new alternatives and mitigation may be identified through further agency coordination.

The phased approach to the Service's activities under Section 2(b) of the FWCA is described in the August 26, 2010, Scope of Work. Phase I included a marine survey and a supplemental stream and project area survey which occurred in coordination with the HDAR.

Prior Fish and Wildlife Service Studies and Reports

Prior to this survey, no Fish and Wildlife Service surveys or studies have been conducted in the marine areas in the vicinity of the Iao Stream confluence with the sea.

DESCRIPTION OF THE PROJECT AREA

Iao Stream is located in Iao Valley in the West Maui mountains on the Island of Maui and is 5 kilometers (km) (3.1 miles) west of Wailuku (Figure 1). The stream mouth is located 1.5 km (0.9 miles) northeast from Kahului Harbor and 1.1 km (0.7 miles) southwest of Waiehu Stream mouth. The coastal area between streams forms a small embayment that is somewhat protected from small swells. The shoreline consists mostly of small basaltic boulders and is north facing subject to strong seasonal winter swell and strong seasonal summer trade wind swell. The conditions around this area are routinely rough and therefore may experience lighter vessel traffic than leeward areas.

FISH AND WILDLIFE RESOURCE CONCERNS AND PLANNING OBJECTIVES

The primary concerns with the proposed project include potential impacts to native stream fauna due to planned project construction and operation, and impacts to the coral reef resources and near shore environment adjacent to the mouth of Iao Stream. As noted, the Scope of Work (SOW) was divided into marine and freshwater survey phases due to the seasonal availability of access to the site to perform the surveys. Therefore, in Phase 1, the specific planning objective is to provide technical assistance to the Corps for the development of alternative project plans for evaluation in the DEIS that avoid and minimize impacts to existing aquatic resources. An additional objective is to assist the Corps with developing mitigation measures that compensate for unavoidable impacts. The Resource Agencies encourage the Corps to work with Maui County, the local sponsor to select an alternative that meets their flood control objectives while maintaining and enhancing the existing significant habitat values at the proposed project site. Achieving this goal will necessitate the Corps, in partnership with Maui County, and with technical assistance from the Service to; 1) obtain updated biological data and habitat assessment for the proposed project site; and when the DEIS is published; 2) analyze the impacts of proposed-project alternatives on fish and wildlife resources and their habitats; 3) identify the proposed-project alternative least damaging to fish and wildlife resources, and 4) recommend mitigation for unavoidable project-related habitat losses consistent with the FWCA and the Service's Mitigation Policy (U.S. Fish and Wildlife Service, 1981), as well as the Corps and Environmental Protections Agency’s 2008 Compensatory Mitigation for Losses of Aquatic Resources.

The Service's Mitigation Policy (U.S. Fish and Wildlife Service, 1981) outlines internal guidance for evaluating project impacts affecting fish and wildlife resources. The Mitigation Policy complements the Service's participation under NEPA and the FWCA. The Service's Mitigation Policy was formulated with the intent of protecting and conserving the most important fish and wildlife resources while facilitating balanced

development of this nation's natural resources. The policy focuses primarily on habitat values and identifies four resource categories and mitigation guidelines. The resource categories are the following:

a. Resource Category 1: Habitat to be impacted is of high value for the evaluation species and is unique and irreplaceable on a national basis or in the local region.

b. Resource Category 2: Habitat to be impacted is of high value for the evaluation species and is relatively scarce or becoming scarce on a national basis or in the local region.

c. Resource Category 3: Habitat to be impacted is of high to medium value for the evaluation species and is relatively abundant on a national basis.

d. Resource Category 4: Habitat to be impacted is of medium to low value for the evaluation species.

The marine coastal area surrounding Iao Stream mouth is considered a coral reef and meets the description of Resource Category 2. The coral reef surrounding the mouth of Iao Stream can be considered high value due to the marine resources documented in this Phase 1 survey. In addition, coral reefs are considered scarce based on the local, national, and global decline of coral reefs (Williams et al., 2009; Walsh *et al.*, 2010; Waddell (ed.), 2005; Waddell and Clarke (eds.), 2008; Wilkinson (ed), 1998; Wilkinson (ed), 2000; Wilkinson (ed), 2004; Wilkinson (ed), 2008) and the geographical constraints of coral reefs in the United States. Coral reefs have also been designated as Special Aquatic Sites under the Clean Water Act (CWA). Special Aquatic Sites are defined as "geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values." They are further described as "significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region" (40 CFR Part 230 §230.44/FR v.45n.249).

These designations of Resource Category 2 and Special Aquatic Site require the Service to recommend ways for the action agency to mitigate losses, through measures to avoid or minimize significant adverse impacts. In the event losses are unavoidable, measures to immediately rectify, reduce, or eliminate losses commensurate with project permitting (with the understanding that the Corps Planning Division is responsible for their own consistent with CWA regulatory requirements) or implementation will be recommended under the FWCA. Recommendations will focus on compensation for the replacement of in-kind habitat values and ecological functions. An effective and verifiable mitigation program planned and executed by the project proponent is required under NEPA and the CWA.

EVALUTION METHODOLOGY

Information from other sources

Information relating to the coastal area surrounding Iao Stream was collected from literature searches and known entities conducting research or management. Although sparse results were developed from literature searches, a substantial amount of information was discovered to be available through government agencies doing work within the region. These sources include the Coral Reef Assessment and Monitoring Program (CRAMP) (Jokiel *et al.*, 2011), HDAR Habitat and Fish Assessments (Walsh *et al.*, 2010), National Oceanic and Atmospheric Administration's (NOAA) Coral Reef Ecosystem Division (CRED) surveys (unpublished), NOAA's Shallow-Water Benthic Habitat Maps (Battista *et al.*, 2007), Lidar imagery (JALBTCX, 2002; JALBTCX, 2007), historical imagery (Coastal Geology Group, 2011), and sea turtle disease and nesting (Van Houtan *et al.*, 2010; Parker and Balazs, 2010; Balazs and Hau, 1986). In addition, information on sea turtles and historical observations were collected by direct communication with HDAR and included unpublished information (Skippy Hau, pers. comm.).

Phase 1 Survey protocols

The goal of a Phase 1 survey is to generally document and spatially define the marine resources within a potential project area. This Phase 1 marine survey was conducted with two teams, consisting of two marine biologists per survey team. A combination of snorkeling and scuba gear was used to directly observe the coral reef community around the mouth of Iao Stream. Surveys were concentrated within 500 to 700 meters (m) (545 to 765 yards) of Iao Stream mouth extending an additional 1000 m (1095 yards) to the northwest and 450 m (490 yards) to the southeast. Equipment used to conduct the marine survey included: snorkel and scuba diving equipment, safety equipment, data sheets and clip-boards, digital dive watches, digital cameras, handheld Global Positioning Systems (GPS), waterproof bags, cave reels with sufficient line (at least 75 m (80 yards)), and towed floats (large enough to support the GPS). Marine survey work was limited to between 6:00am and 10:00am due to strong seasonal winds.

Each of the two survey teams was equipped with a digital camera, a floated GPS unit, and datasheets attached to a clipboard to record data. The teams snorkeled or dived in a pre-determined direction or pattern following a compass heading. The direction and length of a survey transect was determined by the extent and shape of the project survey area or limitations of dive time. The survey team was comprised of a photographer and a data observer. The data observer was responsible for recording habitat observations and biological classifications with relative abundance as well as maintaining the compass bearing and direction of the survey transect. The photographer was primarily responsible for photo-documenting habitat features, species and anomalies (*e.g.*, debris) and towing the GPS.

The GPS was contained in a waterproof pouch attached to a surface float. The GPS was mounted on the top of the float to maintain a good connection with satellites. The observer was responsible for maintaining the float line directly above the dive team to ensure that the floated GPS was in close proximity to the photographer.

Prior to departing the harbor in the morning, the dive teams synchronized the times on the GPS units, dive watches and digital cameras. A photograph was taken of the GPS time after the GPS unit acquired a strong satellite signal. This was repeated for both cameras and GPS units and was later used to completely synchronize the time between camera and GPS for each dive team. GPS waypoints were taken at the start and end of the survey transect.

The photographer was responsible for photographing dominant habitats, sub-habitats, unique features, species and debris. Photographs were taken periodically to document habitat conditions. Additional photos were taken when there was: 1) a change in benthic habitat type, a sub-habitat or unique feature, 2) a rare or protected species, 3) invasive or alien species, 4) disease, 5) debris, and 6) unexploded ordnances. After the survey team descended to the survey depth, the photographer adjusted the white balance function on the digital camera to correct for coloration. Adjustments to the digital camera white balance were also performed any time the survey depth changed substantially in the course of a survey transect. Digital photographs were taken at approximately a 45° angle to the benthic substrate to document habitat features.

The data observer was responsible for recording benthic habitat observations of the affected marine environment on a data sheet. The time and date of the dive was recorded so that it could be referenced to underwater photos and GPS data. The dominant benthic habitat was identified and described on the datasheet, and the time of observation noted. Observations of sub-habitats, such as a variation in substrate composition, were also recorded. Unique features such as ledges, crevices or overhangs were similarly recorded. Observations of organism disease, presence of invasive species, alien species, rare and/or protected species, debris, contaminants or unexploded ordnance were noted as well. In addition, the data observer recorded relative abundance for types of substrate and biological classifications. The relative abundance was recorded as a category 0-3 with zero being not present, category 1 being sparse, category 2 being moderate, and category 3 being dominant. Generally, category 1 was considered less than 10% visual coverage, category 2 being 10–80% visual coverage, and category 3 greater than 80% visual coverage. These relative abundances were recorded for each classification including: 1) mud, 2) sand, 3) bare substrate, 4) sea grass, 5) crustose coralline algae, 6) turf algae, 7) filamentous-like bloom, 8) macroalgae, 9) zoanthids, 10) soft coral, and 11) coral. In addition, when coral was estimated the coral growth forms present were noted. These growth forms included: 1) encrusting, 2) branching, 3) sub-massive (lobate), 4) massive, 5) columnar, 6) foliaceous, 7) plate-like, and 8) free-living.

Processing data included using GPS Photolink© software to geo-reference photos. Geo-referenced photos were labeled with descriptive information such as latitude, longitude, time, date, habitat descriptors, species names, and any other pertinent information. GPS

Photolink© provided a geo-database that was imported into ArcGIS©. The geo-database was then overlaid on an existing data-layer of the Iao Stream mouth area to produce a map of the GPS tracks (Figure 2).

Relative abundance data was processed by entering the abundance data for each classification into a spreadsheet. The GPS data was downloaded in a .txt format. Both the abundance data and the GPS data were imported into the same Microsoft Excel© spreadsheet. The abundance date/time column was compared to the GPS date/time column to determine appropriate latitude and longitudes for each entry. This was completed automatically by the VLOOKUP formula. This datasheet was then imported into ArcGIS© allowing any of the relative abundances and classifications to be displayed geographically. These relative abundances and classifications were then processed with an Inverse-Distance Weight Interpolation tool in order to predict the area covered by a specific classification. The output resulted in a mosaic of the surveyed area (Figures 3-5).

DESCRIPTION OF FISH AND WILDLIFE RESOURCES AND HABITAT

Information from other sources

Coral Reef Assessment and Monitoring Program

The Coral Reef Assessment and Monitoring Program (CRAMP) has conducted long-term monitoring at over 30 sites across the Main Hawaiian Islands including nine sites on the Island of Maui. One of those sites is Papaula Point (20º 55.307' N, 156º 25.572' W; Figure 6) located 5.3 km (3.3 miles) northeast of the entrance to Kahului Harbor and approximately 6.2 km (3.9 miles) from the mouth of Iao Stream. The HDAR has continued surveys at this site and has plans to continue to monitor this location.

Papaula Point monitoring site includes data from both 4 m (13 feet) and 10 m (33 feet) depth. CRAMP describes the surrounding area as:

> "Agricultural in nearby saddle land. Colonized hard bottom with thin veneer over basalt pavement. Encrusting coral colonies dominant form. Pseudo spur and groove with narrow channels of course carbonate sand. Northern exposure with low rugosity and low relief due to extreme wave impacts. Low human activity due to inaccessibility."

CRAMP reports benthic data that includes rugosity, sediment composition, sediment grain size, coral cover (%), and fish density and biomass. Algae and invertebrate data were not reported. Data is reported from 1999 to 2010 (Jokiel *et al.*, 2011). Figure 7 shows the coral cover at both the 4 m (13 feet) and 10 m (33 feet) sites and a decline in coral cover from nearly 60% in 2002 to 8% in 2009. In addition, the invasive macroalga, *Acanthopora spicifera*, has increased. HDAR lists Papaula Point as a site of particular concern and suggests the site may have undergone an ecosystem collapse (Walsh *et al.*,

2010). The proximity of this site to the mouth of Iao Stream may denote a similar vulnerability or a susceptibility to decline of the existing coral reef resources.

HDAR's Habitat and Fish Assessments

The HDAR also monitors sites for trends in reef fishes that may be affected by the 2007 State of Hawaii law that bans lay-gillnets on Maui (HAR 13-75-12.4). These surveys are known as the Habitat and Fish Assessment (HAFA) surveys. The HAFA surveys include seven sites on the Island of Maui and two of the sites are near to Iao Stream's mouth. These sites include Waihee and Paia. Waihee (20º 56.511' N, 156º 30.451' W; Figure 6) is located 4.2 km (2.6 miles) northwest from Iao Stream and 5.7 km (3.5 miles) northwest of Kahului Harbor. Paia (20º 55.945' N, 156º 22.457' W; Figure 6) is located 11.7 km (7.3 miles) east of Iao Stream and 10.7 km (6.6 miles) northeast from Kahului Harbor.

These sites are rated to have had a high level of pressure from lay gill-nets. Waihee is reported to have about 17% coral and 17% algae cover while Paia is reported to have approximately 17% coral and 34% algae cover (Walsh *et al.*, 2010). Waihee is characterized as pavement and Paia mostly basaltic rocky and boulder habitat (Kristy Stone, HDAR, pers. comm.).

NOAA's Coral Reef Ecosystem Division

NOAA's CRED in partnership with the HDAR conducts Ecological Assessments every two years around the Main Hawaiian Islands (MHIs). These surveys typically focus on areas around the MHIs that are generally considered hard to reach and fairly inaccessible and are typically north facing shores. NOAA CRED conducted surveys along north Maui in 2006, 2008 and 2010. The Ecological Assessments consist of three types of diver surveys including Towed Diver Surveys (TDS), Rapid Ecological Assessments (REAs), and Stationary Point Counts (SPCs). A full description of the methods and analysis of the Ecological Assessments can be found at http://www.pifsc.noaa.gov/cred/eco_assess.php. TDS tracks and locations of REAs for 2006, 2008, and 2010 are shown in Figure 6. The TDS and REAs collect different types of benthic data. While the TDS collects an estimate of coral cover as well as fish biomass and conspicuous invertebrate abundance, the REAs collect more specific and accurate data. REAs include an assessment of coral size class structure which can be used as a metric for ecological function within an area. The coral cover estimated by the four nearest TDS from 2006 to 2010 ranged from 21% to 63%. Of these four surveys, three survey tracks were conducted in similar locations for each year while one track was immediately offshore of Iao Stream. The coral cover ranged from for 21% to 30% to 27% for the years 2006 to 2008 to 2010. These estimates are similar and provide a broad context for coral cover in the area to the NNW of Iao stream. The additional survey track immediately offshore from Iao stream estimates coral cover to be 63% and correlates to a "reef pavement" classification on the NOAA Shallow Water Benthic Habitat maps (see below). The REA from the nearest sites (MAI-21) has coral size frequency distribution (Figure 8) that suggests a fairly stable coral size structure as corals remain present in the larger size classes suggesting less environment disturbance over time. The only

exception is coral in the genus *Montipora* where intermediate sized classes were found, but not larger sizes classes (> 0.8 m (31 inches)). This may be a result of species differences within the genus *Montipora* or an environmental constraint on the genus at the specific location. Additional biological data exists for other nearby sites.

NOAA's Shallow-Water Benthic Habitat Maps

NOAA's Shallow-Water Benthic Habitat Maps of the Main Hawaiian Islands (2007) provide classification of habitats including habitat zone, habitat structure (both major and detailed geomorphological), and biological cover information (both major and detailed) (Battista *et al.*, 2007). The maps were generated by using interpretation of orthorectified satellite imagery. The types of habitat zones within the area of Iao Stream are shown in Figure 9. These include Bank/Shelf, Fore Reef, and Reef Flat, and unknown types. The unknown classification correlates to survey observations of high water turbidity and these high turbidity areas may obscure satellite interpretation. The habitat structure is shown in Figures 10-11 and includes coral reef and hardbottom, unconsolidated sediment, and unknown for gross structure (Figure 10) and mud/sand, pavement, rock/boulder, spur-and-groove, and unknown for more specific structure types (Figure 11). The biological cover is shown in Figure 12 and includes coral, macroalgae, and unknown. More specifically, detailed biological cover in Figure 13 is separated by percentage of cover into 10%-<50%, 50%-<90%, and 90%-100% for each biological classification.

The NOAA maps provide some useful but broad overview of the habitat within the given area. However, the maps are not entirely accurate based on field observations from this Phase 1 survey. For example, Figure 11 shows the area within the Phase 1 surveys as reef pavement and the area to the northeast as spur-and-groove habitat. The Phase 1 surveys found the entire area to be spur and groove. In addition, a large portion of this area is also labeled as unknown. Anecdotal observations from the area suggest that the areas listed as unknown correlate with extremely low water visibility as discussed in the Phase I observations. High water turbidity may limit the interpretation of satellite imagery.

NOAA's Shallow-Water Benthic Habitat Maps can be useful in providing very general information on habitat, structure, and biological cover, however must be interpreted with caution due to the inaccuracies occurring in some of the maps.

Lidar Imagery

In 1999 data were collected by the Scanning Hydrographic Operational Airborne Lidar Survey (SHOALS) to investigate near-shore bathymetry of Maui (JALBTCX, 2002). Lidar (Light Detection and Ranging) is able to measure water depth through the reflection of light from the water surface and sea bottom. The data is then able to be processed to develop a bathymetric layer for the area. Further description of the technology and metadata for the 1999 Maui dataset can be found at: ftp://soest.hawaii.edu/coastal/webftp/Maui/Shoals/Maui.met.

In 2007 the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) collected Lidar data for the northern coastlines of the Hawaiian Islands (JALBTCX, 2007). Further information on this dataset can be found at: http://csc.noaa.gov/dataviewer/webfiles/metadata/usace2007_hi_template.html.

High quality bathymetric maps can be extremely valuable in describing and understanding a coral reef. For example, bathymetry may be able to show that the reef around the Iao Stream mouth area is a spur and groove habitat. While this data exists for much of the northern Maui coastline, there is a gap in the data for the immediate area outside Iao Stream mouth as shown in Figure 14. It is recommended that further surveys using Lidar should be conducted to fill this gap.

Historical Coastal Imagery

A compilation of coastal imagery around Maui can be found at: http://www.soest.hawaii.edu/coasts/data/maui/index.html (Coastal Geology Group, 2011). This compilation includes some historical satellite images of the reef area around Iao Stream. Of particular note is an image taken in 1960 showing a large sediment plume coming from Iao Stream (Figure 15). This image is evidence of historical sediment impacts for at least 50 years. Anecdotal observations have been reported about episodes of sea urchins (*Echinothrix* sp.) dying and washing on the shore. These episodes were reported near Paukukalo, Maui (located at the bay in-between Waiehu and Iao Streams) in the 1980s after heavy flow from Iao Stream, suggesting a correlation between events (Skippy Hau, pers. comm.). An understanding of the historical changes to this area is important in developing mitigation for any future projects.

Turtles

Green Sea Turtle, *Chelonia mydas*, presence has been documented within the area of Iao Stream and northern Maui and this species has been reported to nest at several locations on northern Maui (Figure 16) (S. Hau, unpublished data). These locations include Waihee and Waiehu, with the Waiehu nesting site very close to Iao Stream (small beach in between Waiehu and Iao Streams) (Parker and Balazs, 2010). However, these areas are not routinely monitored and it is presumed that the incidence of turtle nesting is under-reported. If turtles have been reported to nest within an area, it should be assumed that they could nest again within the vicinity of the reported nesting location. Turtles were sighted offshore during the Phase 1 surveys. Additionally, the area around Iao and Waiehu has been categorized as having a high incidence of fibropapillomatosis, a tumor-forming disease (Van Houtan *et al.*, 2010). This disease has been shown to be elevated in areas with increased coastal eutrophication (Van Houtan *et al.*, 2010).

Hawksbill Turtles, *Eretmochelys imbricata*, have not been reported to nest along the northern coastline of Maui (Parker and Balazs, 2010). However, Olive Ridley, *Lepidochelys olivacea*, turtles have been reported to nest at Paia, Maui (Parker and Balazs, 2010; Balazs and Hau, 1986).

Observations from Phase 1 Survey

The area in the vicinity of Iao Stream includes three discreet reef areas. These include an inshore reef, surf zone, and spur-and-groove reef (Figure 17). This Phase I survey was only able to map resources in the inshore reef and spur-and-groove habitats due to high swells in the surf zone. Detailed observations are discussed for each area below.

Inshore Reef

The inshore reef area consisted of the shallow bay immediately to the west of the mouth of Iao stream. The Phase I surveys included photo documenting the inshore reef area as well as qualitatively describing the benthic cover within the area. The area was fairly homogenous in habitat type and is represented by geo-referenced photographs in Figures 18–19. The area was dominated by filamentous turf algae growing over small boulders and cobble. Coral was present, but scarce (<<10% cover) and scattered across the area as shown in Figure 3. Coral species observed included *Montipora patula, Montipora capitata, Montipora flabellata, Porites lobata, Porites compressa, Pocillopora meandrina, and Pocillopora damicornis*. Figure 4 shows zoanthids were very rare and largely absent from the area. Macroalgae were present, but not in high abundance or biomass. Figure 5 shows the cover of macroalgae to be less than 10% in some areas, but greater than 10% in others. The invasive alga, *Acanthopora spicifera*, was observed in low abundance within the bay. Macro-invertebrates were observed, as well as a few surgeon fishes. Turtles were not observed in the Inshore Reef area during the Phase I surveys.

The benthos was covered with a fine layer of dark colored sediment likely originating from the terrestrial environment. Visibility in the water column ranged from approximately 0.5–1 m (1–2 feet) up to 3 m (10 feet). The lowest visibility was within what seemed to be a semi-permanent turbid plume located perpendicular to shore in the central section of the Bay. This semi-permanent turbid plume can be seen from Google images and also correlates with an unknown designation in the NOAA Benthic Habitat maps (Figures 9–13). This plume may represent the transport of suspended sediment out of the bay from which from both Iao and Waiehu Stream waters enter and mix with the marine environment.

Spur-and-Groove Reef

A spur-and-groove reef area was found immediately offshore of the Iao stream mouth beyond the surf break, located along the coastline extending north-northwest (NNW) and south-southeast (SSE). This area consisted of highly three-dimensional topography. The ridges (spurs) of carbonate structure and intervening sand channels (grooves) were oriented parallel to the dominant wave-approach direction and perpendicular to shore. The spur-and-groove area found within the vicinity of Iao Stream extended beyond the scope of the surveys both to the NNW and SSE.

Phase I surveys included photo documenting the area as well as estimating the benthic cover within the area. The area was fairly homogenous in habitat type and is represented by geo-referenced photographs in Figures 20–21. The estimation of benthic cover shows the spur-and-groove area was dominated by coral with the majority of the area having approximately 10% to 80% coal cover as shown in Figure 3. In Figure 3, note the method of interpolation may overestimate the coverage of coral due to few data points taken in sandy areas. The area was also dominated by the presence of zoanthids, *Palythoa caesia*, at less than 10% cover as shown in Figure 4. The common corals included *M. patula, M. capitata, M. flabellata, P. lobata, P. compressa, and P. meandrina*. Less common but also present were *P. damicornis, Pocillopora eydouxi, Pavona varians, Pavona duerdeni, Porites lichen* and *Fungia scutaria*. The dominant zoanthids included *P. caesia* and *Zoanthus sp*. Soft coral observed included *Sinularia densa* found in a patch on one of the ridge tops, and small colonies of *Carijoa riseii* near some ledges. A complete list of observed corals is shown in Table 1 along with coral species observed in previous studies of the coastline. The species list shown in Table 1 does not represent a comprehensive inventory. Hard corals were mostly encrusting in morphology (*M. patula, M. capitata, M. flabellata*), especially along the tops of the ridges. Along the edges of the spurs, colonies were often plate-like (*Montipora spp.*). Sub-massive (*P. lobata*) and branching morphologies (*P. compressa and P. meandrina)* were also present. Several of the observed corals have been petitioned to be listed under the Endangered Species Act including *M. patula, M. flabellata, P. stellata, Cyphastrea ocellina, Leptoseris incrustans* (Sakashita and Wolf, 2009). Other petitioned corals not observed, but which may be present include *Cyphastrea agassizi, Porites pukoensis,* and *Montipora dilitata*. Crustose coralline algae (CCA) were observed mostly in encrusting from, and less commonly in discrete foliose form. CCA, macroalgae, and filamentous turf algae were present across all ridges. Macroalgae cover in the area was generally sparse, but occasionally present in less than 10% cover as shown in Figure 5. Macro-invertebrates were observed, as well as several families of fishes. In particular, lobsters of significant size (near terminal size) were observed on multiple occasions. Small Green Sea Turtles, *C. mydas,* were rarely seen and appeared to be skittish when observed.

Fine sediment (a mix of terrestrially derived fines and carbonate derived sand) was present in the system and most conspicuous where it had settled on top of filamentous turf. Visibility varied from 1–5 m (3–15 feet), with waters southward being clearer, and waters northward being more turbid. Suspended sediment and decreased visibility appeared to be more prevalent at deeper ends of spurs. Typically, a layer of suspended sediment was observed hovering the bottom in sandy areas both in deeper water (~ 15 m (50 feet)) and in-between spurs.

Surf Zone

The area of reef in-between the inshore reef area and the spur-and-groove reef area largely represents the surf zone. This area is prone to large winter north swells as well as intermediate sized waves during summer trade winds. This area was observed to be a high energy habitat during the Phase 1 surveys while the weather conditions were mild and is known to generally be a high energy area (Patrick C. Caldwell, National

Oceanographic Data Center Honolulu, pers. comm. 7/15/2010). Surveys were not able to be conducted within this zone due to swells during the survey period. However, based on observations of the seaward side of the inshore reef area and the inshore side of the spur-and-groove area, we presume this surf zone has a decreased amount of coral cover and probably has seasonal variation of macroalgae. It is assumed the spur-and-groove area extends into the surf zone area from a habitat perspective. The significance of this area lies in its potential importance for certain species of fishes. The HDAR has a HAFA survey location within this surf zone to monitor fish abundance (Figure 6).

Other

An additional reef area exists approximately 1.6 km (1.0 mile) off shore of Iao stream. The NOAA Benthic Habitat Maps show coral reef and hard bottom habitat to exist a significant distance off shore (Figures 6 and 10). NOAA's TDS conducted at this location (Figure 6) validates this habitat and shows a high percent coral cover of 63% (CRED, unpublished). While this habitat was not surveyed during this Phase I survey, it is suggested that this area be mapped if additional surveys are to be conducted.

PROJECT IMPACTS

Impacts to the marine area surrounding Iao Stream that may result from the proposed stream construction action are difficult to predict. The spur-and-groove area located in the immediate vicinity of Iao Stream was observed to have a high abundance of coral by Hawaii standards, given that the Coral Reef Assessment and Monitoring Program indicates that average coral cover in the Main Hawaiian Islands is approximately 22% (CRAMP, 2008). Additionally, the area was observed to have generally low water visibility (1–5 m (3–15 feet)) and signs of sedimentation. While there was little sedimentation found on the carbonate structures of the spur-and-groove, suspended sediment was otherwise apparent across the area. An increase in suspended sediment may reduce water clarity further, which can have a number of impacts on the ecological processes of the reef. The chronic deposition and resuspension of sediment can also have additional impacts on ecological processes (Rodgers, 1990; Fabricius, 2005). Potential impacts can be lethal and sub-lethal and may include an increase in coral mortality, a decrease in coral and other organism recruitment success, a decrease in coral fecundity, a decrease in coral growth rate, the alteration of bioerosion processes, an increase in disease in marine fauna, an increase in nutrients coupled with algal blooms, and a reduction in suitable habitat for coral reef organisms (Rodgers, 1990; Grigg and Dollar, 1990; Nugues and Roberts, 2003; van Katwijk *et al.*, 1993; Gilmour, 1999; Babcock and Smith, 2000; Fabricius, 2005; Weber *et al.*, 2006). Hence, a further increase in sedimentation and turbidity resulting from sediment transfer due to the project may contribute to coral reef decline within the area.

RECOMMENDATIONS

The following recommendations are provided by the U.S. Fish and Wildlife Service (USFWS) in coordination with the National Marine Fisheries Service (NMFS) and the

Hawaii Department of Land and Natural Resources, Division of Aquatic Resources (HDAR):

1) The Army Corp of Engineers (ACOE) should evaluate the risk of increased turbidity and sedimentation being transferred to the marine environment from fine particulates for each project alternative. This can be achieved by developing a sediment transport model consisting of information from existing conditions within and adjacent to the stream corridor within the influence of floodwaters. Model parameters can be projected for each project alternative and stream component modification to estimate changes in sediment transport. This assessment should include sediment data collection on current baseline conditions under normal and peak flows (to the extent peak flows can be estimated and monitored) and the contribution from each stream feature or characteristic such as stream bed, sedimentation basin contours, stream flow obstructions (natural or man-made), stream bank morphology, composition and character, and any other stream design feature. Sediment data collection should include the type and size of sediment that is transported through various sections of the stream and that is potentially deposited in the marine environment.

2) The ACOE should consider alternatives that minimize sediment transport to the marine environment to the maximum extent practicable. Options that minimize sediment transfer and simultaneously do not present other environmental problems should be considered priority design criteria. Actions that increase ground water recharge and drainage retention while minimizing the use of storm drain, or relict irrigation ditch systems should be considered. Examples of options include: 1) construction of strategically located sediment trapping basins, or 2) maintaining or emulating a natural stream bottom or permeable substrate. These approaches would decrease the volume of sediment laden flood water transported by channelized areas that would normally be directly shunted to the marine environment.

3) The ACOE should evaluate the impact to the marine environment from potential changes that may occur in the sediment rate and sediment load as well as potential increases in eutrophication. Potential marine impacts include sedimentation (smothering of coral and other benthic organisms) and turbidity (suspended fine sediments), which can result in a reduction of coral health via decreased light availability, increases in algal growth and decreases in coral cover, changes in organism diversity and abundance, changes in the composition of sand/sediment, increased incidence of disease in corals, fishes, turtles or key invertebrates, and any other biological or habitat changes. To better understand these impacts, we recommend a Phase II survey be conducted near the mouth of Iao Stream as well as on the reef directly offshore to measure and document coral reef conditions.

4) The ACOE should consider quantifying contribution of fine sediment and sediment-related impacts to coastal marine waters and associated coral reefs from Waiehu stream. If it is found that this stream is a significant source of

sedimentation to the local coral reef, actions to reduce sediment inputs could be considered partial mitigation for impacts of the Iao Stream project.

5) The ACOE should consider taking actions to minimize sedimentation and erosion through a broader watershed management approach. An analysis of the broader watershed to determine individual key threats that increase the likelihood of increased erosion will allow for targeted actions to be taken to minimize the transfer of sediment into Iao Stream, thereby reducing subsequent sediment transport to the marine environment. An example of an upper watershed action that could help to reduce future sediment load from erosion is to provide ungulate fencing and removal in certain forested areas.

SUMMARY OF POSITION

The summary of position is provided jointly by the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and the Hawaii Division of Aquatic Resources (HDAR).

This Fish and Wildlife Coordination Act Report should be considered an Addendum Marine Habitat Characterization to the previous Phase I Supplemental Stream Survey, and its recommendations should be considered in addition to the recommendations from the report. The USFWS, NMFS, and HDAR are concerned with increased sedimentation in the marine environment around the mouth of Iao Stream as a result of this proposed project. Available information from similar habitats along the coast suggests that coral reef resources are in decline, and this Phase I survey detected high turbidity in the area around Iao Stream's mouth. Further investigation should be conducted to determine the current rate of sediment deposition from Iao Stream, and any potential increase resulting from the project. It is also important to further investigate the contribution of sediment from Waiehu Stream to determine the scale of deposition relative to Iao Stream.

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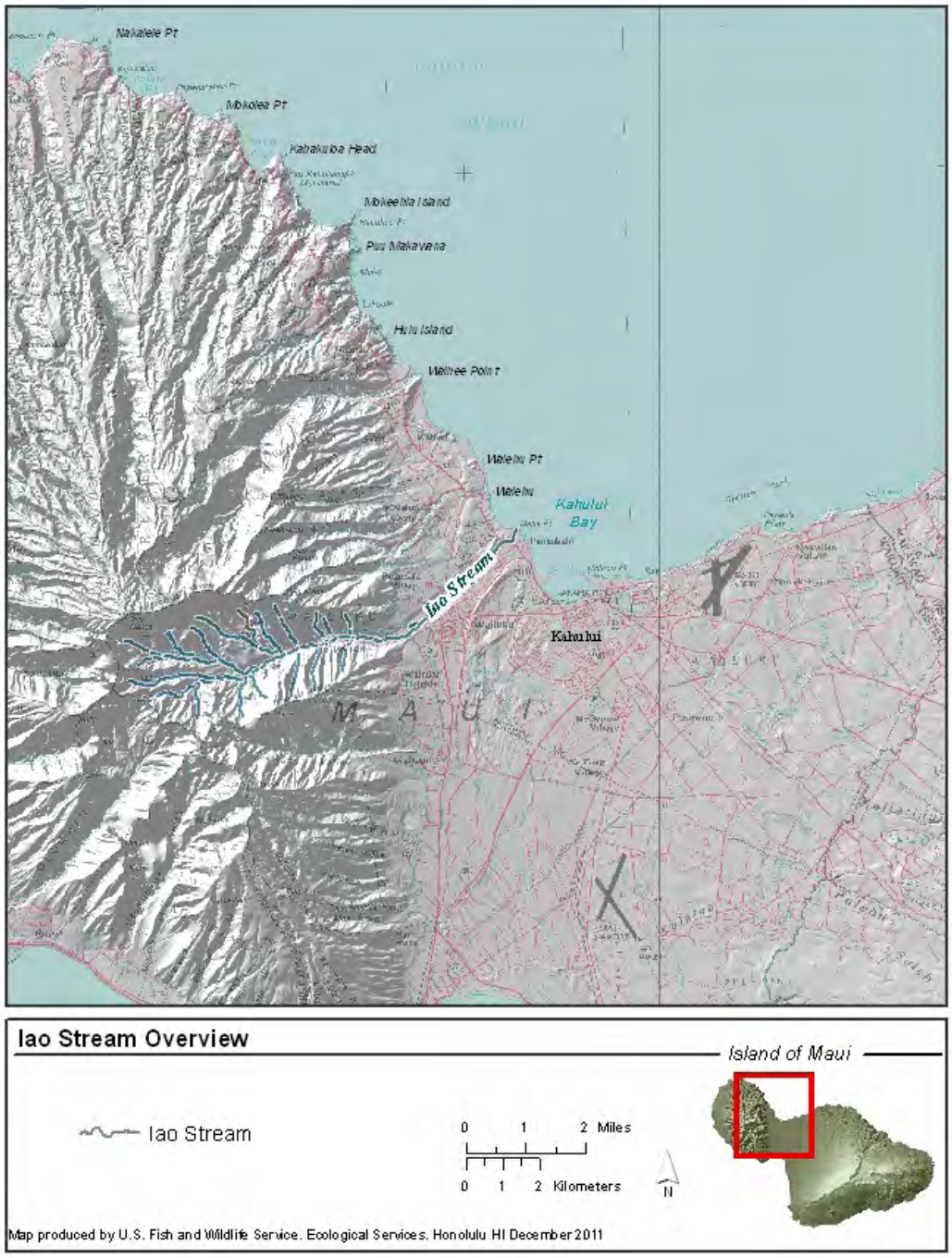

Figure 1. Map showing location of Iao Stream on the Island of Maui.



Figure 2. Map showing the location of all georeferenced photographs taken during the Phase I survey.

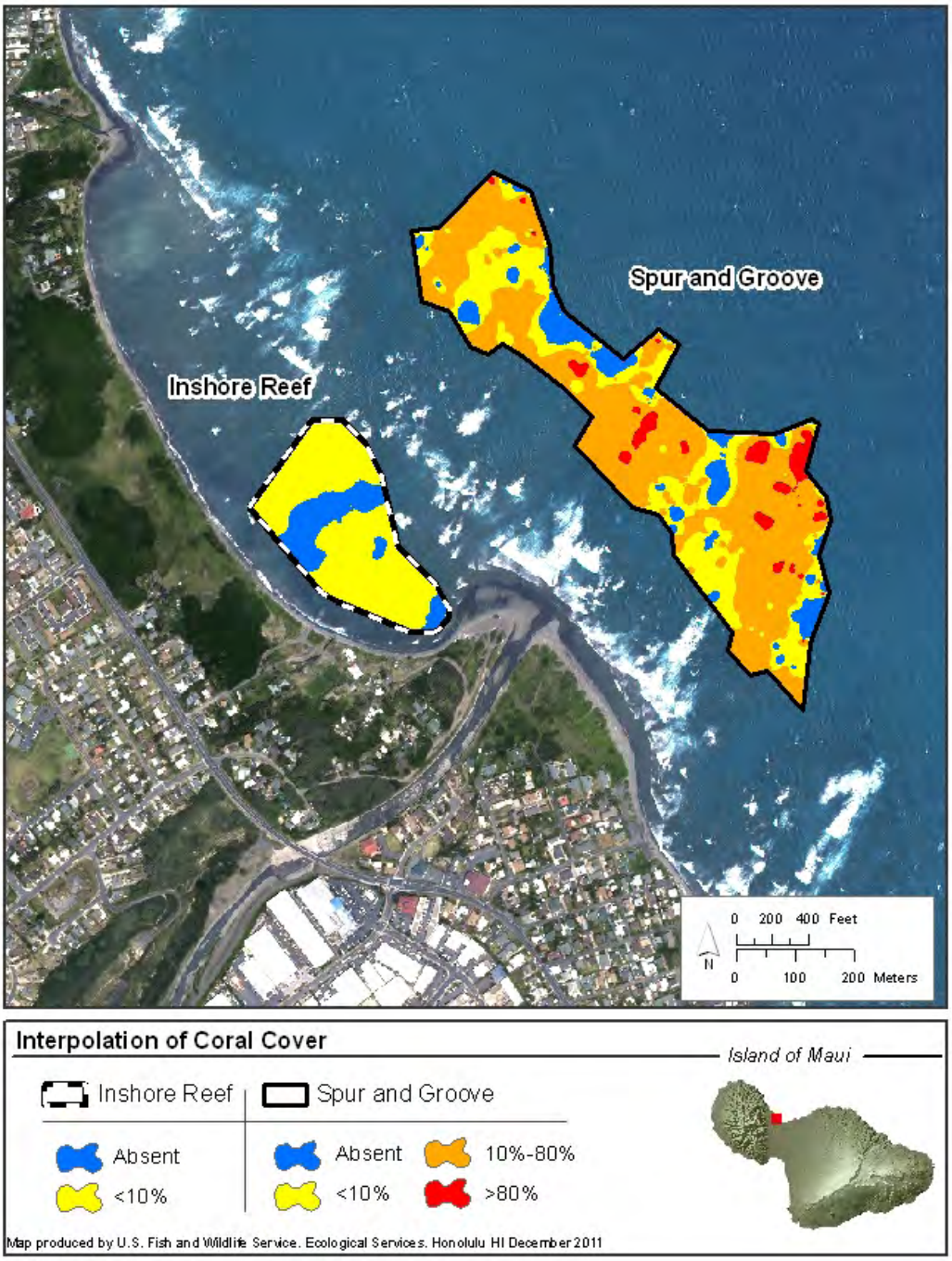

Figure 3. Map showing the interpolation of coral relative abundance data.

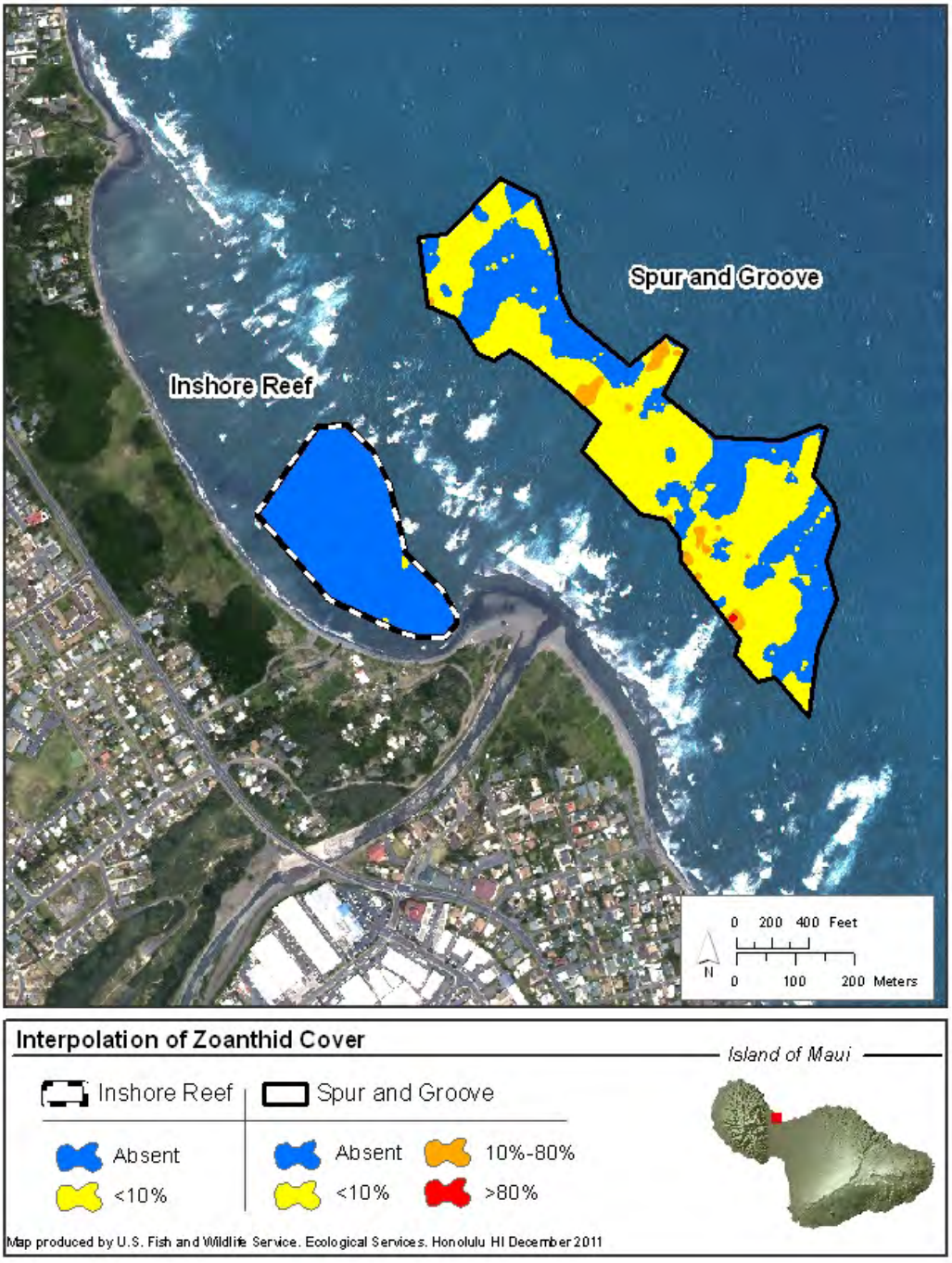

Figure 4. Map showing the interpolation of zoanthid relative abundance data.

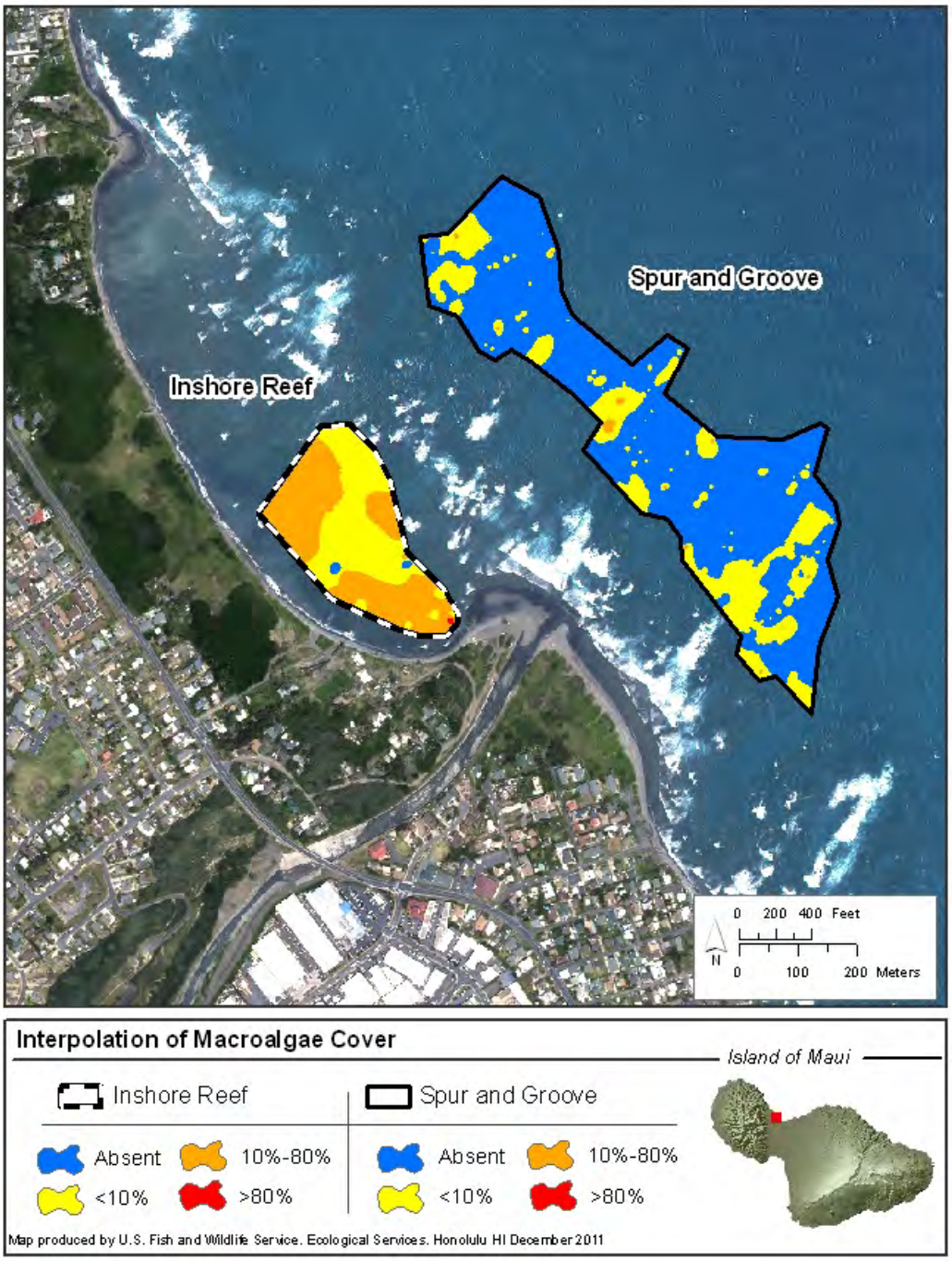

Figure 5. Map showing the interpolation of macroalgae relative abundance data.

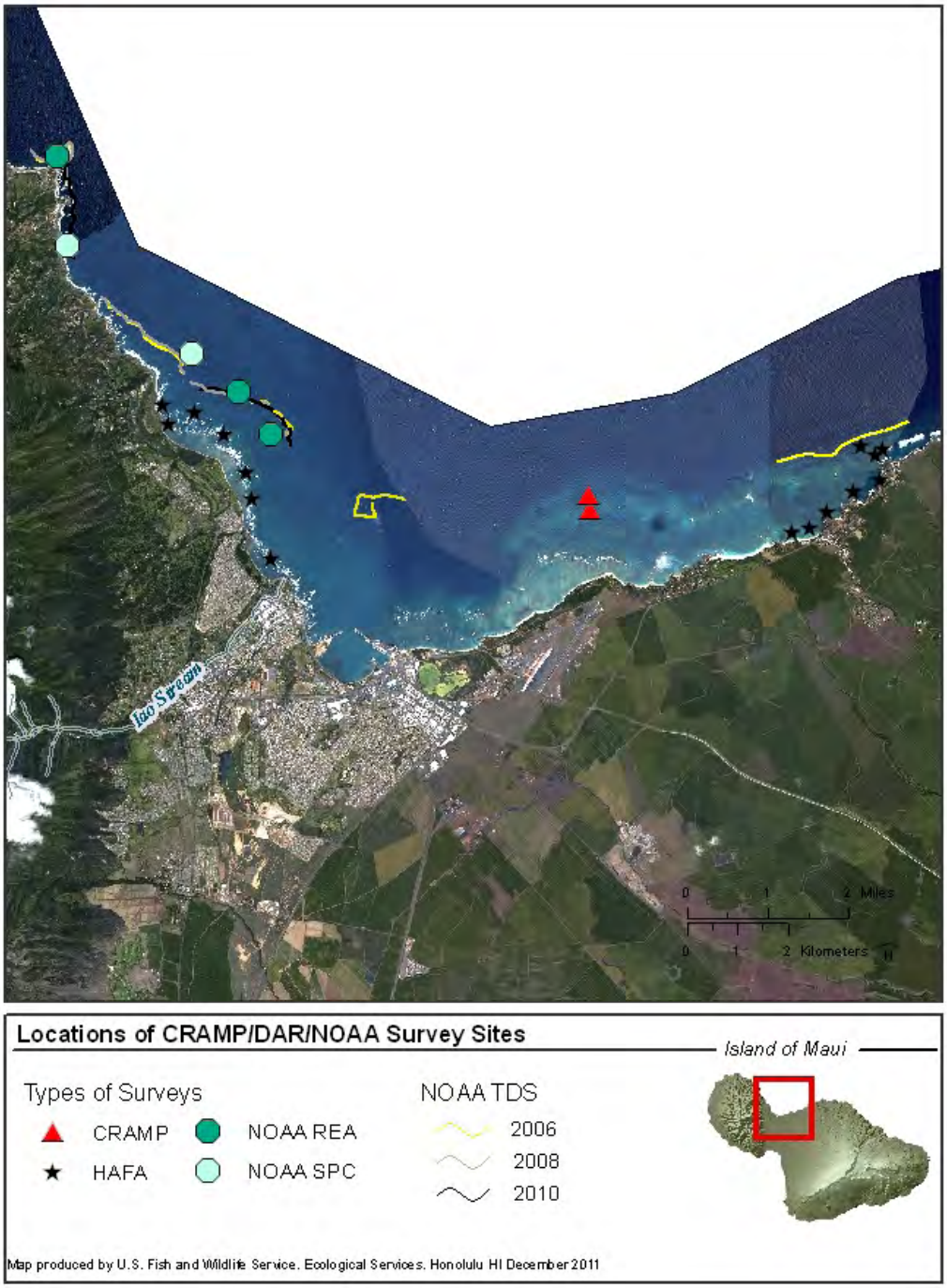

Figure 6. Map showing the location of other known surveys including CRAMP, HDAR HAFA, NOAA SPC, NOAA REA, and NOAA TDS.

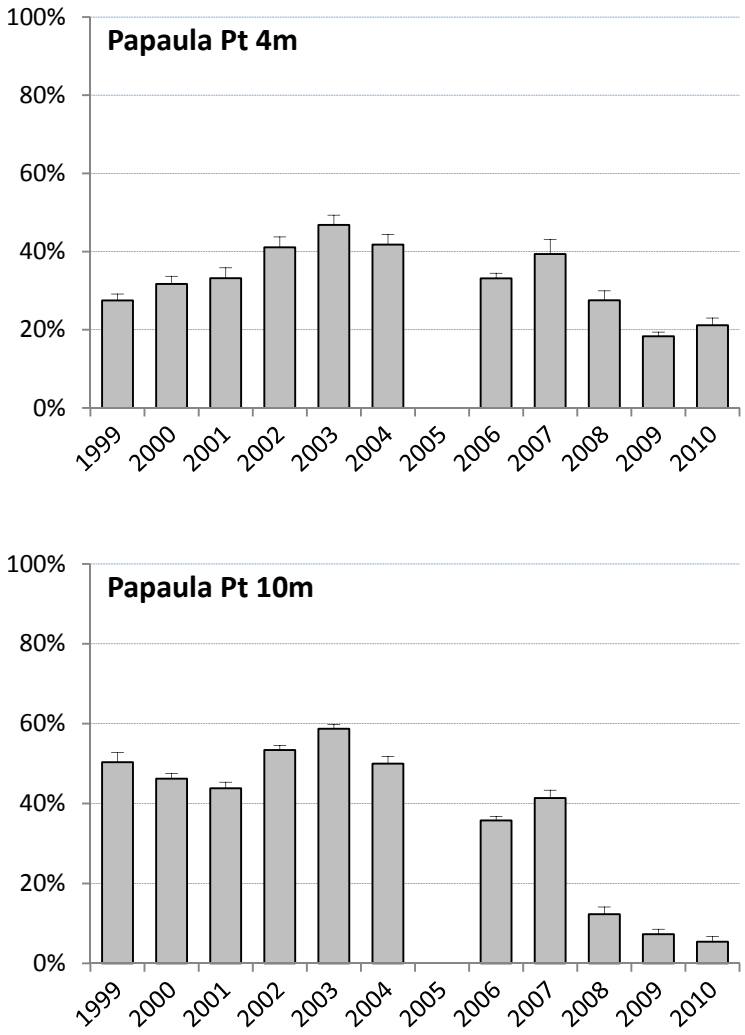

Figure 7. Graphs showing the percent coral cover over time from Papaula, Maui (Walsh *et al.*, 2010).

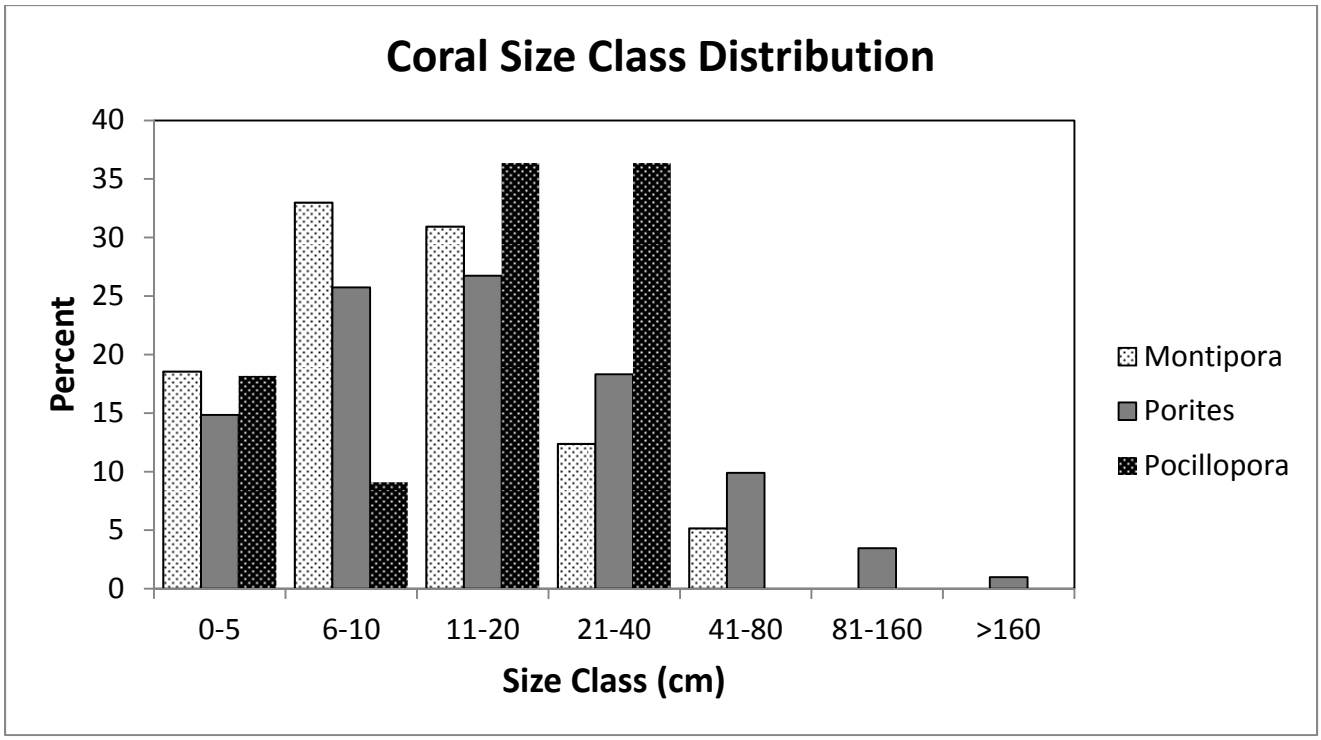

Figure 8. Graph showing the coral size class distribution for the closest NOAA REA site (MAI-21) to Iao Stream (NOAA unpublished data).

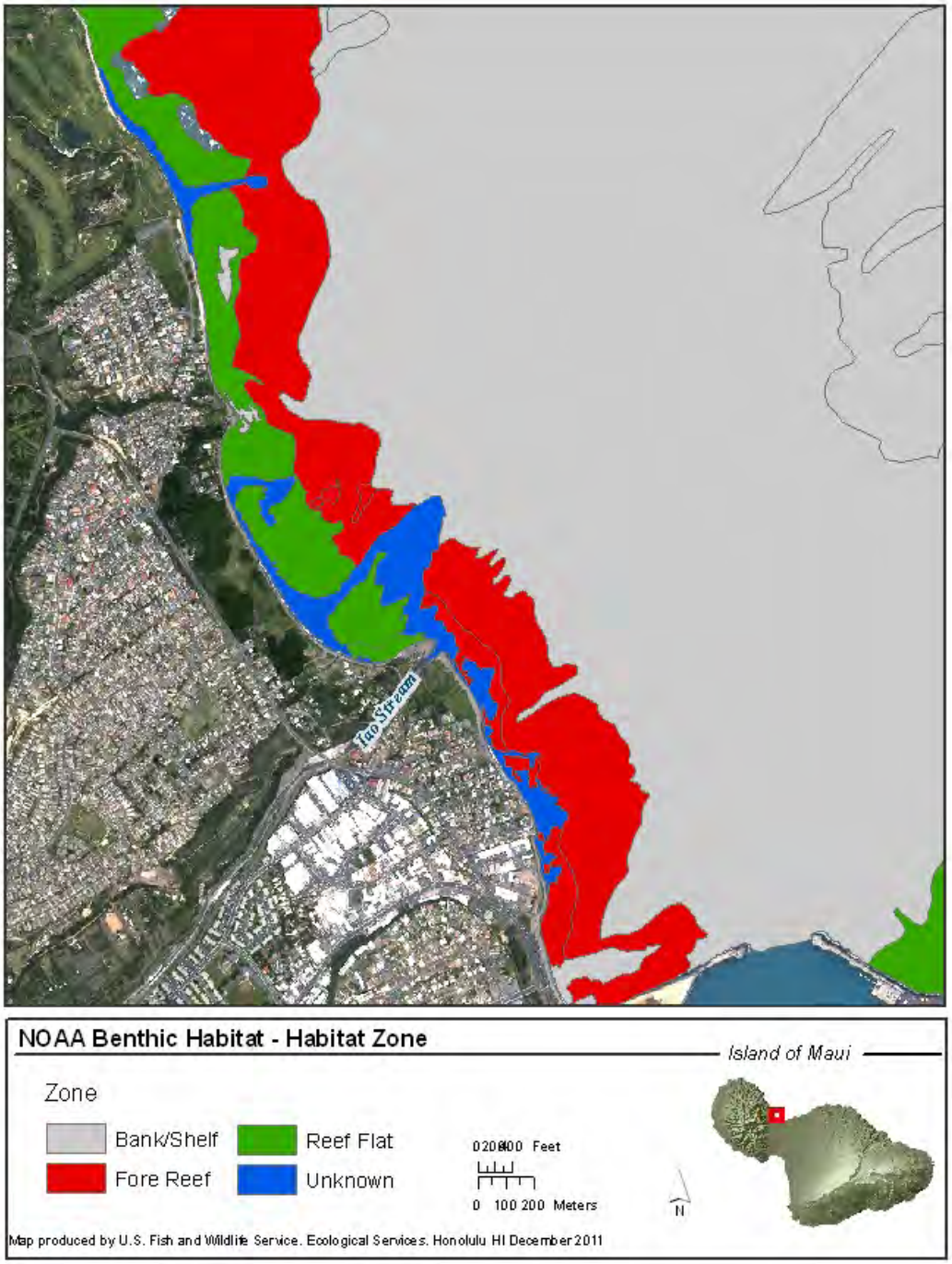

Figure 9. Map showing the NOAA's Benthic Habitat data for habitat zone.

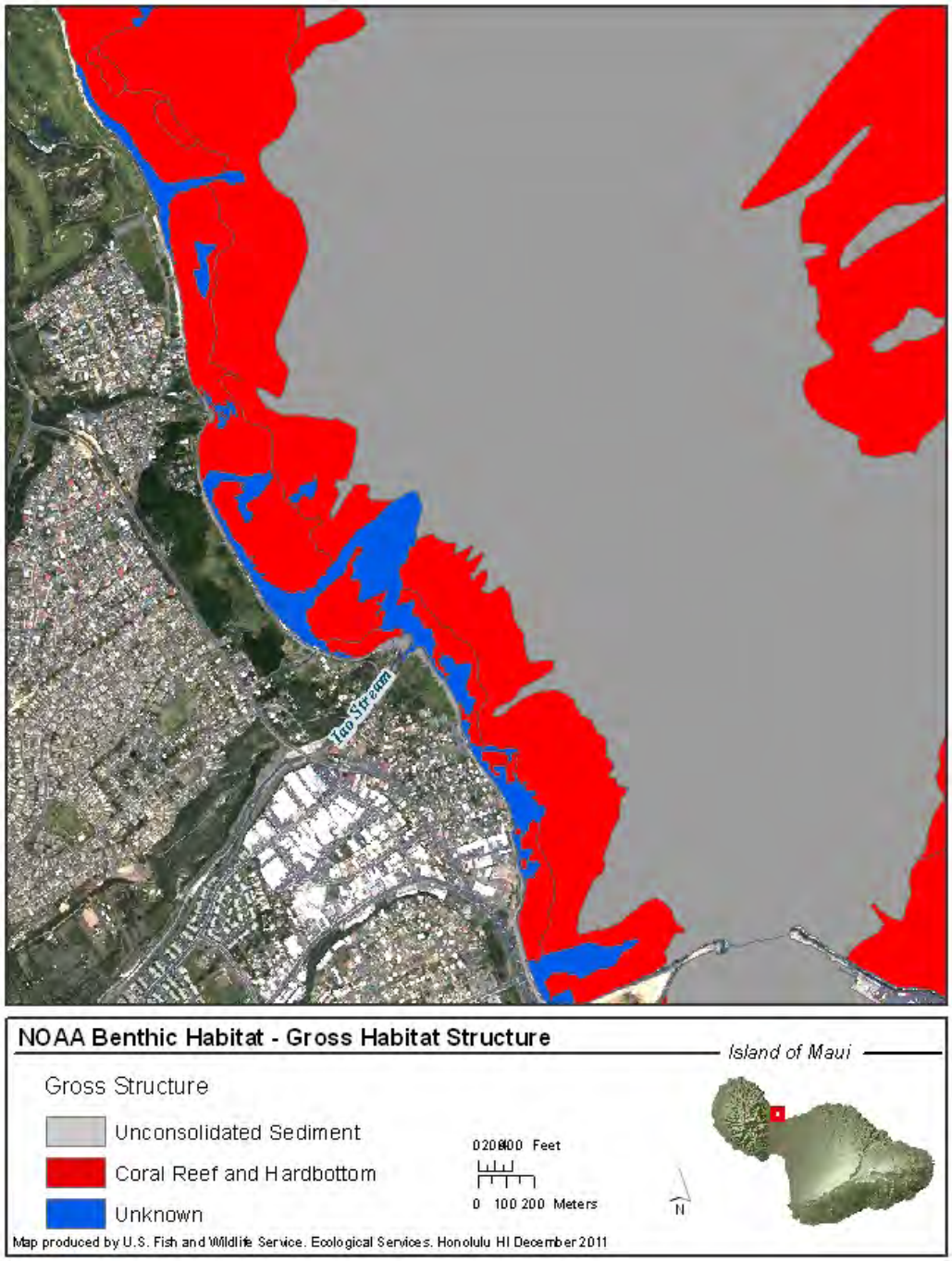

Figure 10. Map showing the NOAA's Benthic Habitat data for gross habitat structure.

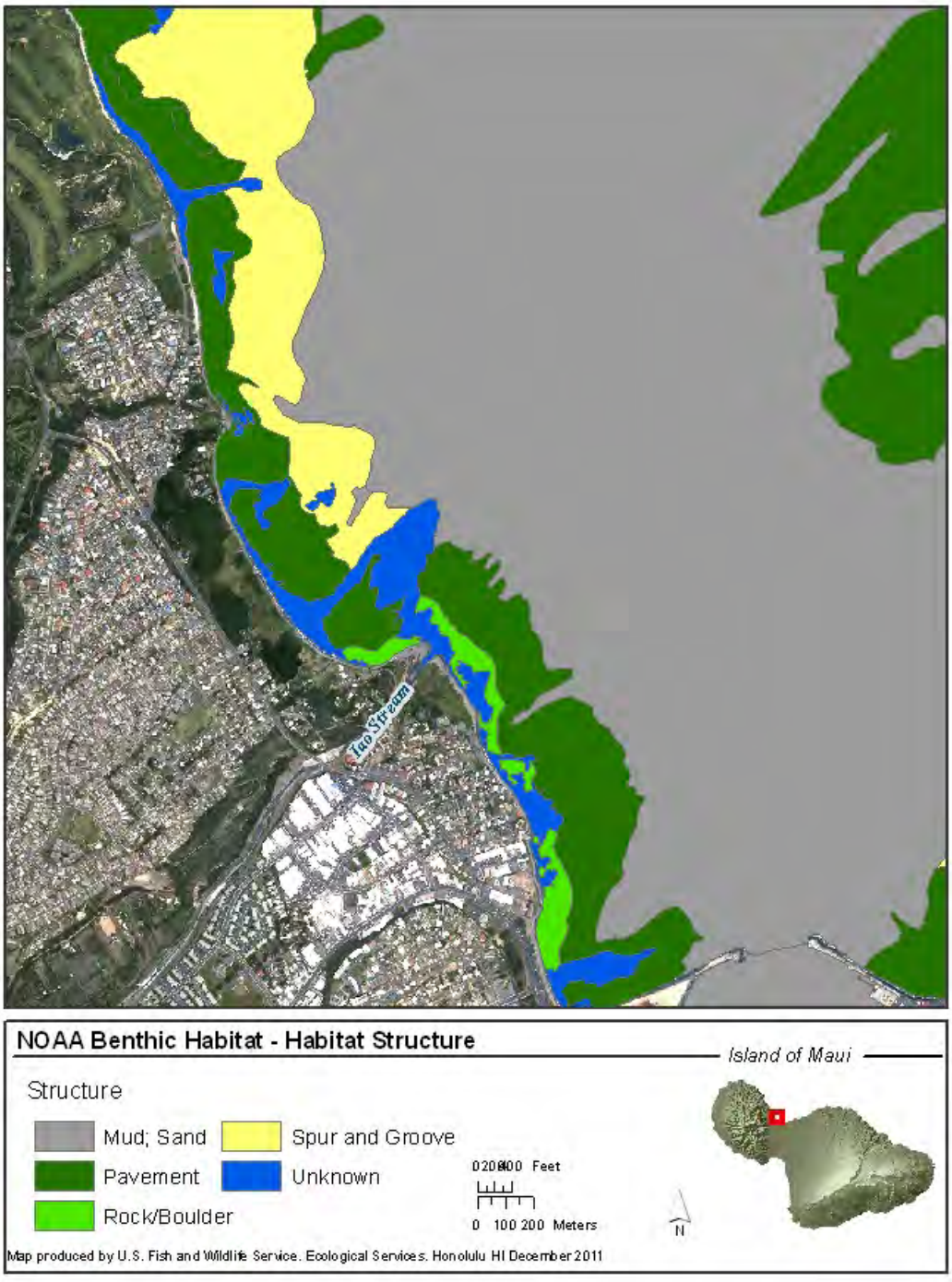

Figure 11. Map showing the NOAA's Benthic Habitat data for habitat structure.

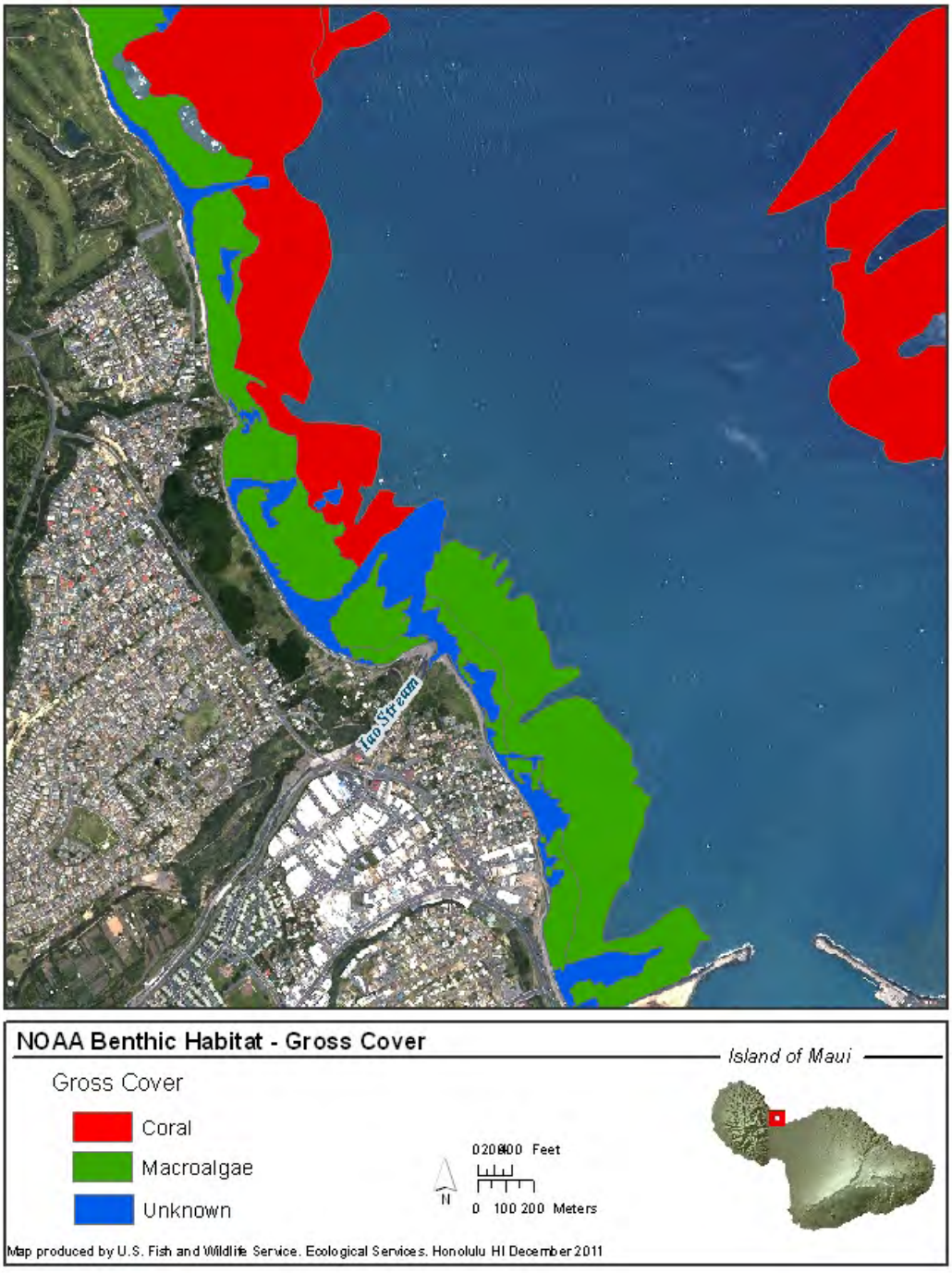

Figure 12. Map showing the NOAA's Benthic Habitat data for gross benthic cover.

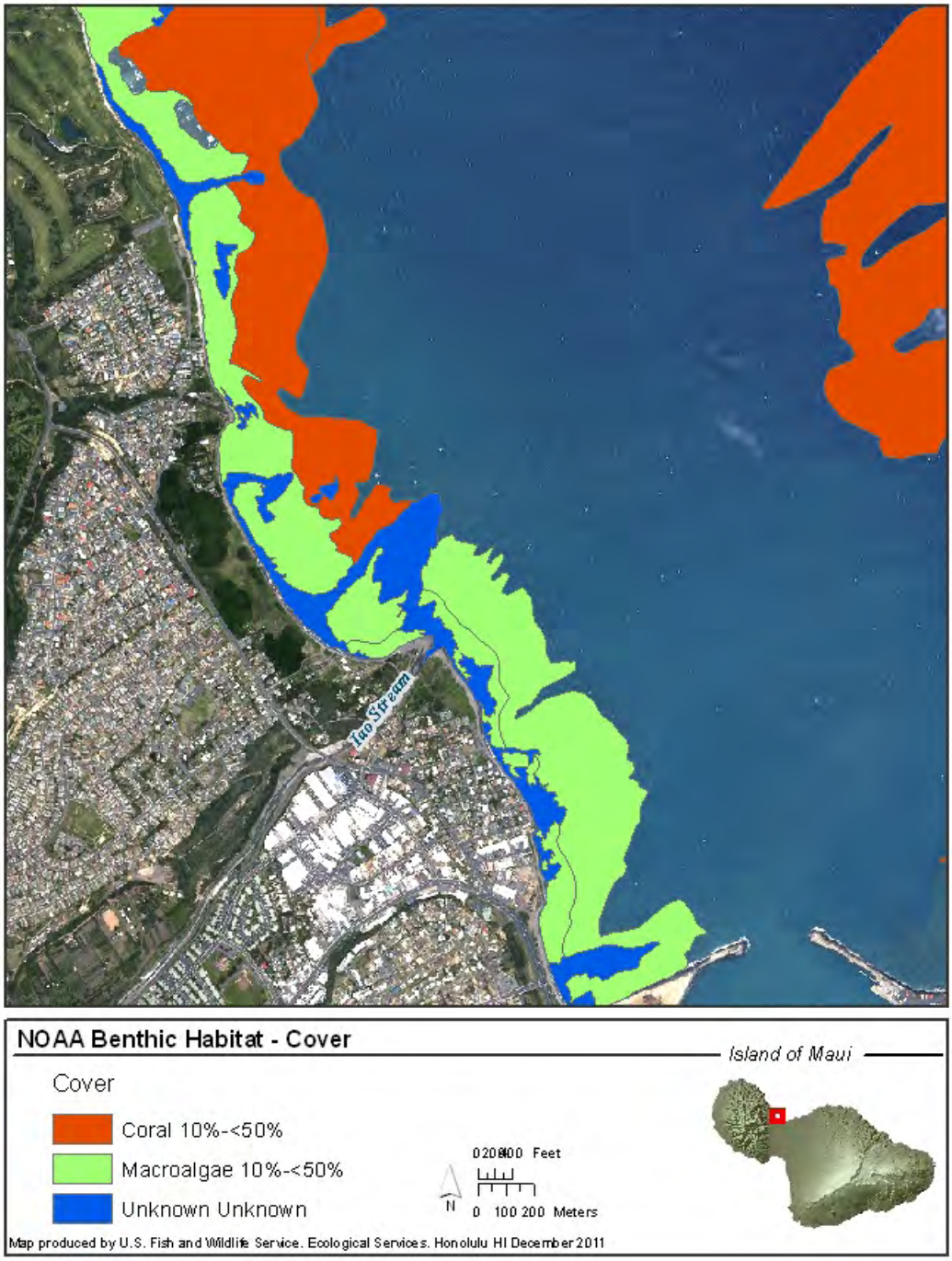

Figure 13. Map showing the NOAA's Benthic Habitat data for benthic cover.

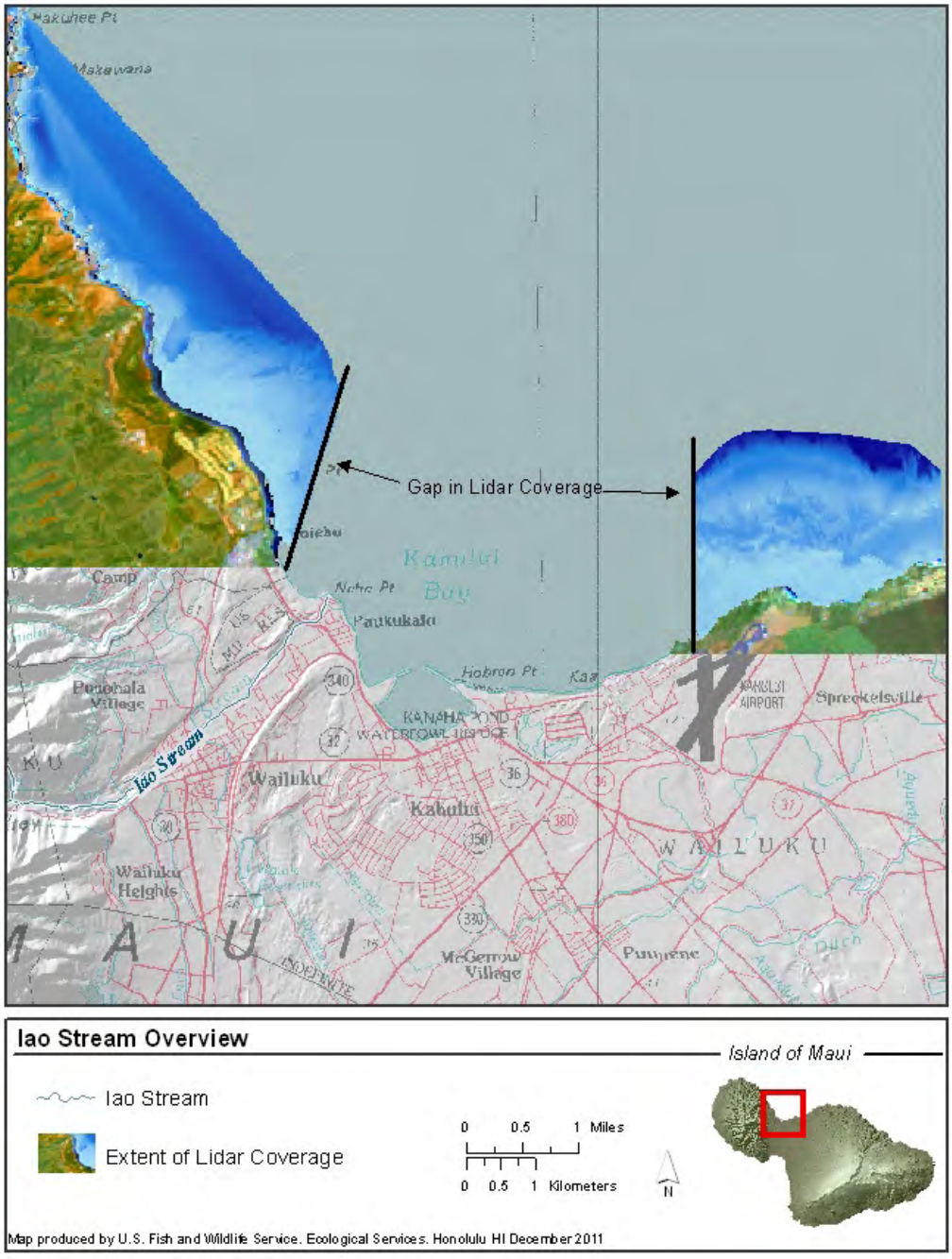

Figure 14. Map showing the gap in Lidar coverage for the marine area around Iao Stream.

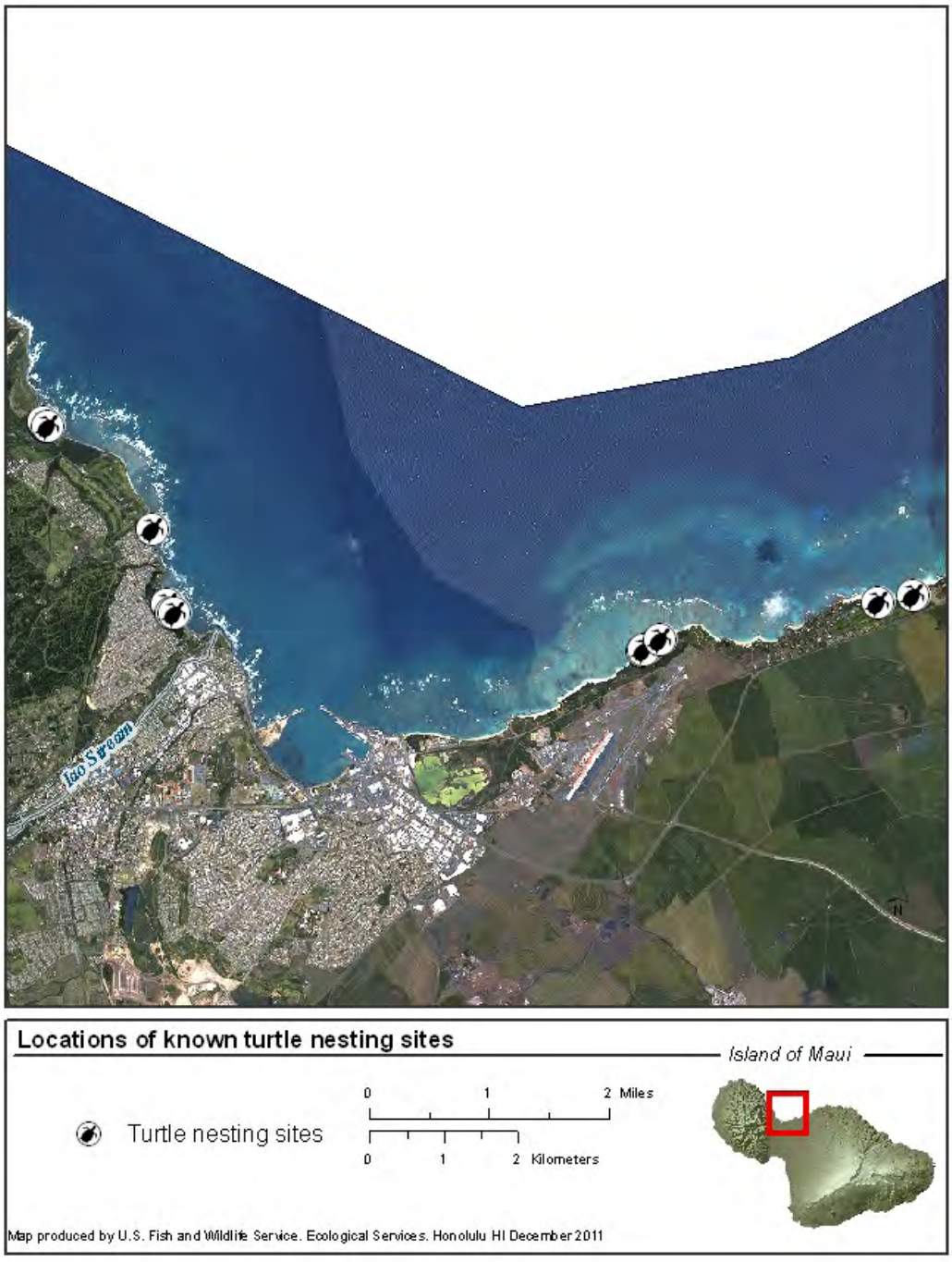

Figure 15. Map showing documented turtle nesting locations (S. Hau, unpublished data).



Figure 16. Map showing a large sediment plume in the marine area around Iao Stream in 1960.

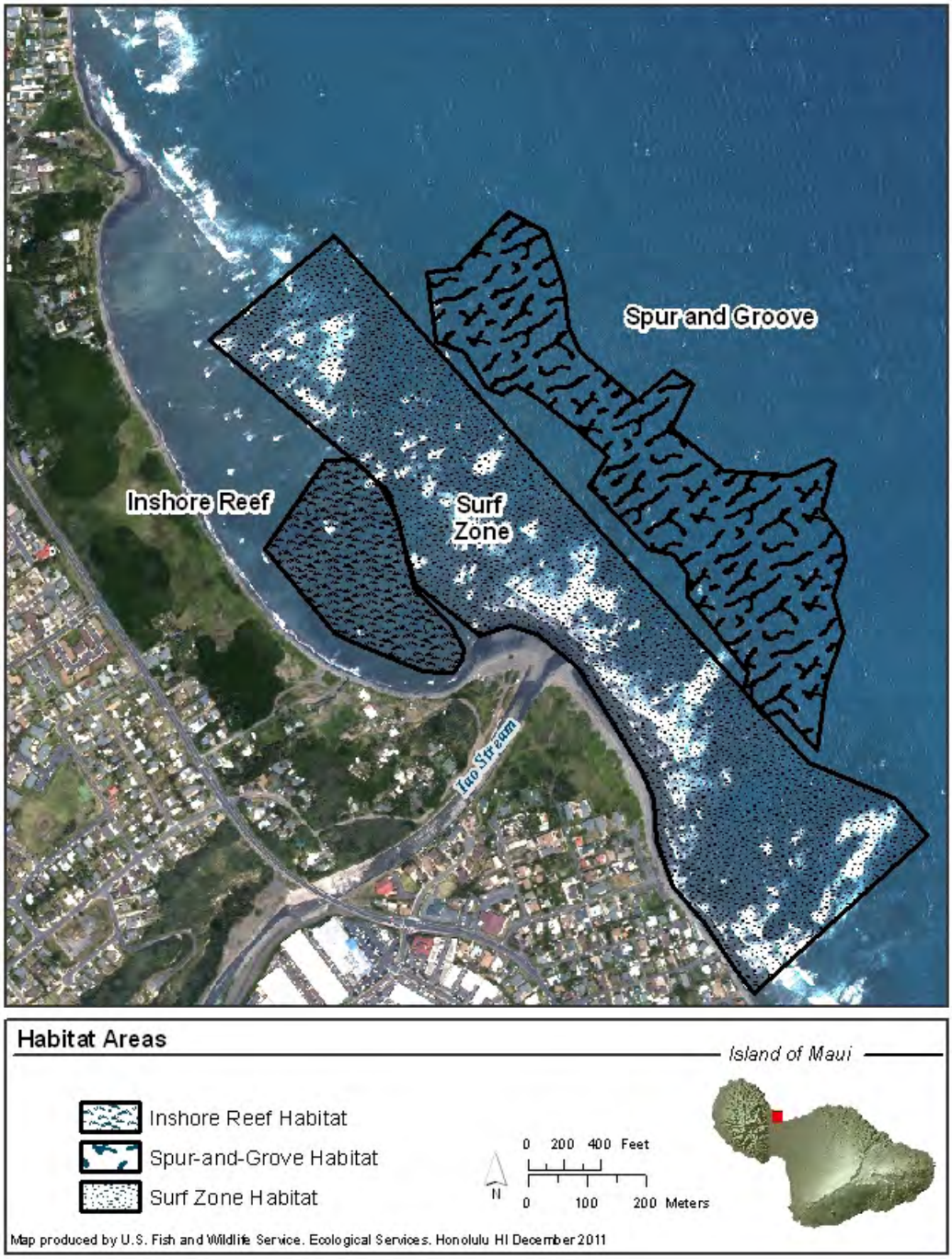

Figure 17. Map showing three designation habitats documented in this Phase I survey.

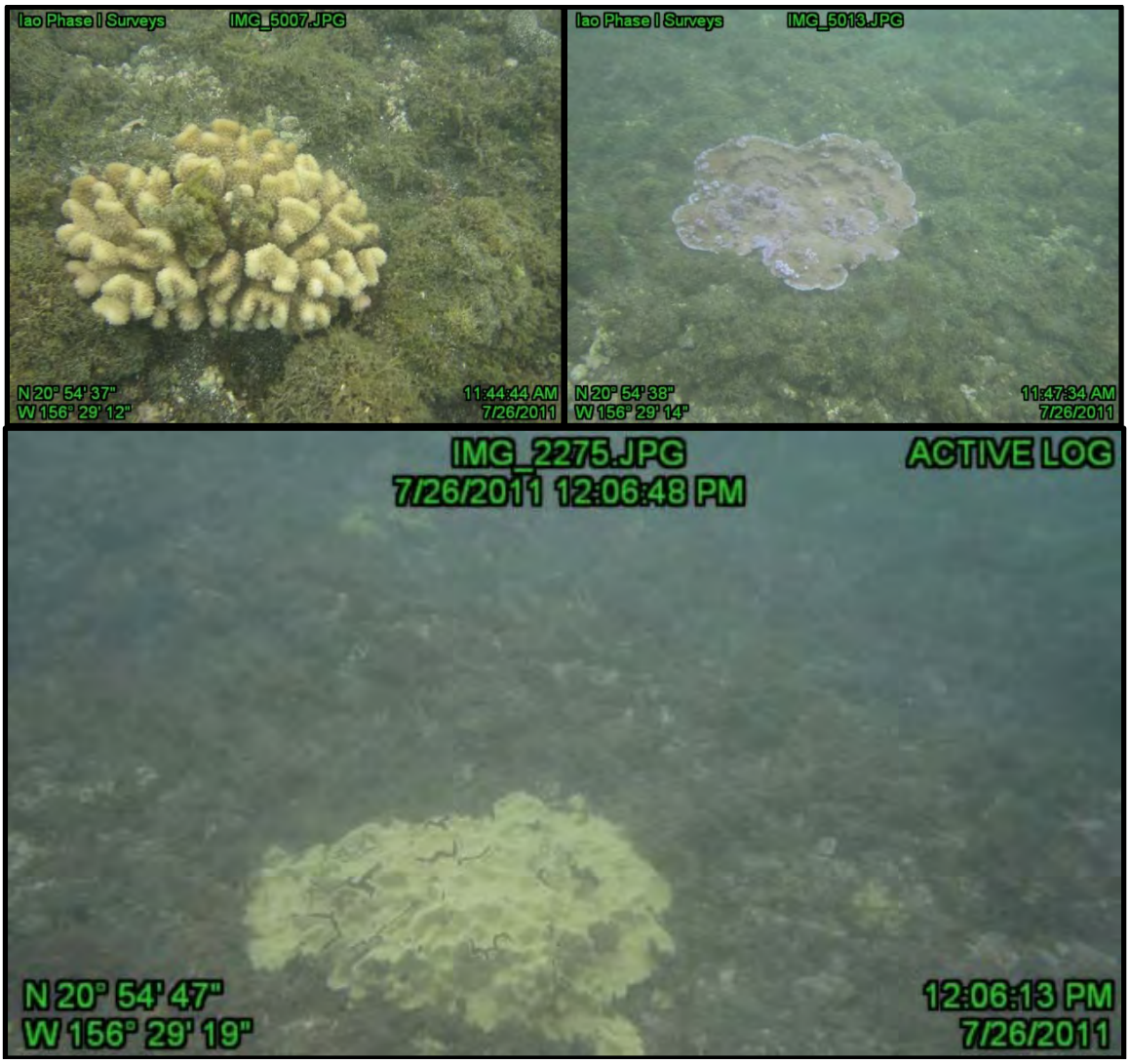

Figure 18. Images of coral from the Inshore Reef area. Upper left: *Pocillopora meandrina*. Upper right: *Montipora flabellata*. Lower: *Porites lobata*.

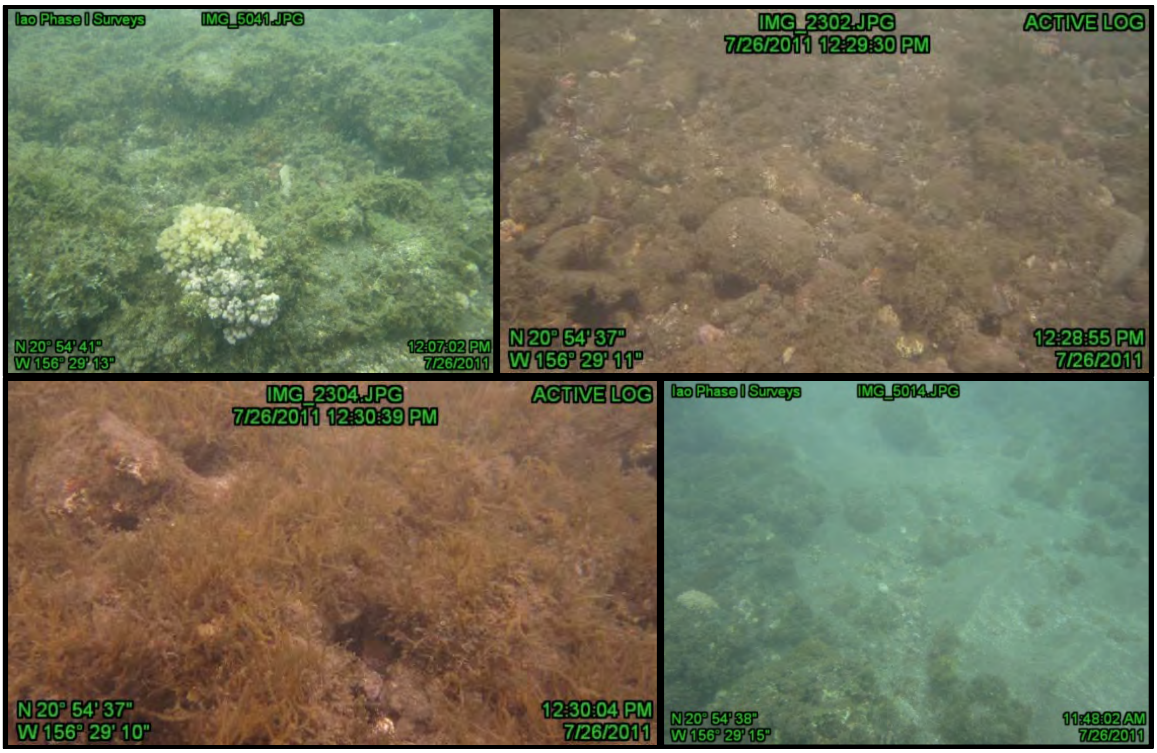

Figure 19. Images of habitat characteristics from the Inshore Reef area. Upper left: mix of macroalgal cover and sporadic corals (*Pocillopora damicornis*). Upper right: mix of sand and small boulders. Lower left: invasive macroalgae, *Acanthopora spicifera*. Lower right: small sandy area with small boulders and macroalgae.

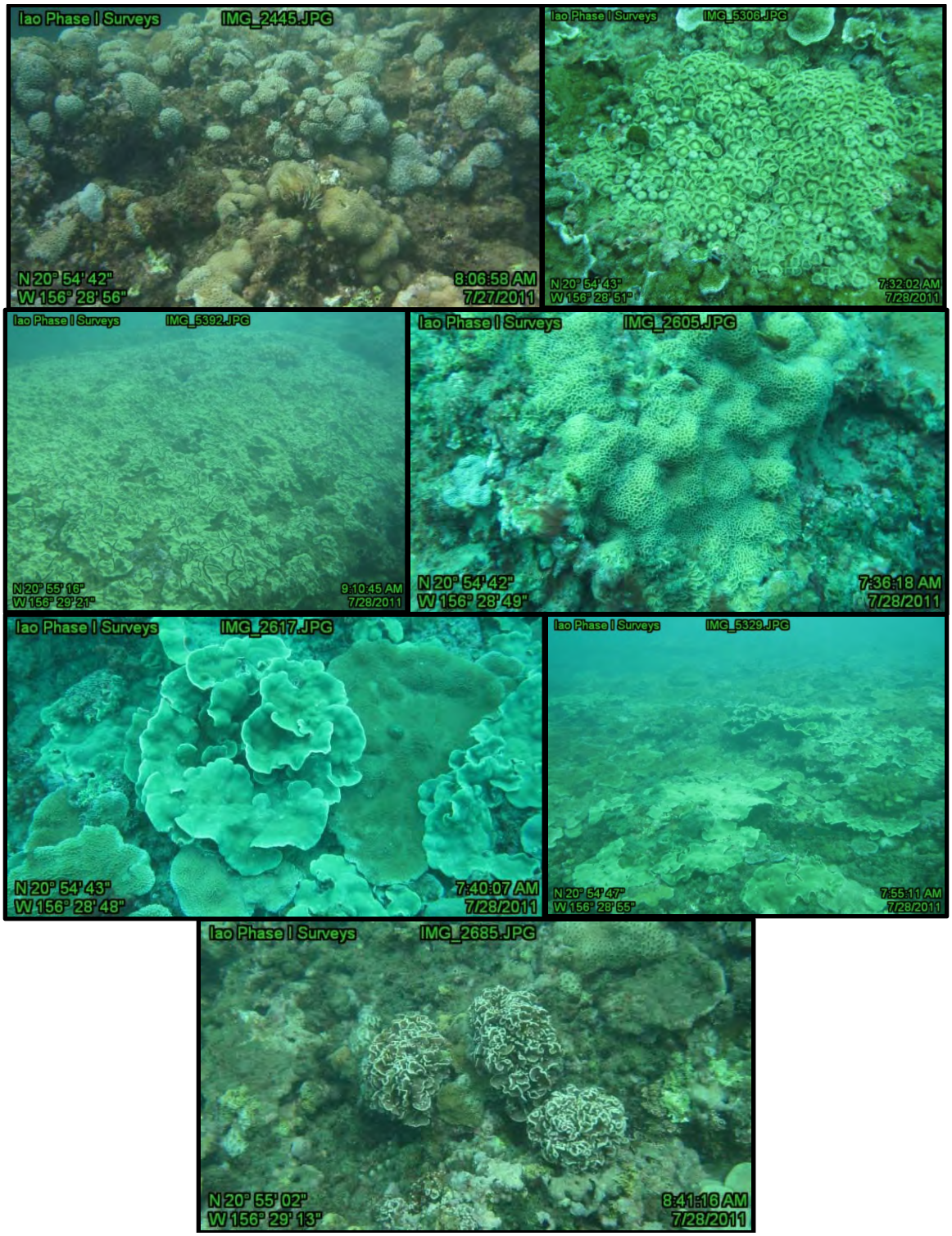

Figure 20. Images of coral and habitat from the Spur-and-Groove area. Upper left: area dominated by the Zoanthid, *Palythoa caesia*. Upper right: zoanthid, *Zoanthus* sp. Second from top, left: area dominated by encrusting Porites lobata. Second from top, right: coral, *Pavona varians*. Third from top, left: corals, *Portites lichen* and *Montipora capitata*. Third from top, right: reef area dominated by encrusting coral. Lower: Small clumps of bushy coralline algae (species uncertain).

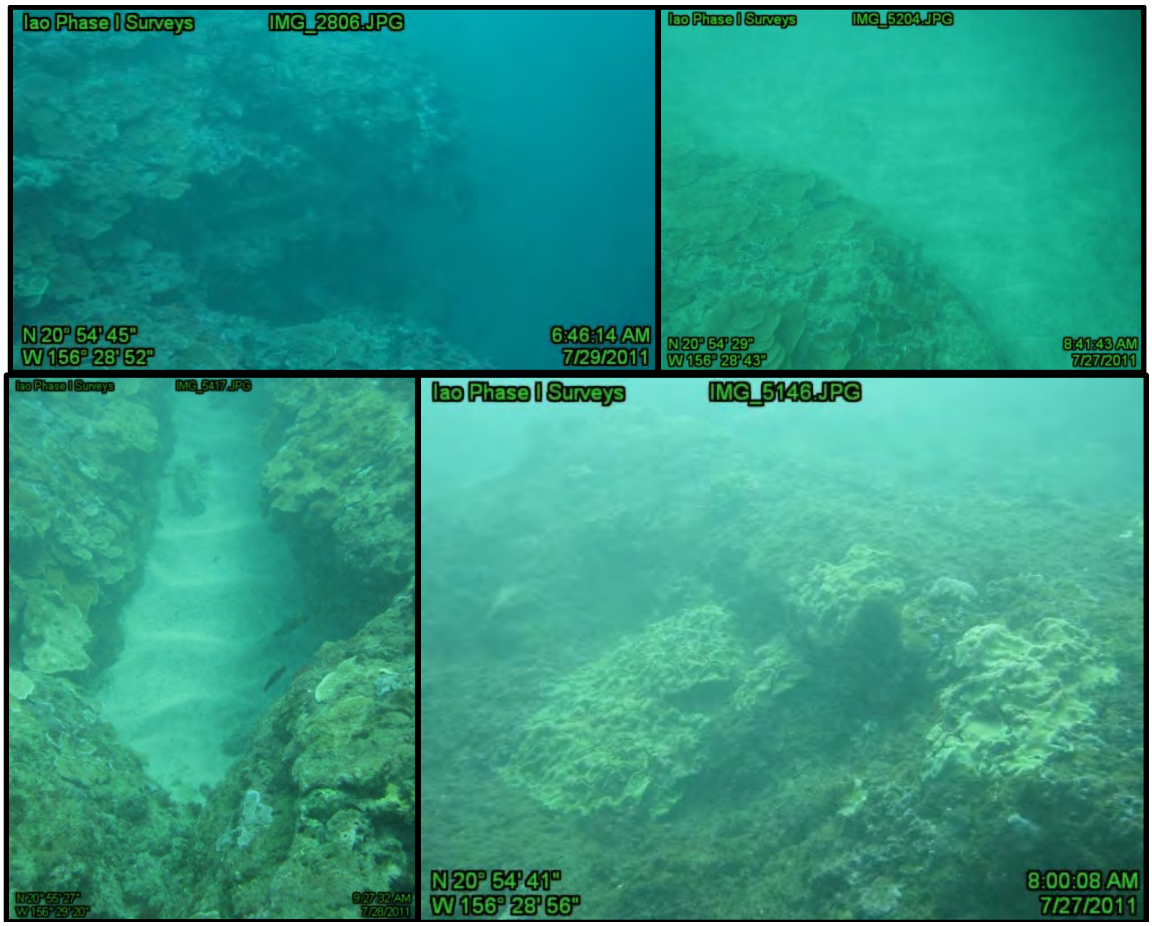

Figure 21. Images for Spur-and-Groove area. Upper left: edge of a vertical side of spur with coral dominating top of spur. Upper right: edge of spur and sand interface with plate and encrusting coral dominating spur edge. Lower left: small sand channel in coral surrounding. Lower right: sloping spur with intermittent encrusting corals.

Table 1. Table showing documented coral species within the marine area of Iao Stream. Corals notated with an asterisk represent species that have been petitioned to be listed under the ESA.

NOAA REA	CRAMP	FWS Phase I
Fungia scutaria	*Cyphastrea ocellina**	*Carijoa riseii*
Montipora capitata	*Fungia scutaria*	*Cyphastrea ocellina*
*Montipora flabellata**	*Leptastrea bottae*	*Fungia scutaria*
Montipora incrassata	*Leptastrea purpurea*	*Montipora capitata*
*Montipora patula**	*Leptoseris incrustans**	*Montipora flabellata**
Montipora sp.	*Montipora capitata*	*Montipora patula**
Palythoa sp.	*Montipora flabellata**	*Palythoa caesia*
Pavona duerdeni	*Montipora patula**	*Pavona duerdeni*
Pavona varians	*Montipora studeri*	*Pavona varians*
Pocillopora meandrina	*Montipora studeri*	*Pocillopora damicornis*
Pocillopora sp	*Pavona maldivensis*	*Pocillopora eydouxi*
Porites compressa	*Pavona varians*	*Pocillopora meandrina*
Porites evermanni	*Pocillopora damicornis*	*Porites compressa*
Porites lobata	*Pocillopora eydouxi*	*Porites lichen*
	Pocillopora ligulata	*Porites lobata*
	Pocillopora meandrina	*Psammocora nierstraszi*
	Porites brighami	*Psammocora stellata**
	Porites compressa	*Sinularia densa*
	Porites evermanni	*Zooanthus sp.*
	Porites lichen	
	Porites lobata	
	Porites rus	
	Psammocora nierstraszi	
	*Psammocora stellata**	
	Unknown Coral	

Appendix I:

Sedimentation Study

Sedimentation Study
Environmental Assessment for
ʻĪao Stream Flood Control Project
Wailuku, Island of Maui, Hawaiʻi
March 2015

The objective of this sedimentation study was to determine whether implementing the Preferred Alternative of the proposed Iao Stream channel modification would result in increased sediment loads that could impact water quality as this stream water enters Kahului Bay. The preferred alternative is to construct a diversion structure to divert stream flow into a natural wetland area during high flow events to reduce the rate of discharge within the main channel section that has been most affected by erosion during such flow events. Improvements to the affected channel section are also proposed to maintain the integrity of the channel and to reduce erodibility of this channel section. Therefore, this sedimentation study focused on potential changes in sediment loads associated with channel erosion within the affected reach, immediately upstream of the proposed diversion structure (river station 79+20) and extending to the point at which water within the wetland re-enters the main channel (river station 45+60). Results for the current condition (i.e., no channel modifications) are compared to those for the implemented Preferred Alternative.

Assumptions made in this study include:

1. A Standard Project Flood (SPF) flow event of 27,500 cubic feet per second (cfs)
2. Upstream sediment basin is properly maintained and captures all upstream sediment load for the SPF flow condition
3. Sediment sources affecting ocean are limited to in-channel erosion (scour and bank erosion) during high flow events.
4. Eroded soil has same physical properties throughout affected reach

Approach

Main Channel

Given the lack of existing measured data associated with in-channel erosion and sedimentation yields for Iao Stream, the current analysis had to rely on empirical relationships based on rates of erosion predicted from soil properties and shear stresses associated with different sized flow events. The rate of erosion of fine grained sediments within the affected reach was estimated using the following modified form of the excess shear stress equation (Clark and Wynn, 2007):

$$\varepsilon^* = k_d(\tau_a - \tau_c)hL \qquad [1]$$

where ε^* is the eroded sediment volume per time per unit length of the stream segment (m^3/sec), k_d is the erodibility coefficient (m^3/N•s), α is an exponent (assumed here to be 1), τ_a is the applied sheer

stress at the channel midpoint (Pa), and τ_c is the critical shear stress to initiate erosive loss (Pa), *h* is height of the inundated channel section for a specific flow event, and *L* is the length of the stream segment. τ_a was calculated from the slope of the energy grade line (S) that was provided as output of the HEC-RAS design simulations (included in the Engineering Documentation Report [EDR] prepared for the Preferred Alternative) for the SPF flow event and application of the following equation:

$$\tau_a = \rho g d S \quad [2]$$

where ρ is the density of water (kg/m^3), *g* is acceleration of gravity (m/s^2), and *d* is the height of water above the midpoint of the channel during a flow event (m). Equation 2 parameter *d* and Equation 1 parameters *h* and *L* were also obtained from the HEC-RAS design simulation output at each channel segment cross-section simulated.

Values for the parameters k_d and τ_c, in Equation 1, are difficult to quantify and assign for a given channel reach as they can be highly variable and dependent on soil physical characteristics and stream bank vegetative root density conditions that can change between channel segments within a given reach. Empirical relationships have been developed for these parameters based on the results of flume studies and in-channel measurements. In this study, the following empirical relationship was employed (Hanson and Simon, 2001):

$$k_d = 0.2{\tau_c}^{-0.5} \quad [3]$$

which was derived from in-channel measurements (i.e., in situ submerged jet tests) on cohesive stream beds across the Midwestern United States. Based on the results of Hanson and Simon (2001) study, a value of 10 Pa was assigned to represent τ_c for the affected reach for Iao Stream as a conservative estimate for a "moderately resistant" soil. Applying Equation 3, a value of 6.3×10^{-8} m^3/N•s was obtained and used to represent k_d for the affected reach.

Overflow Channel

The approach used to estimate sediment yields for the overflow channel was the same as that used for the main channel. However, values for k_d and τ_c were modified to account for reductions in erosion potential resulting from the presence of vegetative cover within the overflow channel. During a recent reconnaissance trip, photographic images (similar to those provided as Figure 1 were taken within the overflow area. Figure 1a is the view from Imi Kala bridge looking west and shows bare soil that is assumed to be returned to grassland similar to that in the image background. Figure 2a and 3a are views from atop Levee F looking into the overflow area, showing current land use as pasture land and small agriculture.

The presence of vegetation within the overflow area will reduce the erodibility of the soils (i.e. increase τ_c) by reducing flow velocities and strengthening the soil by adding cohesion. To account for this reduced erodibility, critical shear stress coefficients (τ_c^*) determined for varying vegetative cover

types (Julian and Torres, 2006) (Table 1) were applied to develop an effective critical shear stress coefficient ($\tau_{c,eff}^{overflow}$) representing the overflow area as:

$$\tau_{c,eff}^{overflow} = \tau_c^{bare} f_{bare} + \tau_c^{grass} f_{grass} + \tau_c^{ST} f_{ST} + \tau_c^{DT} f_{DT} \quad [4]$$

Applying Equation 4, a value of 4.875 was determined for $\tau_{c,eff}^{overflow}$ that served as a multiplier to the critical shear stress value of 10 Pa determined for the main channel soils, resulting in a critical shear stress of 48.75 for the overflow area. Equation 3, was then used to provide an k_d for the overflow area of 2.86×10^{-8} $m^3/N\bullet s$.

Table 1. Critical shear stress coefficients and vegetative cover fractions applied to overflow.

Vegetative Cover*	τ_c^*	**fraction within overflow (f)**
Bare Soil (bare)	1	0.2
Grass Cover (grass)	1.97	0.5
Sparse Trees (ST)	5.4	0.15
Dense Trees (DT)	19.2	0.15



Figure 1. Current vegetated condition of the overflow area: a) looking west from Imi Kala bridge, b,c) views from Levee F looking into the overflow area.

Results

Main Channel

The results of these calculations are summarized in Table 2. The Current Condition case represents hydraulic conditions and total sediment loading rates resulting from an SPF flow event (i.e., 25-year recurrence interval event) occurring with no channel modifications or flow diversions present. The Preferred Alternative case represents implementing the proposed flow diversion into the adjacent flood plain without any additional channel modifications downstream of the diversion. Construction of the flow diversion reduces the flood discharge through the affected reach from 27,500 cfs (total SPF flow) to 5,670 cfs during the SPF event, thereby reducing the overall hydraulic contribution to erosion. The rate of sediment loss from the affected reach during an SPF flow event for the current condition is estimated as 1044 metric tons per hour (Mg/hr). For a 1-hour SPF event, the estimated 1044 Mg of sediment lost from the 0.7 mile long affected reach represents the total sediment load for the event, and would include both the suspended and bed load components. Implementing the flow diversion alone results in a reduced sediment loading rate of 288 Mg/hr, or an estimated 72% reduction in total sediment lost during the SPF event. Channel improvements included in the Preferred Alternative (i.e., stream bank stabilization via partially grouted riprap, fully grouted riprap, and shotcrete along the affected reach) will further reduce total sediment losses resulting from an SPF event, and consequently reduced suspended sediment loads. Therefore, implementing the Preferred Alternative will provide a net benefit with respect to mitigating the suspended sediment load entering Kahului Bay.

Overflow Area

For an SPF flow event (i.e., 25-year recurrence interval event), the rate of sediment loss from within the overflow area for the current condition of the overflow area is estimated as 97 Mg/hr (Table 3). This sediment load would be additive to the main channel yields when flow re-enters the main channel. Over time, allowing the bare soil areas to return to a natural vegetative cover or implementing engineered cover options would further reduce erosion potentials and resulting sediment yields within the overflow area.

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Table 2. Results of Sediment Load Calculations for the Iao Stream Affected Reach

	Current Condition					Implementing Proposed Action (Flow Diversion Only)				
Distance from ocean outlet (miles)	SPF Discharge (cfs)	Energy Grade Slope (ft/ft)	Calculated Applied Shear Stress (Pa)	Estimated Total Sediment Load (m^3/hr)	Estimated Total Sediment Load (Mg/hr)	SPF Discharge (cfs)	Energy Grade Slope (ft/ft)	Calculated Applied Shear Stress (Pa)	Estimated Total Sediment Load (m^3/hr)	Estimated Total Sediment Load (Mg/hr)
1.5	Bridge Above Diversion									
1.473	27500	0.0012	40	2.1	5.5	20049	0.0148	383	15.6	0.0
1.452	27500	0.0213	503	18.2	48.2	18237	0.0275	511	16.4	0.0
1.429	27500	0.0365	774	27.7	73.5	10131	0.0008	26	0.8	2.0
1.411	27500	0.0376	724	18.4	48.8	5670	0.0206	537	18.4	48.6
1.397	27500	0.0341	685	14.1	37.4	5670	0.1027	842	7.1	18.8
1.361	27500	0.0315	618	31.9	84.6	5670	0.0236	226	5.5	14.6
1.323	27500	0.0253	503	27.8	73.7	5670	0.0253	250	6.7	17.7
1.285	27500	0.0077	176	10.7	28.5	5670	0.0205	240	7.6	20.1
1.248	27500	0.0046	104	5.9	15.5	5670	0.0293	294	7.8	20.8
1.209	27500	0.0743	814	25.5	67.7	5670	0.0282	225	5.0	13.2
1.174	27500	0.0276	348	11.1	29.4	5670	0.0315	256	5.2	13.8
1.128	27500	0.0120	220	13.3	35.1	5670	0.0260	222	6.2	16.5
1.088	27500	0.0145	245	11.8	31.3	5670	0.0324	215	4.1	10.8
1.043	27500	0.0236	448	27.9	73.9	5670	0.0413	401	12.7	33.7
1.013	27500	0.0154	407	23.5	62.3	5670	0.0214	227	5.1	13.6
0.972	27500	0.0250	523	32.8	86.8	5670	0.0275	225	5.4	14.2
0.932	27500	0.0201	404	23.5	62.3	5670	0.0230	194	4.6	12.2
0.898	27500	0.1121	1334	39.9	105.7	5670	0.0292	270	6.1	16.2
0.857	27500	0.0213	339	16.0	42.4	5670	0.0007	14	0.2	0.6
0.821	27500	0.0175	282	11.8	31.2	12615	0.0004	12	0.1	0.3
Totals					**1044**					**288**

Table 3. Results of Sediment Load Calculations within Overflow Area

	Current Condition				
Floodplain Stage (miles)	SPF Discharge (cfs)	Energy Grade Slope (ft/ft)	Calculated Applied Shear Stress (Pa)	Estimated Total Sediment Load (m^3/hr)	Estimated Total Sediment Load (Mg/hr)
1.473	2730	0.025505	154.4704882	0.455056057	0.0
1.452	21720	0.019144	166.0450171	0.791893565	0.0
1.429	21720	0.045095	405.2919999	1.952041718	5.2
1.411	21720	0.030547	383.7187482	2.56322956	6.8
1.397	21720	0.0219	242.348872	1.015065341	2.7
1.361	21720	0.05476	507.7153537	5.184483714	13.7
1.323	21720	0.018203	158.4277016	1.227598485	3.3
1.285	21720	0.025737	185.1263195	1.261534291	3.3
1.248	21720	0.024928	159.17706	0.882950853	2.3
1.209	21720	0.013359	99.08793878	0.492802762	1.3
1.174	21720	0.016418	137.490739	0.880259121	2.3
1.128	21720	0.064283	327.805083	2.215305215	5.9
1.088	21720	0.029409	188.6699427	1.215145614	3.2
1.043	21720	0.018486	118.8711796	0.686691393	1.8
1.013	21720	0.043825	231.3458952	0.9786297	2.6
0.972	21720	0.010756	135.2732603	1.509885971	4.0
0.932	21720	0.100318	742.5902319	6.95274162	18.4
0.898	21720	0.012555	116.217769	0.718616752	1.9
0.857	21720	0.02611	182.3429264	1.294540441	3.4
0.821	21720	0.01687	301.4728148	5.502325491	14.6
Total					**96.8**

Appendix J:

Archaeological Inventory Survey

FINAL REPORT

Archaeological Inventory Survey in Support of the Modification to the ʻĪao Stream Flood Control Project, Alternative F, Wailuku Ahupuaʻa, Wailuku District, Maui Island, Hawaiʻi.

TMK: [2] 3-4-032: 001 [por.]

Prepared for:

GSI Pacific Inc.
181 South Kukui Street
Honolulu, Hawaii 96813

March 2015

PACIFIC CONSULTING SERVICES, INC.

720 Iwilei Road, Suite 424, Honolulu Hawaii 96817

FINAL REPORT

Archaeological Inventory Survey In Support of Modification to the ʻĪao Stream Flood Control Project, Alternative F, Wailuku District, Wailuku Ahupuaʻa, Maui Island, Hawaiʻi

(TMK:[2] 3-4-032:001 [por.])

Prepared by
Nicole Vernon, M.A.
Stephan D. Clark, B.S.
and
Dennis C. Gosser, M.A., RPA
Principal Investigator

Prepared by
Pacific Consulting Services, Inc.
720 Iwilei Road, Suite 424
Honolulu, HI 96817

Prepared for
GSI Pacific, Inc.
181 S. Kukui Street
Honolulu, HI 96813

March 2015

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INTRODUCTION

Under contract to GSI Pacific, Inc., Pacific Consulting Services, Inc. (PCSI) has prepared this Archaeological Inventory Survey report in support of the proposed modification, Alternative F, to the ʻĪao Stream Flood Control Project, Maui Island, State of Hawaiʻi [TMK (2) 3-4-032:001 (por.)]. The subsurface archaeological survey was carried out in accordance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations (36 CFR 800).

PROJECT DESCRIPTION AND LOCATION

The Proposed Action, Alternative F, consists of features intended to reconnect the main channel with the floodplain to reduce damaging flows along the main channel and right bank levees. The reconnection would be accomplished by lowering the left bank, grading the overflow area to disperse flow into the floodplain, and constricting the main channel with a concrete diversion wall to force flood flows to leave the main channel and enter the existing floodplain on the left bank of the stream. A portion of the left bank would be raised further downstream to contain the overflow within the floodplain. Even further downstream, the left bank would be lowered to allow the return of the overflow into the main channel. The Proposed Action would also include bank stabilization along the right bank upstream of the proposed overflow channel and downstream of the outflow return location to prevent further erosion in these areas. Furthermore, the existing revetment between the overflow channel and outflow return location would be reconstructed as part of the Proposed Action.

The objective of the archaeological study was to sample the proposed overflow channel area (herein referred to as the project area) where ground-disturbing activities are being proposed to determine if subsurface historic properties are present, and to determine if additional archaeological features are likely to be present in the non-sampled portion of the floodplain where stream waters would be diverted to until returning to the main channel downstream.

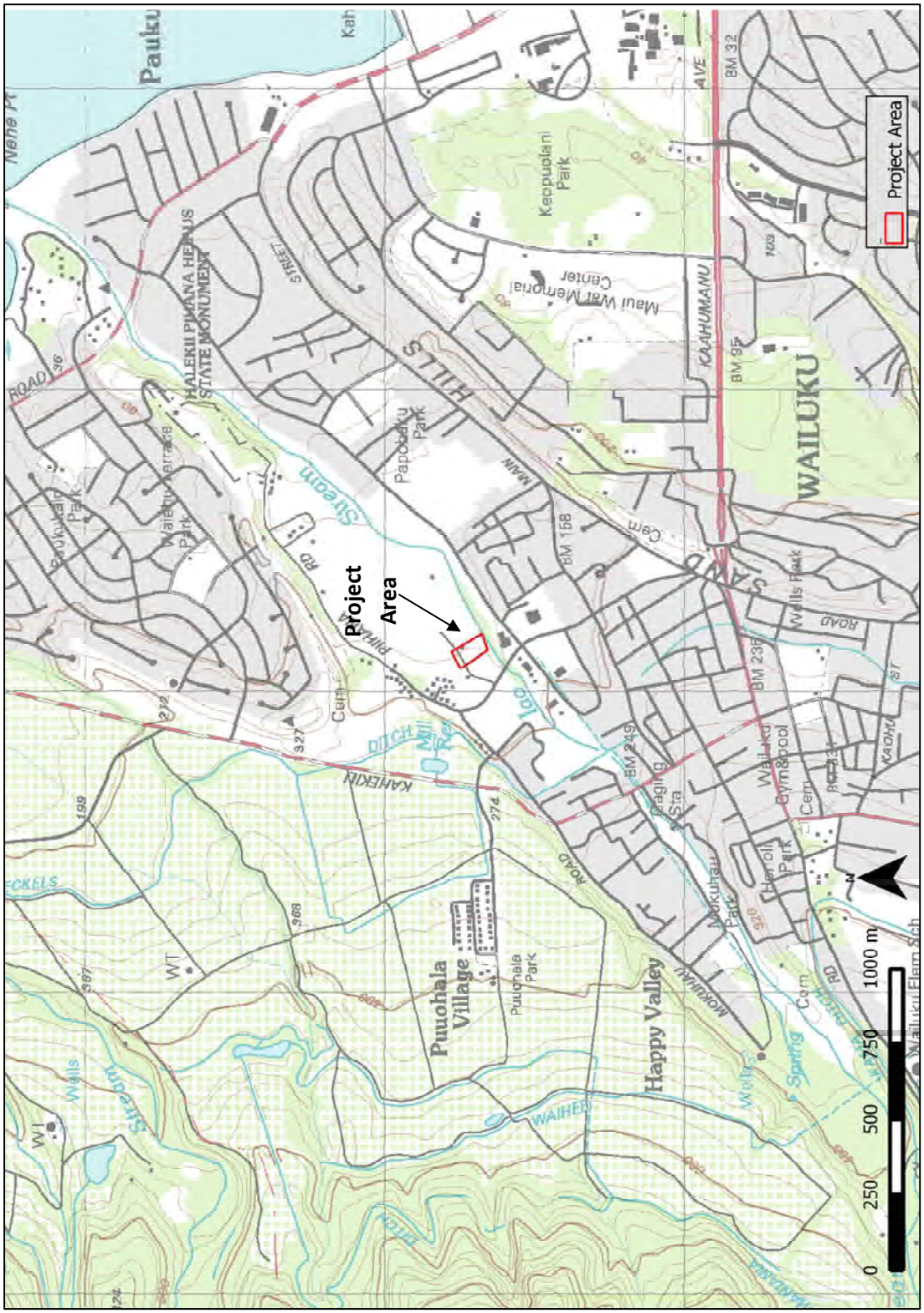
The approximately 0.7 hectares (1.7-acre) project area is located along the north bank of ʻĪao Stream, 2.1 km (1.3-miles) inland (southwest) of Nehe Point in Wailuku Ahupuaʻa (Figure 1). ʻĪao Stream flows through ʻĪao Valley from the West Maui Mountains. Wailuku Ahupuaʻa extends *makai* from Kauaula Ahupuaʻa in the Lahaina District through the valley and coastal plain to Kahalui Bay. Waiehu Ahupuaʻa and Waiehu Valley are to the northwest, and Waikapu Ahupuaʻa and Wailuku Town are to the southeast.

ENVIRONMENTAL BACKGROUND

TOPOGRAPHY AND SOILS

ʻĪao Valley is formed of younger alluvium with lithified calcareous sand dunes resting on alluvial fans near the shoreline and on each side of the *makai* portion of the stream near Wailuku Town (Macdonald et al. 1983:387). The cliffs at the back of ʻĪao Valley are the boundary of an extinct caldera. The lava that once flowed has been eroded by ʻĪao Stream, which formed a deep valley “into the low-permeability volcanic dike compartments which impound groundwater to high altitudes” (USGS 2013). During dry periods the stream continues to be fed by groundwater leaking from these dike compartments. Downstream water is diverted by tunnels and ditches to irrigated agricultural fields, which may at times run dry (USGS 2013).

The project area is situated on the north side of ʻĪao Stream, approximately 50 to 60 m above mean sea level (amsl). Soils at the project area include ʻĪao cobbly silty clay with 3–7 percent slopes (IbB) and Pulehu cobbly clay loam with 0–3 percent slopes (PtA). The ʻĪao series


Project Area
Project Area
0
250
500
750
1000 m
WAILUKU
Puuohala Village
Happy Valley
HALEKII PIHANA HEIAUS STATE MONUMENT
Kepuoolani Park
Maui War Memorial Center
Papohaku Park
Puuohala Park
Wells Park
Waiehu Terrace Park
Waiehu Golf Course
Wells Park Spring
WAIHEE
KAHEKILI
KAUHUMANU
MAIN
ROAD 36
ROAD 340
Wells Park Road
Waiehu Golf Course
Waiehu Golf Course Spring
Waiehu Golf Course Ditch
Waiehu Golf Course Mill Reservoir
Waiehu Golf Course Pond
Waiehu Golf Course Reservoir
Waiehu Golf Course Road
Waiehu Golf Course Well
Waiehu Golf Course Windmill
Waiehu Golf Course Wall
Waiehu Golf Course Wall
Waiehu Golf Course Wall

is found on valley fills and alluvial fans and consists of deep, well drained soils that formed in alluvium weathered from basic igneous rock (Soil Survey Staff 2014). Pulehu series is found on alluvial fans, stream terraces, and in basins and well drained soils that formed from alluvium washed from basic igneous rock (Soil Survey Staff 2014).

RAINFALL AND VEGETATION

Annual rainfall in the lower part of ʻĪao Valley averages about 630 mm (24.84 in) per year, with most rain falling in the winter months between November and March (Giambelluca et al. 2013:313-316). Current land use can be described as informal ranching. Satellite imagery indicates that recently TMK 3-4-032:001 was divided by fencing into lots containing small structures (likely for chickens) with some larger structures possibly used as residences. Prior to the current study, all above-ground structures were removed from the property.

Current vegetation in the project area consists of grasses and trees, including *kao haole (Luceana glauca*). Past land use on the project parcel likely included wetland taro (*Colocasia esculenta*) and sugarcane (*Saccharum* spp.) agriculture. Sections of sugarcane drip line were still visible in 1998 (Burgett and Spear 2003:6). Prior to a flood in 1916, the vegetation along ʻĪao Stream included Hawaiian *kamani* trees (*Calophyllum inophyllum*), but since then *koa haole (Luceana glauca*) and *kukui* (*Aleurites molucanus*) dominate the streambed (Connolly 1974:6).

HISTORICAL BACKGROUND

This section presents the ethno-historical and archaeological background information for the project area. Data from background research were compiled to create an overview of traditional Hawaiian and historic-era land use and subsistence practices.

MYTHS AND LEGENDS

Na Wai ʻEha, or “the four waters,” is the traditional name for the land containing the Waikapu, Wailuku, Waiehu, and Waiheʻe streams (Handy and Handy 1972:496). Each of these areas has its own wind. Wailuku’s wind is named Makani-lawe-malie, or “the wind that takes it easy” (Sterling 1998:62). The streams have more violent names from their association with past battles. Wailuku is known as “water of destruction” after a legendary battle where men fought with owls (Sterling 1998:63, 74).

There are several chants that mention Wailuku. In a chant to Keʻelikōlani (Princess Ruth Keelikolani), Pipi composed the following:

Koe Wailuku i ka malu Kuawa, Ke hoopaio la me Kaiaiki, me ke Kaahaaha, Anu o Niua, hamo ke kilioopu ka o kai, Pohu ke kaha maloko o Hupukoa, Hoopaaia i ka uwahi a ke kai . . .	Except Wailuku in the shade of Kuawa In the contentions of Kaiaiki with Kaahaaha, Niua was cold; the grass waved towards the sea. Calm was the channel within. Hupukoa, Withheld was the spray of the sea. . . [Fornander 1919–20:487]

Another chant describes the landscape of Wailuku:

Kahua aolelo Wailuku-e. He Aha Kula-loa? Kaupaku Lanakila. Kaluanui o Kaluanui, Ke ku la i na puu mahoe; Na hale loulu a Kane, I ako noʻu i Auwahi.	Wailuku is the locality of flying clouds. It is broad Kula? It is open upland. Kaluanui of Kaluanui, It stands by the twin hills, The palm houses of Kane Which were thatched for me at Auwahi. [Fornander 1916-7: IV: 286-7]

The chiefess Wailuku, who was the wife of chief Maui-nui and sister of the Oahu chief Kakuhihewa, appears in the legend of “Lepeamoa.” Towards the end of the legend:

> Kakuhihewa of Oahu is entertaining his sister [Wailuku] and her husband Maui-nui and has bet his own lands against those of his brother-in-law upon a cock-fight. He now offers his daughter in marriage to the man who can produce a cock to win the bet for him. Kauilani, who is in high favor with the chiefess, promises to do this. The Maui cock is a kupua bird related to Lepe-a-moa's family and named Ke-au-hele-moa. A kupua in the form of an elepaio bird warns Kauilani not to let the cock see his sister before the fight. He wears her concealed in a garland about his neck until the fight begins. The Maui cock tries all its bodies in succession but the hen wins. At first the new wife is jealous of the beautiful sister, but after their girl child Kamamo is born and adopted by the kupua sister, Kauilani goes to live at Kakuhihewa's court. [Westervelt 1923:429]

Wailuku is also the death place of the Maui chief Hua who was known for his wickedness. After being unjust to his *kahuna* (priest; expert) he was sentenced to death. Seeking revenge, the *kahuna* brought on a drought:

> Hua, the chief, lived on, and because of the lack of water and food he sailed for Hawaii, the home of his elder brother; but because Hawaii also suffered from lack of water and food he came back and lived at Wailuku. Wailuku also did not have any water, and that caused the chief to be crazed, so he leaned against the edge of the precipice and died, and that was the origin of the saying "The bones of Hua rattle in the sun.” [Fornander 1918-19: 516]

TRADITIONAL LAND USE

During the pre-Contact and early post-Contact periods ʻĪao Valley and the greater Wailuku area was a political and ceremonial center (Cordy 1981, 1996; Kirch 1985). According to Sterling, ʻĪao Valley and the surrounding area was home to many chiefs and a large population, making Wailuku a “chiefly center” (1998:90). The literal translation of ʻĪao is “cloud supreme” and was once a sacred burial place for chiefs (Pukui et al. 1974:55). Numerous *heiau* were once present in the area, which indicates ʻĪao Valley was of ceremonial importance during the pre-Contact period. During the early historic period several famous battles were fought from the coast to the valley. Land Commission Awards (LCA) granted in the mid-nineteenth century in lower ʻĪao Valley indicate a substantial population was once present in the area and that the land was agriculturally very important.

Archaeological investigations in Wailuku Ahupuaʻa indicate settlement occurred between c. A.D. 1100 (Kirch 1985:142) and A.D. 1200 (Fredericksen and Fredericksen 1996). An early traditional account from the 1400s tells of how the king of Maui, Kakaʻe, was so revered that commoners would suffer punishment by death if they looked upon him (Sterling 1998:84). As a result, King Kakaʻe became a hermit in ʻĪao Valley in order for his subjects to live without fear. It is also said that Kakaʻe created a sacred burial ground in ʻĪao Valley for himself and worthy successors (Burgett and Spear 2003:12).

The pre-Contact population in ʻĪao Valley was centered at ʻĪao Needle (Connolly 1974:5). Fish and *kalo* (taro) supplied from the nearby coast and the *loʻi* systems along stream banks was the base of a subsistence diet. Sterling reports that there were two ʻ*auwai* (irrigation ditch) in the valley that “have existed immemorially and were evidently constructed for the purpose of irrigating *kalo* on the plains which stretch away to the northward and southward of the river. Several minor ʻ*auwai* have, since ancient times, tapped the river at different points lower down and spread the water through the lands in the gulch on either side of the river bed” (1998:86).

Similarly, Handy and Handy reported that in “ancient times” the *loʻi* system in Waihee and Wailuku Valley “was the largest continuous area of wet taro cultivation in the islands” (1972:496). During the early nineteenth century, Rev. H.T. Cheever, wrote:

> As you get into the valley and vega of Wailuku, you see numerous remains of old kihapai, or cultivated lots, and divisions of land now waste, showing how much more extensive formerly was the cultivation, and proportionally numerous the people, than now . . . The whole valley of Wailuku, cultivated terrace after terrace, gleaming with running waters and standing pools, is a spectacle of uncommon beauty to one that has a position a little above it. [Cheever 1851:124]

ʻĪao Valley’s importance as a ceremonial and political center is reflected in traditional accounts as well as the Halekiʻi-Pihana heiau complex (SIHP No. 50-50-04-0522) constructed in the eighteenth century. These *heiau* are most often associated with Kahekili between c. A.D. 1765–1790 and Kamehameha I during his conquest of Maui in 1792 (Yent 1983: 18). Halekiʻi Heiau was possibly designed by a Hawaiian named “Kiha” (Sterling 1998:89). The name of the *heiau* means “house of images.” It is said to have been a chiefly residence guarded by images (Kolb 1990:4).

Pihana Heiau is credited to Kahekili, though it is also said that the *heiau* was constructed overnight by *Menehune* using rocks from Paukukalo beach (Kolb 1990:4). The *heiau* is known as the place where Kamehameha I’s wife — Keopuolani, a *tabu* chiefess of divine rank — was born, where Kahekili lived, and where Kahekili’s father, Kekaulike, died (Yent 1983:7). Also, Thrum (1906:46) wrote that Kamehameha I invoked his god of war at Pihana Heiau after defeating Kalanikupuli and his warriors at the Battle of ʻĪao in 1790).

Aside from the legendary battle where men fought alongside owls, there were three early battles at Wailuku. The first took place “in the Wailuku valley near the present female seminary,” where Kihapiʻilani, the future king of Maui, was defeated and barely escaped (Thrum 1913:130). In the second battle, Kihapiʻilani was victorious with the help of warriors from Hawaiʻi. The third battle was fought on the Wailuku plains in the 1770s. At Ka-lani-hale (“house of heaven”), the royal palace of the Maui king Kahekili, King Kalaniopuu and his army, called the *Alapa*, were surprised by a huge force composed of both Oʻahu and Maui warriors. The *Alapa* were decimated and Kahekili remained king of Maui (Westervelt 1923:124-142). After the battle, Kiwalao, Kalaniopuʻu’s son and a high ranking chief, was sent as an ambassador to Kahekili’s court in Wailuku:

> Runners carried the news of the coming of this prince to the Maui king. He was lying on a mat in the royal grass house at Wailuku. Ka-lani-hale —“the heaven house” — was the name of this home of the king.
>
> As Kiwalao drew near the door all the Maui chiefs prostrated themselves before him, while the king lazily turned over and partly raised himself, lifting his head in token of friendly greeting. To have turned away from the prince, letting his face look down, would have been the sign of immediate death of his visitor. Kiwalao, with slow and dignified tread, crossed the room and seated himself in his uncle's lap. Then both wailed over the troubles which had brought them together, and over the deaths among their followers.
>
> The embassy was successful, and terms of peace between the two kings were arranged. Kalaniopuu returned to Hawaii, to begin at once a new crusade against Kahekili. During the ensuing two years the war degenerated into a series of petty raids by which he kept his wife's brother busy marching warriors from one end of Maui to the other to repel his attacks. In 1779 the coming of Captain Cook changed the course of action and gave the people new things to think about, until Kamehameha secured white men's arms and conquered all the islands. [Westervelt 1923:141–2]

HISTORIC LAND USE

The population in ʻĪao Valley began declining in the 1800s, although people continued to depend upon the stream for subsistence as in the past (Connolly 1974:5). Traditional land divisions of the fifteenth and sixteenth centuries persisted until the 1848 *Māhele*, which introduced private property into Hawaiian society (Kamakau 1991:54). During the *Māhele*, the Land Commission required the Hawaiian chiefs and *konohiki* (land agent for the *aliʻi*) to present their claims to the Land Commission. In return they were granted awards for the land quit-claimed to them by Kamehameha III. The remaining unclaimed land was then sold publicly, "subject to the rights of the native tenants" (Chinen 1958:29). The new western system of ownership resulted in many losing their land. Often claims would be made for discontiguous cultivated plots with varying crops, but only one parcel would be awarded.

Following the Kuleana Act of 1850 that granted individual *kuleana* (commoner) lots, records of the LCAs associated with the area indicate that the population was concentrated near ʻĪao Stream. According to Sterling (1998:86): "The district of Wailuku was once thickly settled, *kuleanas* to the number of over 400 were granted to natives and others. A large portion of these cultivated *kalo* with the aid of water from the river." In 1848, Wailuku area residents submitted 199 land claims, 127 of these being awarded by the Land Commission (Burgett and Spear 2003:14). These LCAs indicate several types of land use: *loʻi* systems, *kula* lands (dry land agriculture), *hala* clumps *(Pandanus odoratissimus* or screw pine, whose leaves are woven into baskets or mats); and *poʻālima* (land farmed by tenants for *aliʻi* one day in five) (Tome and Dega 2004:8). Claims were also made for ʻ*ili* (land division of an *ahupuaʻa*), *moʻo* (land division of an ʻ*ili*), and *apana* (land division of a *kuleana).* LCA within or adjacent to the current project area on the north side of ʻĪao Stream are listed in Table 1 and illustrated in Figure 2 and Figure 3 (see Appendix A for copies the LCA documentation and Appendix B for Foreign Testimony).

Table 1. Land Commission Awards (LCAs) in the Vicinity of the Study Area.

LCA No.	Award	Claimant
3465	One *loʻi.*	Keawe
3477	One *loʻi* and six *poʻālima*.	Kekoona
3385:2	One *loʻi.*	Pahoa
3381	One *loʻi* and one *moʻo*.	Puniho

In 1823, a Chinese man named Hung-tai operated Wailuku's first sugar mill (Silva N.D.:13). During the following decade, Missionary Richard Armstrong promoted the planting of sugarcane to residents in Wailuku. He supervised the construction of a rudimentary mill and offered technical support (Weaver 1924:59). Kamahameha III began small-scale sugarcane cultivation in ʻĪao valley in the 1840s. The American Charles Wilkes stayed in Wailuku during this time. A plantation that he visited was operated by Chinese and used local labor. He wrote the following narrative about his experience:

> After breakfast, Mr. Greene was obliging enough to accompany us to see the sugar-mills and taro-plantations, in the valley of the Wailuku. The sugar-manufactory is an experiment of the king, and is now under the superintendence of a Chinese. By some awkward mistake in making the agreement, his majesty's interests were entirely lost sight of, and it is said that he will lose money, although his agents have a prospect of considerable gain. The iron-work of the mill was imported from the United States, and is turned by water-power. The water wheel is badly constructed: it is a breast-wheel, with great loss of power.

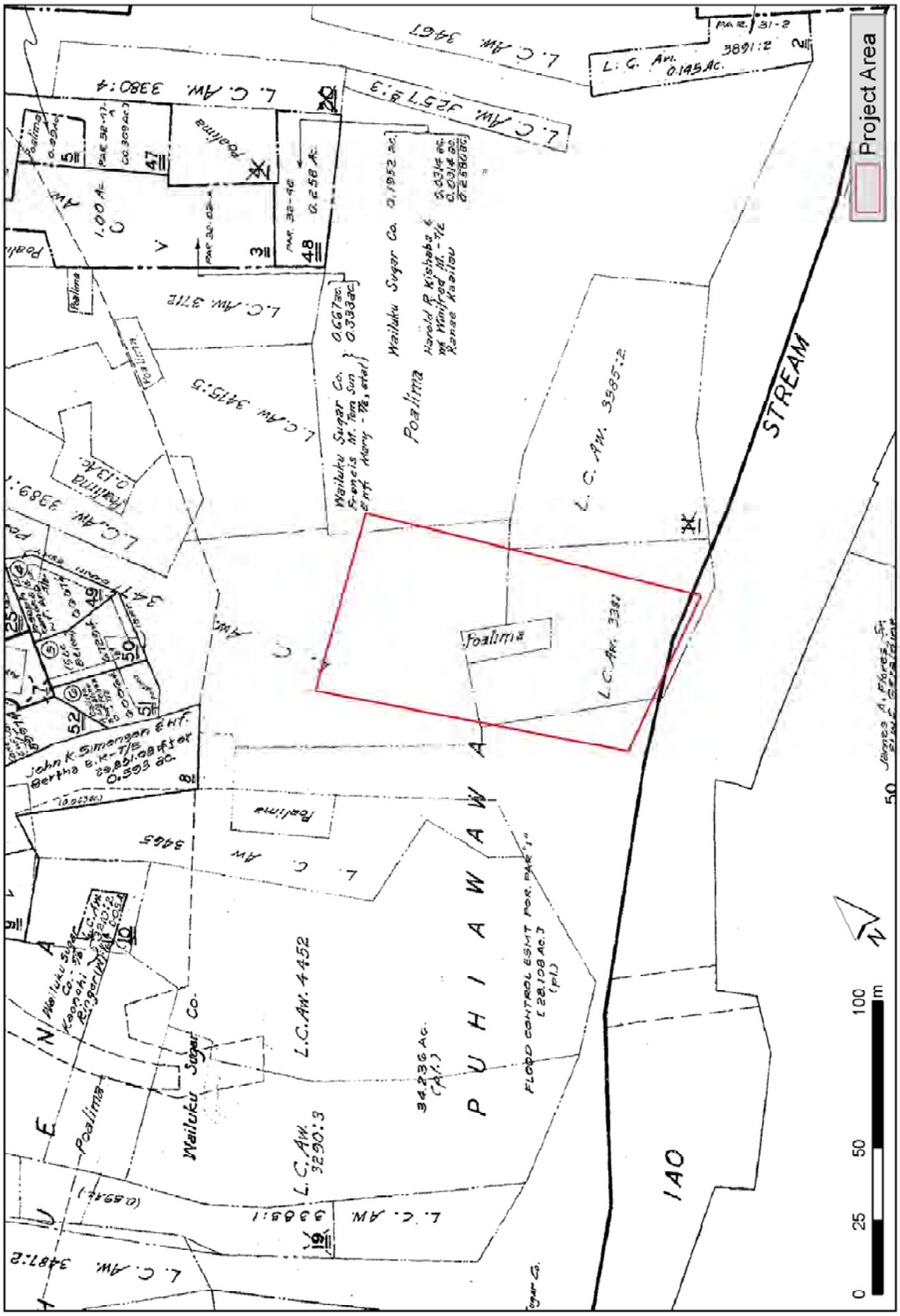


Figure 2. TMK Map Showing LCA Parcel with Project Area Overlain (Tax Map Bureau 1994).

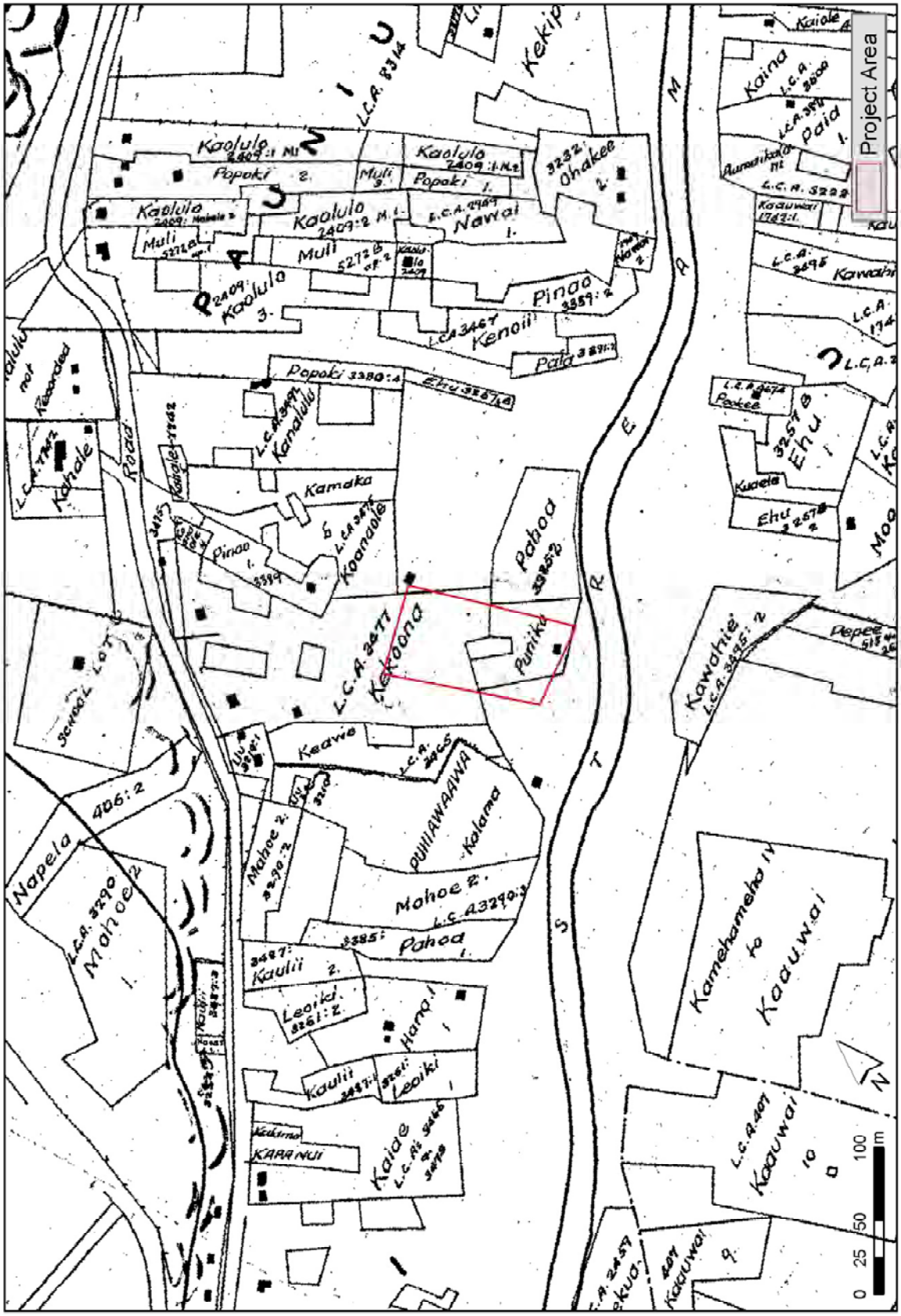


Figure 3. 1882 Map by Monseratt with Project Area Overlain (Monserrat 1882).

> There appears but little economy about the establishment: as an instance of this, instead of drying and preparing the cane for fuel, they use wood altogether, which is very scarce, and costs much to transport it. The sugar appears to be of good quality, and with proper attention, the manufacture could no doubt be made profitable. I understood from the Chinese who had charge, that the sugar could be sold at four cents per pound, and that with a proper economy as to fuel, might be reduced to half that sum.
>
> Both the king and chiefs have a desire to encourage the arts and agriculture. Unfortunately, however, after they have incurred expenses, they are obliged to give the sole direction into the hands of those who have nothing but their own interests in view. The consequence is that in all these undertakings the king and chiefs have found themselves deceived, by listening to foreigners by whom they have been defrauded. [Wilkes 1845:242-32]

The Wailuku Sugar Company was established in 1862 by James Robinson & Company, Thomas Cumming, J. Fuller, and agent C. Brewer and Company (Wilcox 1996:122). The company was managed by Rev. Edward Bailey, who had traveled to Maui as a missionary in 1837. He left the mission in 1850 to farm. By 1867 the Wailuku Sugar Company was producing 800 tons of sugar from 500 acres of cane. In 1868 Bailey resigned in order to run his own plantation (Dorrance and Morgan 2001:65). During this early period, a visiting American official of the American Board of Commissioners for Foreign Missions documented productivity in the area:

> The soil of Wailuku is rich and deep, and the sugarcane is extensively cultivated. The rains, though copious, are not sufficient, and channels are therefore cut along the foot of the hills, for conveying the waters of the mountain streams where they may be diffused over the entire plantations. Good cane lands have here been sold for eighty dollars the acre. Along the streams are numerous taro patches, of course covered with water. This district is one of the chief producing regions for that indispensable article of native food, out of which the poi is manufactured. [Anderson 1864:177]

By the late 1800s, a vast amount of ʻĪao Valley was planted with sugarcane. In 1865, the Wailuku Sugar Company purchased a mill and land from the neighboring Bal & Adams plantation. Ten years later they incorporated. In 1877, the son of Rev. Edward Bailey, William Bailey, sold the family's 420-acre plantation to Wailuku Sugar Company. A map was produced for a court case over water rights between E. Bailey and Wailuku Plantation, which dates the map to between 1868 and 1877. The map depicts the Wailuku mill, the Bal & Adam mill, *loʻi*, and various other structures in the area (Figure 4). The current study area is situated in a former cane field of the Wailuku Sugar Company. In the following decades the company continued expanding by acquiring new plantations in Waiheʻe and Waikapu, constructing a larger mill, and laying a railroad transport system (Silva N.D.:15).

According to Connolly the sugarcane industry dominated commerce and land use in the ʻĪao Valley area in the early 1900s (1974:5). Throughout the valley extensive water irrigation ditches, terraces, free standing walls, historic house sites, and mill structures were constructed. In 1905, Wailuku Sugar Company built another mill and again increased its acreage (Silva N.D.:15). Along the lower portion of the stream there was agricultural terracing and a Portuguese worker's camp. The laborers planted taro and other vegetable in the *loʻi* nearby (Connolly 1974:5). The work camps were destroyed by the flood in 1916.

In 1912, Mr. Willie Crozier installed a rock crusher in the valley, hoping to supply rock to all construction projects on the island (Burgett and Spear 2003:24). Four years later it was destroyed in the flood. The flood also devastated remaining *loʻi* and portions of the Haleki'i-

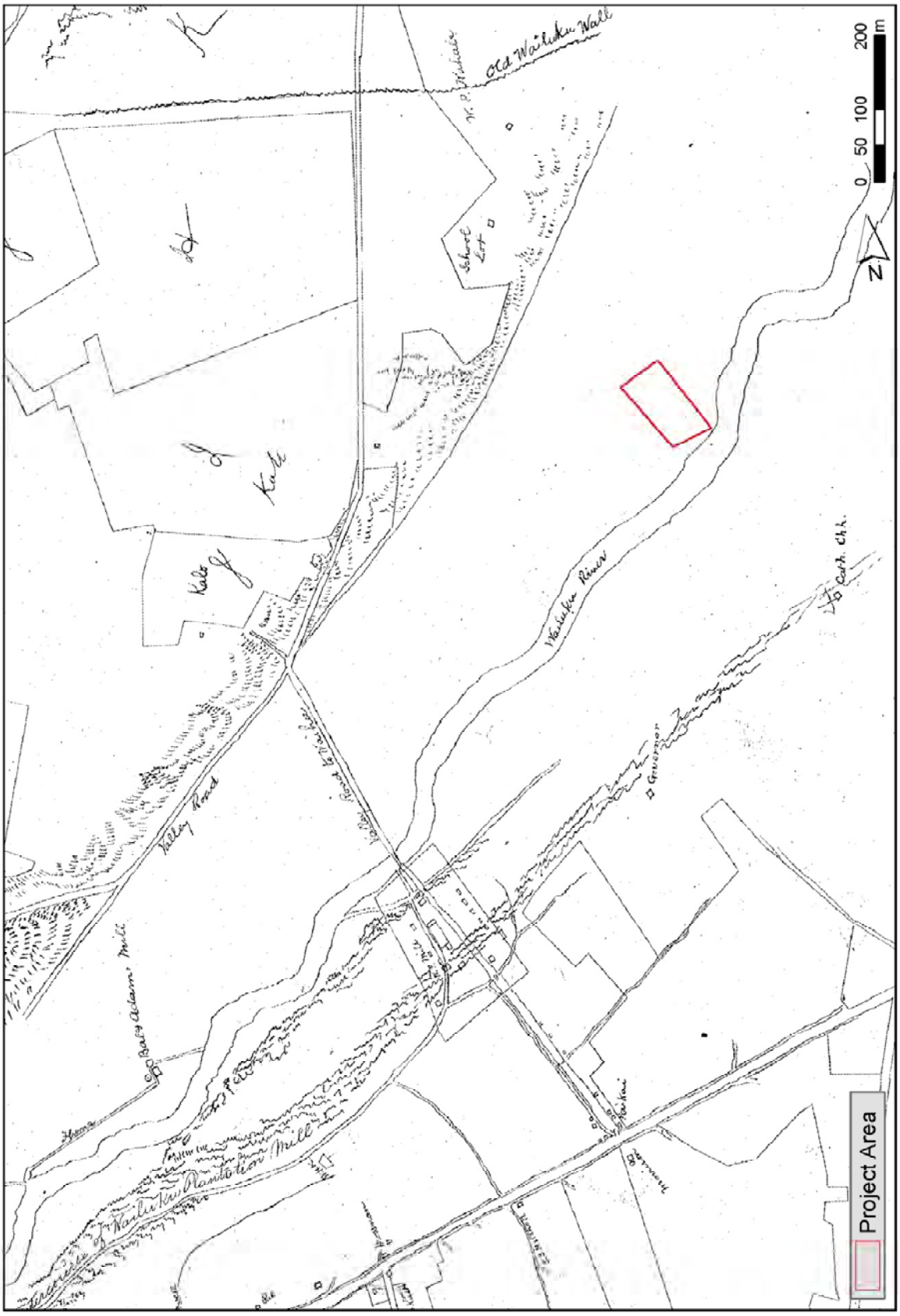


Figure 4. Map of Wailuku Sugar Company ca. 1867 by Rev. E. Bailey (Baily N.D.).

Pihana Heiau Complex. According to Burgett and Spear (2003:24), archaeological remnants in the valley may also have been detrimentally affected by the flood. After the 1916 flood the land was replanted in sugarcane and the water systems were restored (Connolly 1974:6). A historic topographic map from 1924 shows the location of various camps, the rail, and the mill at Wailuku Sugar Company (Figure 5). The following excerpt from Handy and Handy (1972) describes the landscape during this period:

> Wailuku is the third of "the Four Streams," the great torrent that drains the highest cloud-capped uplands of western Maui through deep ʻĪao Valley. Much of the upper section of what is now the city of Wailuku is built on old terrace sites. Along the broad stream bed of ʻĪao Valley, extending several miles up and inland, the carefully leveled and stone-encased terraces may be seen. In the lower section of the valley these broad terraces served, in 1934, as sites for Camps 6 and 10 of Wailuku Sugar Plantation, being utilized for houses, gardens, playgrounds, and roads. A little farther up, neat private homes and vegetable and flower gardens covered these old taro terraces; while at their upper limit the terraces were submerged in guava thickets. Here a few wild taros were found, but we saw no terraces in ʻĪao or Wailuku being used as flooded taro patches. It is significant that here, as at Waiheʻe, the old terraces were adapted to market gardening (Chinese bananas, vegetables, and owners) by Japanese and Portuguese gardeners. [Handy and Handy 1972:497]

Sugarcane production continued to dominate until the mid-twentieth century. Figure 6 is an aerial photograph from 1950 that shows the Wailuku Sugar mill in operation (note the smoke billowing from the stack), and Figure 7 shows the current study area situated in a sugarcane field in 1965. Wailuku Sugar Company ended their operations in 1988. At this time, the irrigation water was diverted to macadamia nut orchards and pineapple crops in the area (Wilcox 1996:125).

PREVIOUS ARCHAEOLOGICAL RESEARCH

Numerous archaeological investigations have been conducted in ʻĪao Valley. Previous work has included archaeological assessment, archaeological surface survey, archaeological inventory survey, archaeological subsurface testing, and archaeological monitoring. A few of these projects were carried out within or near the current study area. The following section focuses on projects conducted in the immediate vicinity of the study parcel in order to compare previous findings of land use (Figure 8). Additional studies near the stream in lower ʻĪao Valley are also included in Table 2.

In 1998, Scientific Consulting Services, Inc. (SCS) conducted archaeological reconnaissance survey and limited subsurface testing for the ʻĪao Stream Flood Control Project (Burgett and Spear 2003). A reconnaissance survey that included the current study parcel revealed only one site (SIHP No. 50-50-04-4755). The site comprises three features: a concrete foundation with concrete troughs, a soil-filled terrace and retaining wall, and wall remnant. These features were interpreted as a small historic habitation complex-activity area (Burgett and Spear 2003:34–6). The excavation of three test units at the site revealed historic and recent materials (modern debris). Historic materials were possibly associated with a post-Contact (late nineteenth or early twentieth century) agricultural site. According to local informants, the area of the find was formerly a piggery. Architectural and surface remains were minimal.

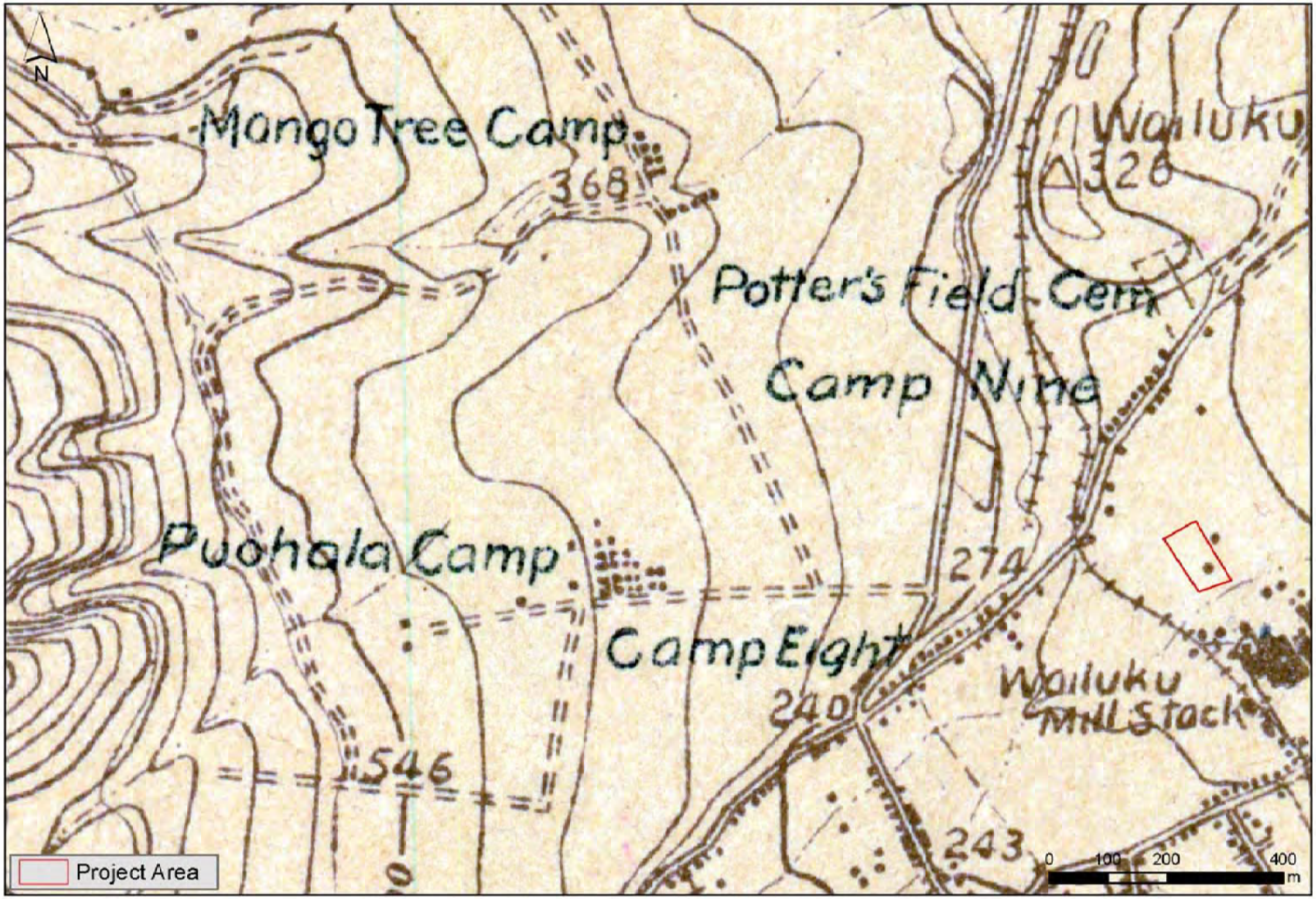


Figure 5 1924 USGS Topographical Quadrangle with Project Area Overlain (U.S. Geological Survey 1927-28).



Figure 6. 1950 Aerial Photograph of ʻĪao Valley with Project Area Overlain (USGS 1950).



Figure 7. 1965 Aerial Photograph of ʻĪao Valley with Project Area Overlain (USGS 1965).



Figure 8. Previously Recorded Historic Properties and Archaeological Projects Near the Project Area.

Table 2. Additional Archaeological Projects Near the Project Area.

TMK	Title	Sites 50-50-04-	Reference
2-3-3-0010:16	Archaeological Survey and Subsurface Testing for the Proposed Pi'ihana Grading Project, TMK 3-3-01:16 (POR.).		Kennedy 1989
2-3-3-002:001	Archaeological Inventory Survey of Pu'uohala Mauka Residential Subdivision, Wailuku Ahupua`a, Wailuku District, Maui Island.	01508, 05195, 05196, 05197	Fredricksen and Fredricksen 2002
2-3-4-002:036	Archaeological Monitoring Report Waiale Road, Land of Wailuku, Wailuku District, Island of Maui. [TMK: 3-4-02:36; 3-4-03:19; 3-4-10:2]	04005, 04067, 04068	Spear, Monahan, Chaffee, Dunn 2004
2-3-4-011:032	Proposed Ke Kama Pono Program Facility Wailuku, Maui Final Archaeological Monitoring Report		Cleghorn and Kirkendall 2009
2-3-4-020:075	Archaeological Reconnaissance of TMK: 3-4-20:75 Lot 55C, A Proposed Post Office Building on the Site of the Wailuku Sugar Mill, Wailuku, Maui		Hammatt 1985
2-3-4-022:005	An Archaeological Assessment Report for a 0.45-Acre Lot on Lower Main Street		Dega and Pestana 2005
2-3-4-023:024	An Archaeological Monitoring Report for a Parcel of Land Located at 1234 Lower Main Street, Wailuku		Fredricksen 2003
2-3-4-030:004	Preliminary Report. Phase I: Archaeological Data Recovery Pihana Heiau, Haleki'i-Pihana Heiau State Monument, Paukukalo, Wailuku, Maui	00592	Yent 1995
2-3-4-030:004	Final Report on the Restoration of Pihana Heiau, Paukukalo, Wailuku, Maui.	00043	Fields and Pagliaro 1996
2-3-4-030:011	Inventory Survey of TMK: 3-4-30:11, Subdivision "C", Located at Paukukalo, Wailuku, Island of Maui.		Kennedy 1990
2-3-4-037:082	Inventory Survey of TMK 3-4-39:82, Lower Main Street and Mill Street.		Fredricksen and Fredricksen 1992
2-3-4-039:051	Archaeological Monitoring Report for the Maui Electric Company Substation Project on Lower Main Street, Wailuku Ahupua'a, Wailuku District, Island of Maui (TMK: 3-4-039:051)	04127	Fredricksen and Fredricksen 2003
2-3-4-039:075	An Archaeological Monitoring Report for a Parcel of Land at 1191 Lower Main Street, Wailuku Ahupua'a, Wailuku District, Maui Island.	04730	Fredricksen 1999
2-3-4-039:076	An Archaeological Inventory Survey of a Parcel of Land in Wailuku Ahupua'a, Wailuku District, Island of Maui		Fredricksen and Fredricksen 2002
2-3-4-039:077	An Inventory Survey of a Commercial Parcel on Lower Main Street, Wailuku, Maui, Hawai'i.		Fredricksen and Fredricksen 1990
2-3-4-039:077	An Archaeological Inventory Survey of the Oceanhouse Inc. Property. TMK: 3-4-39:77. Land of Wailuku, Wailuku District, Island of Maui	04004	Burgett and Spear 1996
2-3-4-039:077	DRAFT: Archaeological Monitoring for the Nicholes Building, Lower Main Street, Wailuku, Island of Maui.	04004	Carson 1999
2-3-4-039:082	Archaeological Inventory Survey for Proposed Maui Texaco Service Station Located at Lower Main and Mill Streets, Wailuku Ahupua'a, Wailuku District, Island of Maui.	04127, 04414	Fredricksen and Fredricksen 1997
2-3-3-001:016 2-3-3-001:033 2-3-3-001:039 2-3-4-032:001 2-3-4-032:010 2-3-4-032:018	Summary Document Regarding Archaeological Activities Surrounding Pi'ihana District #2.		Kennedy 1990

Table 2. Additional Archaeological Projects Near the Project Area.

TMK	Title	Sites 50-50-04-	Reference
2-3-4-012:045 2-3-4-012:047 2-3-4-012:048 2-3-4-012:083 2-3-4-012:086	An Archaeological Monitoring Report for a Portion of Land in Wailuku.		Fredricksen, Erik 2006
2-3-4-013:096 2-3-4-013:100	An Archaeological Inventory Survey for Main Street Promenade, Wailuku Ahupua'a, Wailuku District, Maui Island.	01636, 04834	Fredricksen and Fredricksen 2000
2-3-4-030:019 2-3-4-030:020 2-3-4-030:023	DRAFT An Archaeological Inventory Survey of the proposed Wailuku Parkside Property, Wailuku, Maui Island		Spear, Dunn, Asbury-Smith, and Chaffee 1998
2-3-4-039:081 2-3-4-039:082	Report on Subsurface Inventory Survey at Lower Main and Mill Street, Wailuku Ahupua'a, Wailuku District, Maui Island.	04127	Fredricksen, Fredrickson, and Fredricksen 1995

Archaeological inventory survey was carried out in 2004 by SCS for the proposed Imi Kala Street and Neki Place Extensions (Tome and Dega 2004). Eleven test trenches were excavated at various locations throughout the project area. The testing revealed that evidence of former *lo'i* is extant in the lower valley. Four archaeological sites were documented, one of which, Spreckels Ditch (SIHP No. 50-50-04-1508), was previously recorded. SIHP No. 50-50-04-5564 is the historic bridge constructed for Wailuku's sugarcane industry; and SIHP No.50-50-04-5566 is a small, concrete-lined irrigation ditch constructed by the sugarcane industry and utilized by the more recent macadamia nut industry.

SIHP No. 50-50-04-5565 is former *lo'i* used during the pre-Contact and early post-Contact periods. According to Tome and Dega (2004:26), Layer V (246-311 cmbs) was a compact, very dark grayish brown (10YR 3/2, moist) very fine clayey silt with many iron inclusions and few flecks of charcoal. A single soil sample obtained at 311 cmbs within Layer V was submitted for radiocarbon dating (Beta No. 192863/SCSRC No. 378). This soil sample contained organic material, and yielded a calibrated date range of 1180 to 1290 AD (at 2 sigma) and 1231 to 1272 AD (at 1 sigma) (Tome and Dega 2004:41). No other traditional archaeological sites or features were identified.

Table 3. List of Previously Recorded Archaeological Sites Near the Project Area.

SIHP No.	Period	Description	Source
50-50-04-1508	Historic	Spreckels Ditch	Tome and Dega 2004
50-50-04-4755	Historic	Concrete foundation, one terrace and retainments, and a portion of a stacked wall	Burgett and Spear 2003
50-50-04-5564	Historic	Historic bridge used during the cultivation of sugarcane.	Tome and Dega 2004
50-50-04-5565	Pre-Contact; early post-Contact	Former *lo'i*.	Tome and Dega 2004
50-50-04-5566	Historic	Concrete-lined irrigation ditch	Tome and Dega 2004

RESEARCH DESIGN

Based on the results of archival research and previous archaeological studies in the area, it was expected that historic properties would not be present on the surface of the project

area. Likewise, it was expected that historic land-use patterns (sugar cane cultivation) and natural environmental events (e.g., the 1916 flood) may have obscured traditional agricultural features and historic occupation within the project area. Nonetheless, it was considered possible that remnants of traditional *lo'i* (irrigation ditches, pond basins, terrace faces, etc.) could be present within the project area. Because of the likelihood that historic land use may have altered the material evidence of pre-Contact agriculture, the focus of the field operation was based on possible subtle differences in soil characteristics rather than on built features such as retaining walls. Thus, it was anticipated that most of the data collected in the field would consist of detailed stratigraphic profile drawings and photographs.

RESEARCH QUESTIONS

Three research questions drove the sampling strategy and fieldwork:

1. Is there evidence of pre-Contact/early post-Contact *lo'i* in the project area? If so, is there sufficient evidence to determine the age and integrity of the historic properties?
2. Is there evidence of temporary pre-Contact occupation associated with *lo'i* or post-Contact occupation associated with sugarcane cultivation? And
3. Is there stratigraphic evidence of the 1916 flood episode and if so can subsurface features be temporally correlated with this episode?

SAMPLING STRATEGY

The sampling approach for the current project was to provide sufficient coverage of the project area to identify randomly distributed subsurface features with an areal extent of approximately 10 m x 5 m (an average size *lo'i*). Figure 9 shows the parquet-style configuration of ten 15-20 meter-long trenches distributed systematically across the project area. Using this configuration, the probability of discovering a 10 m x 5 m subsurface feature is approximately 70 percent. Because the orientation of traditional *lo'i* within the project area is not known, the excavation of trenches were oriented in approximately cardinal directions (perpendicular and parallel) relative to the stream orientation within the project area.

METHODS

Fieldwork was conducted between May 12 and May 21, 2014, and guided by the project Work Plan (Vernon and Gosser 2014). Fieldwork involved one archaeologist monitoring trench excavations and two archaeologists recording stratigraphic profiles and collecting data. Monitoring of the trench excavations was necessary to ensure that subsurface historic properties or human burials were not inadvertently impacted.

The horizontal extent of profiling was dependent on the stratigraphic complexity of each trench. Sufficient data was recorded to capture the complexity of the natural stratigraphy. Soil descriptions were compiled using standards established by the USDA and included information concerning soil color (Munsell 2000), texture, consistence, and boundary topography. Where possible, stratigraphic events were correlated between trenches in order to characterize the overall depositional history of the project area.

LABORATORY

One historic glass fragment was recovered during trench excavations. This artifact was transported to the PCSI Archaeology Laboratory in Honolulu for further analysis. In the laboratory, it was cleaned, measured, photographed, and described.

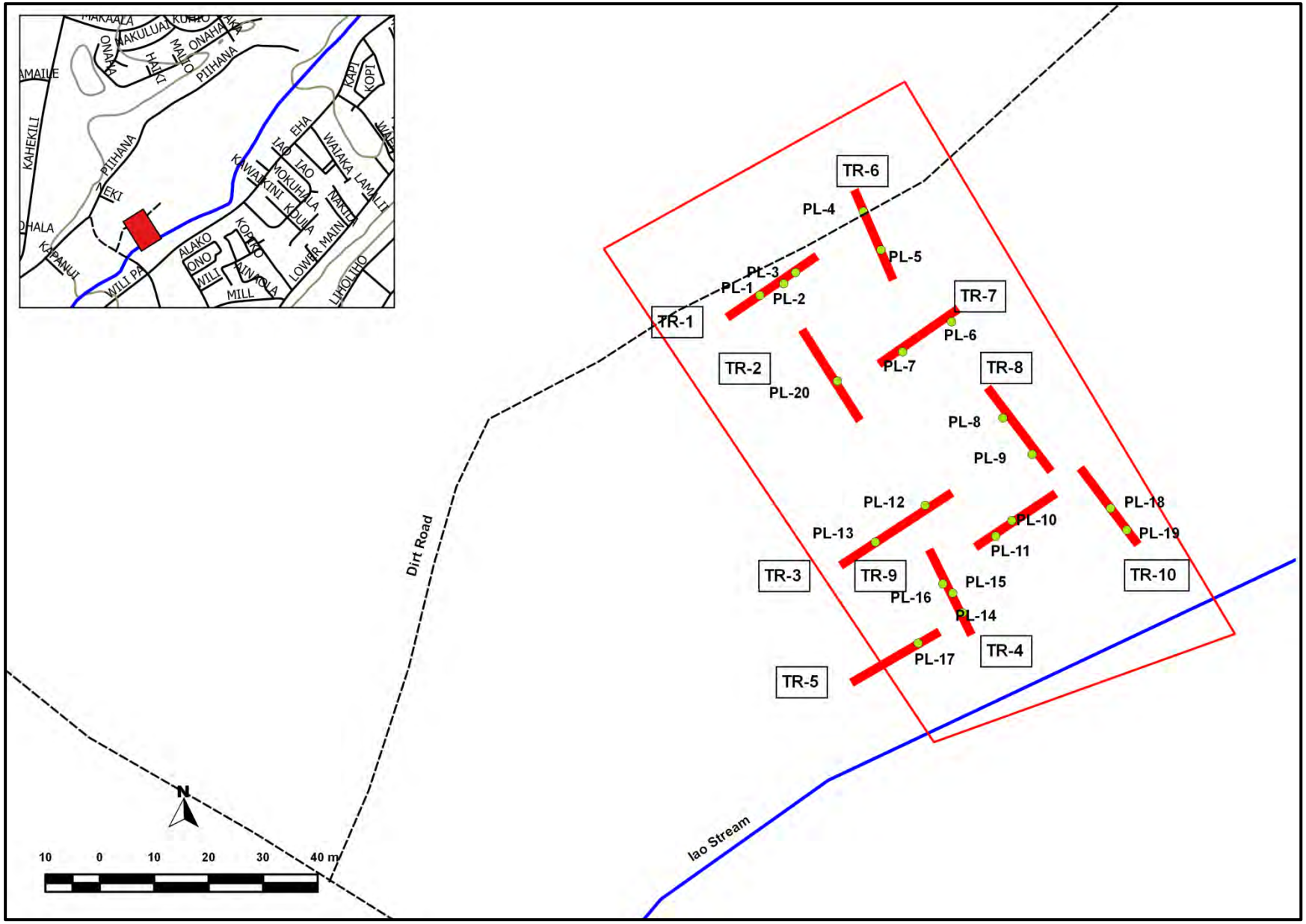


Figure 9. Backhoe Trench Locations and Profile Locales. Inset: Lower Iao Valley Showing Project Area Location.

RESULTS

A total of 10 stratigraphic trenches were excavated by backhoe across the project area (see Figure 9). Table 4 presents a summary of TR1-TR10, and includes the length, depth, and orientation of each trench (trench width was consistently 1.2 m).

Table 4. Proposed Location and Orientation of Trenches within the Project Area.

Trench	Length[1] (m)	Depth (cm) Min/Max	Orientation (deg)
1	19.1	80/140	56/236
2	18.0	120/152	149/329
3	23.0	60/140	57/237
4	16.2	140/230	154/334
5	19.5	150/260	61/241
6	19.7	70/248	158/338
7	16.5	120/136	56/236
8	18.9	100/140	144/324
9	21.2	90/134	57/237
10	20.5	120/160	144/324

[1]:All trenches were approximately 1.2 m wide

No pre-Contact archaeological materials or features were encountered during trench excavations. Recent trash (rusted metal items, aluminum cans, whole and fragmentary bottles, and plastic items) were observed in Layer I deposits but not collected due to the recent age of these items. One piece of possible historic glass was recovered from Layer III in TR-7. Evidence of sugar cane agriculture, in the form of black plastic fragments, was observed in Layer I in all of the trenches, and black plastic fragments in Layer II in TR3 as well as sugar cane slag in TR9.

Stratigraphic sequences were examined within each of the 10 trenches and representative, as well as anomalous stratigraphic sequences in each trench were documented through profile drawings, photographs, and soil descriptions. Nineteen (19) stratigraphic profiles were drawn, and designated as Profile Locales 1 through 15 (PL1-15) and PL17-20. The designation of Profile Locale 16 (PL16) was not used. The term PL1-20 used in this report therefore refers to all the profile locales except PL16. The locations of PL1-20 are presented in Figure 9. A total of ten stratigraphic layers, designated Layers I-X, were identified in PL1-20 in TR1-TR10. In addition, two lenses, designated as Lens A and Lens B, were recorded. A summary of PL1-20 is presented in Appendix C.

Figure 10 presents a composite stratigraphic profile drawing representing all stratigraphic layers observed in TR1-TR10. Table 5 provides a general description, interpretation, and horizontal distribution (i.e., trench and profile location) for each of the ten recorded stratigraphic layers. Because of the many variations observed in color and texture in a majority of the strata, both across the project area and within the trenches, the general descriptions provided in Table 5 provides the predominant color (or colors), and the range of textural classes identified for each stratigraphic layer. Detailed soil/sediment descriptions for 15 of the 19 profile locales (PL1, PL3, PLs 5-7, PLs9-11, PLs13-15, and PL17-20) are presented below by the TR in which they were documented.

Because of the extent of soil color and texture variations within the project area stratigraphy, it was decided to simply designate the observed layers by stratigraphic position for

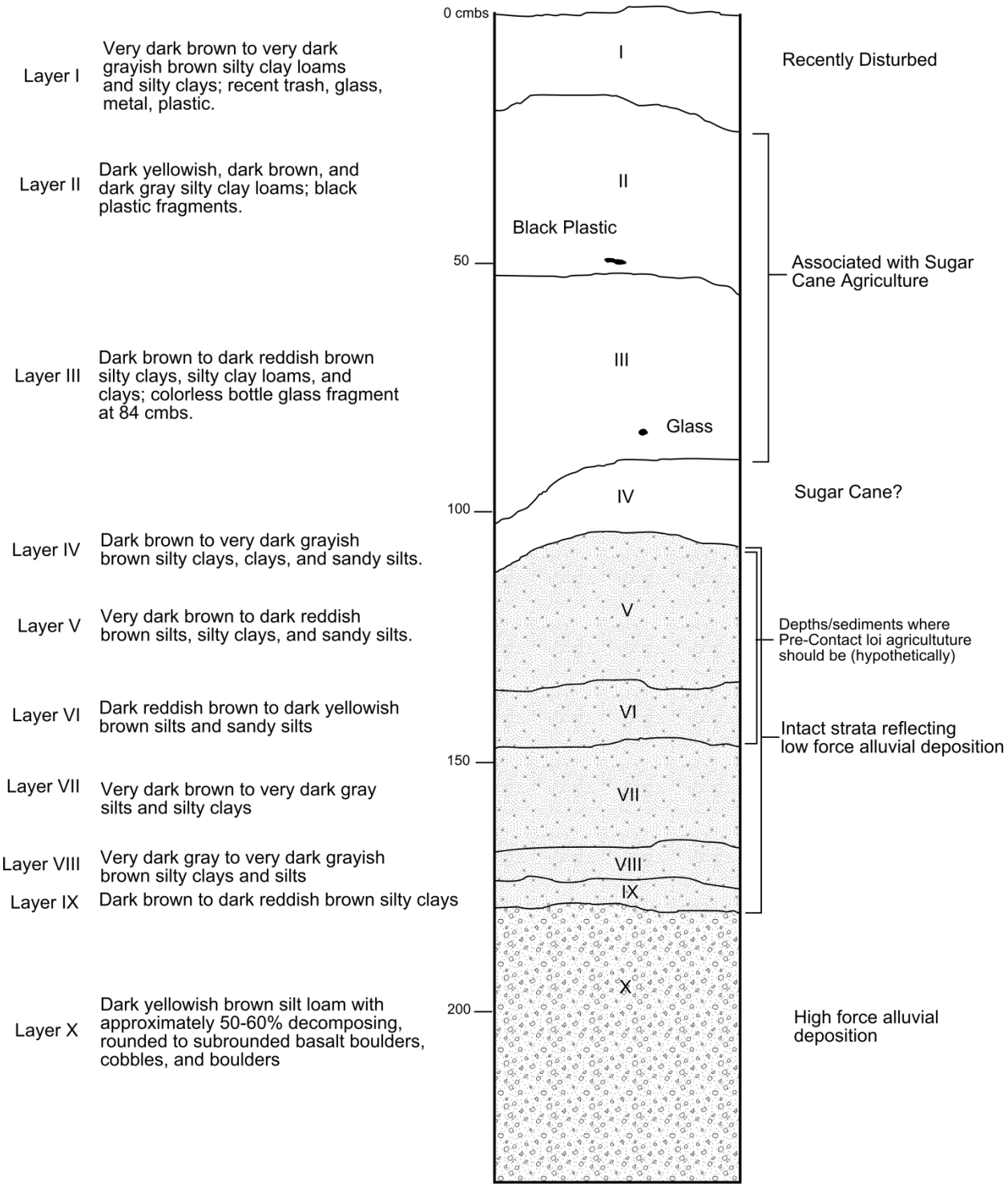


Figure 10. Composite Stratigraphic Sequence.

Table 1. Summary of Stratigraphic Layers Identified in the Project Area.

Layer	Interpretation	General Description	Distribution	Comments
I	Disturbed modern A Horizon	Very dark gray (10YR 3/1, moist) silt loams and very dark grayish brown (10YR 3/2, moist) silty clays and silty clay loams; also present are sandy clay loams; contains recent trash (aluminum cans, bottles, plastic fragments, metal, and PVC pipe fragments).	TR1-10 (PL1-20)	
II	Upper portions of sugar cane agricultural zone	Very dark gray (10YR 3/1, moist) silty clays; also present are silty clay loams, clayey silts, clays, and silt loams with color variations present; contains black plastic fragments.	TR1-10 (PL1-20)	Lens B dark reddish brown silty clay is found within Layer II in TR9 (PL11)
III	Middle portions of sugar cane agricultural zone	Dark brown (10YR 3/3, moist), very dark brown (10YR 2/2, moist), and dark reddish brown (5YR 3/3, 3/2, and 2.5YR 3/4, moist) silty clays, silty clay loams, silt loams, clays, clayey silts, and sandy silts; clear bottle glass fragment found in situ at 82-84 cmbs in TR7 (PL7)	TR1-10 (PL1-20)	Strong brown staining of ped surfaces observed in TR8, PL8-9
IV	Lower portion of sugar cane agricultural zone	Dark brown (7.5YR 3/4, moist) and very dark grayish brown (10YR 3/2, moist) silty clays, clays, sandy silts, silts, and clayey silts; non-cultural.	TR1-10 (PL1-20)	
V	In situ terrigenous sediments	Dark brown (10YR 3/3 and 7.5YR 3/2, moist) and dark reddish brown (5YR 3/3, moist) silty clays, sandy silts, silts, sandy silt loams, and clayey silts, and extremely cobbly, pebbly, sandy silt loams; non-cultural.	TR1 (PL1-3), TR2 (PL20), TR3 (PL13), TR4 (PL14-15), TR5 (PL17), TR6 (PL4), TR7 (PL6), TR8 (PL8-9), TR10 (PL18-19)	Lens A black silt loam found within Layer V in TR7 (PL6); Layer V in TR4 (PL15) correlates to cobble/pebble layer in banks of ʻIāo Stream
VI	In situ terrigenous sediments	Dark reddish brown (5YR 3/4, moist) and dark yellowish brown (10YR 3/4; 10YR 4/6, moist) silts, silty clays, and sandy silts; contains sparse charcoal flecking in TR1 (PL1); non-cultural.	TR6 (PL5), TR7 (PL6), TR8 (PL8-9), TR4 (PL14), TR5 (PL17), TR10 (PL18)	Charcoal in insecure context and insufficient weight for dating

Table 2. Summary of Stratigraphic Layers Identified in the Project Area.

Layer	Interpretation	General Description	Distribution	Comments
VII	In situ terrigenous sediments	Dark brown (7.5YR 3/2; 7.5YR 3/4, moist) to very dark gray (10YR 3/1, moist) silts, silty clays, silty sands, and extremely cobbly, pebbly, silty sand; non-cultural.	TR6 (PL5), TR8 (PL8-9), TR4 (PL14), TR5 (PL17), TR10 (PL18)	Layer VII in TR6 (PL5) correlates to cobble/pebble layer in banks of ʻIāo Stream
VIII	In situ terrigenous sediments	Dark brown (10YR 3/3, 7.5YR 3/2, moist) to very dark gray (10YR 3/1, moist) silts and silty clays; non-cultural.	TR8 (PL9), TR4 (PL14), TR5 (PL17), TR10 (PL18)	
IX	In situ terrigenous sediments	Dark brown (7.5YR 3/4, moist) to dark reddish brown (5YR 3/3, moist) silty clays and silt loams; non-cultural.	TR8 (PL9), TR4 (PL14), TR5 (PL17)	
X	In situ terrigenous sediments	Dark yellowish brown (10YR 3/4, moist) silt loam and very dark brown (10YR 2/2, moist) silty clay with approximately 50-60% decomposing, rounded to subrounded basalt boulders, cobbles, and pebbles; lower boundary not reached; non-cultural.	TR8 (PL9), TR5 (PL17)	Correlates to cobble/pebble layer in banks of ʻIāo Stream

each trench. It was decided not to designate facies changes within the stratigraphic sequences. Facies changes are defined as different stratigraphic layers occupying the same stratigraphic position in a given locale or region. Although there is a variety of sediment color/textures in the same stratigraphic position in the project area, this variation does not include significantly different parent materials, and can be explained by the close proximity of the project area to ʻĪao Stream (from 10.0 to 108 m), one of the primary sources of the sediments observed in the backhoe trenches excavated in the project area. The results of the testing are presented by backhoe trench below. Soil/sediment layer descriptions, profile drawings, and photographs of the profiles are presented for the profile locales documented within each backhoe trench.

TRENCH 1

Trench 1 (TR1) was excavated near the northwest corner of the project area (see Figure 9; see Table 4). This was the first excavated trench, and the stratigraphic sequence recorded at PL1 was considered to be the initial working stratigraphic sequence, to be compared with stratigraphic sequences in the other trenches. Figure 11 presents an overview photograph of TR1 (post-excavation).

Three profile locales (PL1-PL3) were documented in TR1. Profile Locales 1 and 2 (PL1 and PL2), documented in the west-central portions of TR1, are quite similar. Profile Locale 3 documents the stratigraphic sequence in the eastern part of TR1, which exhibited color and texture variations in Layers II, III, IV, and V, not observed in the sequences documented in PL1 and PL2. It was noted that in TR1, more silt layers were present in lower portions of the stratigraphic sequence than were present in upper layers of the sequence.

No archaeological materials or features were found in TR1 excavations. The stratigraphic sequences observed at PL1, PL2, and PL3 are presented below.

Profile Locale 1

Profile Locale 1 was documented on the east face of TR1. The base of excavation at this locale was approximately 131 cmbs.

A total of six stratigraphic layers were identified at PL1, and designated as Layers I-VI. Table 6 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 12 presents the profile drawing at PL1 and a photograph.

Layer II dark yellowish brown silty clay loam deposits documented in PL1 are found only in the western portions of TR1 (including PL2) and in eastern portions of TR7 (PL6). It was not present in PL3 in TR1. Layers V and VI are silt layers, with Layer V exhibiting a dark grayish brown zone overlying Layer VI dark yellowish brown silts.

Sparse charcoal flecking was found in Layer VI in PL1, but it could not be ascertained whether or not the charcoal was cultural. A sample of the charcoal flecking was taken but the sample did not yield a sufficient quantity of charcoal for ID or dating. No definitive archaeological materials or features were encountered in Layers I-VI at PL1.

Profile Locale 2

Profile Locale 2 was documented on the west face of TR1. The base of excavation at this locale was 140 cmbs.

A total of five stratigraphic layers were identified at PL2, and designated as Layers I-V. Table 7 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 13 presents the profile drawing at PL2 and a photograph. In PL2, Layers III, IV, and V show color and textural variations not present in these layers in PL1. While



Trench 1, post-excavation with exposed utility line; PL1 adjacent to photo scale; view to north.

Figure 11. Overview Photograph of Trench 1.

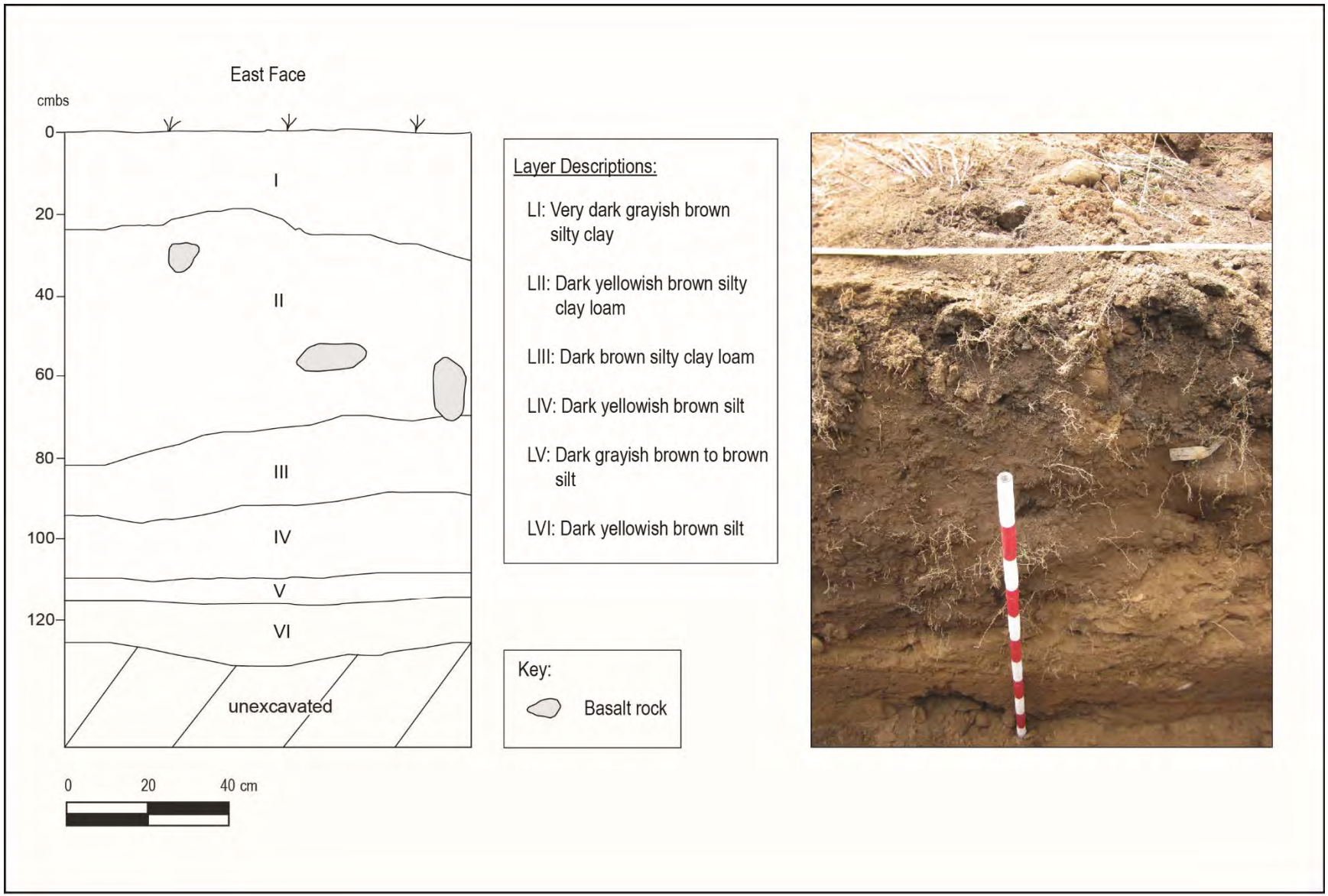


Figure 12. Profile and Photograph of East Face of Trench 1 at PL1.

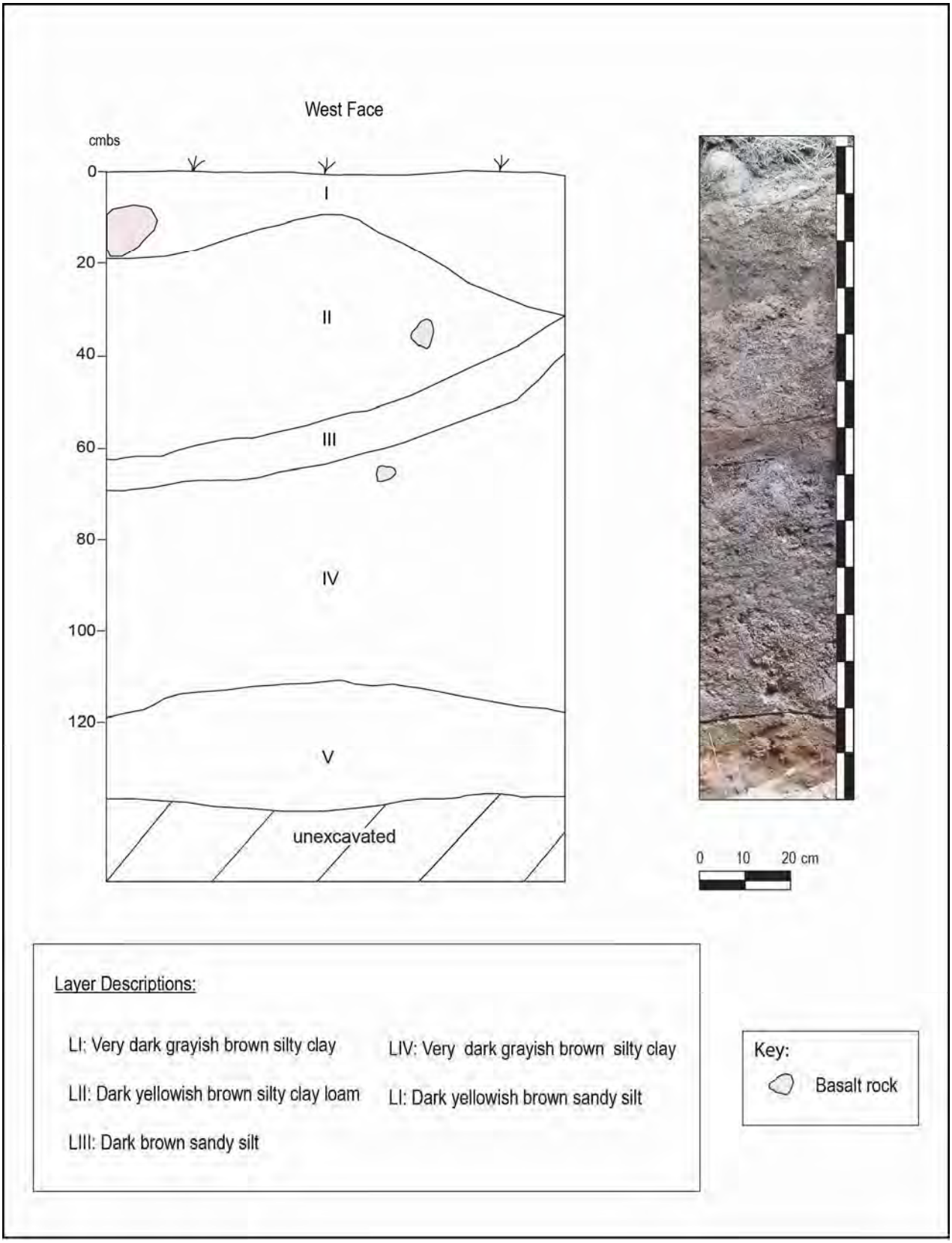


Figure 13. Profile and Photograph of West Face of Trench 1 at Profile Locale 2.

Layer V in PL2 is a sandy silt, it is the same color as Layer VI in PL1 and it is possible these layers may correlate. No archaeological materials or features were encountered in Layers I-V at PL2.

Table 6. Stratigraphic Layer Descriptions for Profile Locale 1 in Trench 1.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/32	18-32 cm thick; very dark grayish brown (10YR 3/2, moist) silty clay; slightly hard, firm, slightly sticky, plastic; contains less than 2%, by volume, rounded to subrounded basalt pebbles and cobbles; common, fine to medium, interstitial roots; abrupt, wavy lower boundary; contains recent rubbish items (rubber/plastic strips).
II	18/82	46-58 cm thick; dark yellowish brown (10YR 3/4, moist) silty clay loam; slightly hard, firm, very slightly sticky, slightly plastic; contains approximately 5%, by volume, rounded to subrounded basalt pebbles, cobbles, and small boulders; few, fine interstitial roots; abrupt, smooth lower boundary; contains limited (sparse) charcoal flecking.
III	70/95	12-22 cm thick; Dark brown (7.5YR 3/3, moist) silty clay loam; slightly hard, firm, slightly sticky, very slightly plastic; contains less than 3%, by volume, rounded to subrounded basalt cobbles and boulders; few, fine, interstitial roots; clear, wavy lower boundary.
IV	89/110	14-19 cm thick; dark yellowish brown (10YR 3/4, moist) silt; soft, very friable, nonsticky, nonplastic; contains less than 2%, by volume, rounded to subrounded basalt pebbles; few, fine interstitial roots; abrupt, smooth lower boundary.
V	108/116	6-8 cm thick; dark grayish brown to brown (10YR 4/2.5, moist) silt; slightly hard, friable, nonsticky, nonplastic; no rock inclusions; no roots; abrupt, smooth lower boundary.
VI	115/131+	10-16+ cm thick; dark yellowish brown (10YR 4/6, moist) silt; slightly hard, friable, nonsticky, nonplastic; no rock inclusions; no roots; lower boundary not reached; contains limited charcoal flecking.

Table 7. Stratigraphic Layer Descriptions for Profile Locale 2 in Trench 1.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/32	11-32 cm thick; very dark grayish brown (10YR 3/2, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; contains less than 2%, by volume, rounded to subrounded basalt pebbles and cobbles; common, fine to medium, interstitial roots; diffuse, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	11/64	5-44 cm thick; dark yellowish brown (10YR 3/4, moist) silty clay loam; slightly hard, firm, very slightly sticky, slightly plastic; contains approximately 5%, by volume, rounded to subrounded basalt pebbles, cobbles, and small boulders; few, fine interstitial roots; abrupt, smooth lower boundary; contains limited (sparse) charcoal flecking.

Table 7. Stratigraphic Layer Descriptions for Profile Locale 2 in Trench 1.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
III	34/70	7-10 cm thick; dark brown (7.5YR 3/4, moist) sandy silt; slightly hard, friable, very slightly sticky, nonplastic; contains less than 3%, by volume, rounded to subrounded basalt cobbles and boulders; no roots; diffuse, smooth lower boundary.
IV	42/118	48-68 cm thick; very dark grayish brown (10YR 3/2, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; contains less than 2%, by volume, rounded to subrounded basalt pebbles; few, fine interstitial roots; clear, smooth lower boundary.
V	112/140+	17-28+ cm thick; dark yellowish brown (10YR 3/6, moist) sandy silt; slightly hard, friable, nonsticky, nonplastic; contains fine to very find basalt sands; no rock inclusions; no roots; lower boundary not reached.

Profile Locale 3

Profile Locale 3 (PL3) was documented on the west face of TR1. The base of excavation at this locale was 140 cmbs.

A total of six stratigraphic layers were identified at PL3, and designated as Layers I-VI. Table 8 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 14 presents the profile drawing at PL3 and a photograph. In PL3, Layer III is a dark reddish brown clayey silt that is not present in PL1 and PL2 in the southern portion of TR1. Layers IV, V and VI at this locale are comprised of sandy silts and silts.

Table 8. Stratigraphic Layer Descriptions for Profile Locale 3 in Trench 1.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/31	24-31 cm thick; very dark grayish brown (10YR 3/2, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; contains less than 2%, by volume, round ed to subrounded basalt pebbles and cobbles; common, fine to medium, interstitial roots; diffuse, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	24/70	16-38 cm thick; dark brown (7.5YR 3/2, moist) to dark grayish brown (10YR 4/2, moist) clayey silt; slightly hard, firm, very slightly sticky, nonplastic; few, fine interstitial roots; clear, wavy lower boundary.
III	46/124	54-58 cm thick; dark reddish brown (5YR 3/3, moist) clayey silt; slightly hard, firm, very slightly sticky, nonplastic; very few, fine, interstitial roots; abrupt, wavy lower boundary.
IV	104/134	7-28 cm thick; very dark grayish brown (10YR 3/2, moist) sandy silt; slightly hard, friable, very slightly sticky, nonplastic; few, fine interstitial roots; clear, smooth lower boundary.
V	124/139	7-8 cm thick; dark brown to dark yellowish brown (10YR 3/3.5, moist) sandy silt; slightly hard, friable, very slightly sticky, nonplastic; contains fine to very fine basalt sands; no roots; clear, wavy lower boundary.
VI	132/140+	2-8+ cm thick; dark yellowish brown (10YR 4/6, moist) silt; slightly hard, friable, nonsticky, nonplastic; no rock inclusions; no roots; lower boundary not reached.

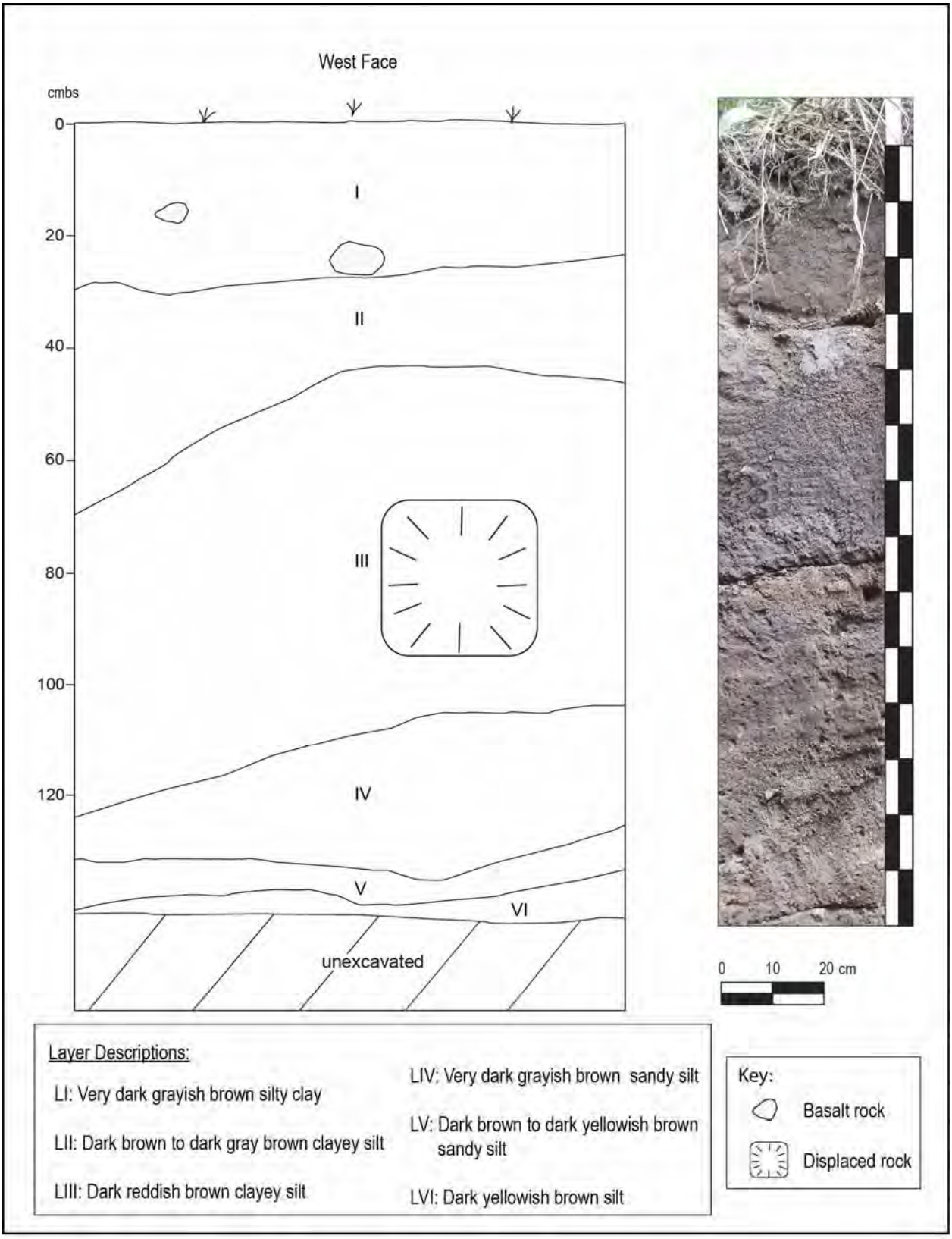


Figure 14. Profile and Photograph of West Face of Trench 1 at Profile Locale 3.

TRENCH 2

Trench 2 (TR2) was excavated in the northwest quadrant of the project area, approximately 10.0 m south of TR1 in a low-lying area that was constantly saturated as a result of three days of rain at the beginning of the project (see Figure 9; see Table 4). This area was approximately 0.5 m lower than the surrounding areas. The base of excavation at this locale was 152 cmbs. Figure 15 presents an overview photograph of TR2, post-excavation. One profile locale, PL20, was documented in TR2. The stratigraphic sequence for this locale is presented below.

Profile Locale 20

Profile Locale 20 (PL20) was documented on the south face of TR2. The base of excavation at this locale was 152 cmbs.

A total of five stratigraphic layers were identified (Layers I-V) in PL20. The stratigraphic sequence in TR2 was consistent within TR2. Table 9 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 16 presents the profile drawing at PL20 and a photograph. Layer V appears to be the cobble/pebble layer observed on the banks of ʻĪao Stream. No archaeological materials or features were found in Layers I-V at PL20.

Table 9. Stratigraphic Layer Descriptions for Profile Locale 20 in Trench 2.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/40	10-40 cm thick; Very dark gray to very dark grayish brown (10YR 3/1.5, moist) sandy clay loam; slightly hard, firm, slightly sticky, plastic; very few, fine, interstitial roots; diffuse, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	10/60	13-28 cm thick; dark brown (10YR 3/3, moist) silt loam; slightly hard, firm, very slightly sticky, slightly plastic; contains decomposing basalt sands and fine gravel; very few, fine, interstitial roots; diffuse, wavy lower boundary.
III	26/96	28-52 cm thick; dark yellowish brown (10YR 3/6, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; very few, fine, interstitial roots; gradual, wavy lower boundary.
IV	80/120	20-30 cm thick; black (10YR 2/1, moist) clay; contains less than 3%, by volume, decomposing, rounded to subrounded basalt cobbles; hard, firm, sticky, plastic; few, fine, interstitial roots; clear, wavy, lower boundary.
V	108/152+	26-44+ cm thick; dark yellowish brown (10YR 4/6, moist) extremely cobbly, pebbly, sandy silt loam; slightly hard, friable, slightly sticky, nonplastic; contains approximately 50%, by volume, decomposing basalt cobbles; no roots; lower boundary not reached.



Trench 2, post-excavation; view to northwest.

Figure 15. Overview Photograph of Trench 2.

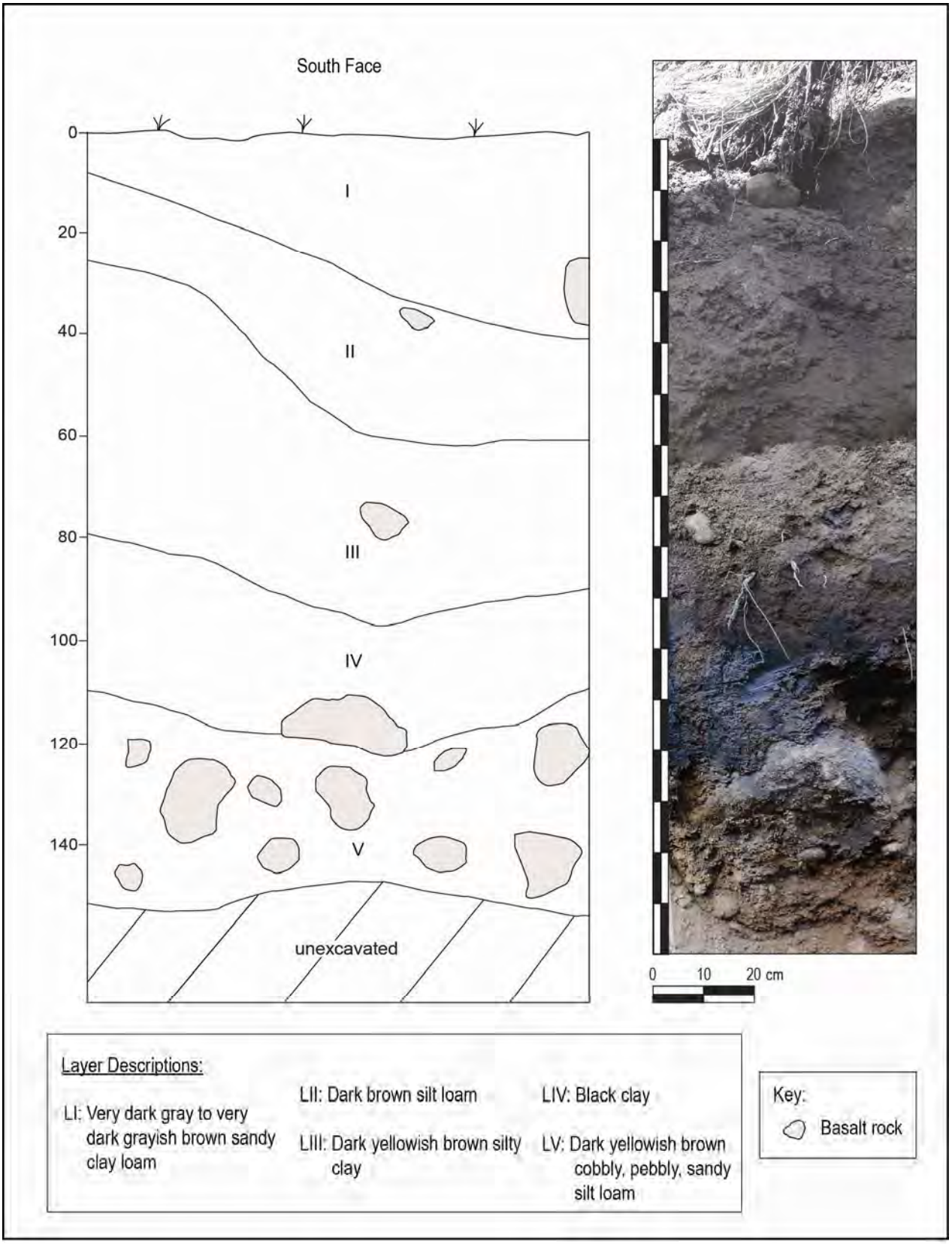


Figure 16. Profile and Photograph of South Face of Trench 2 at Profile Locale 20.

TRENCH 3

Trench 3 was excavated in the west-central portion of the project area (see Figure 9; see Table 4). A total of five stratigraphic layers were identified (Layers I-V) in TR3. Figure 17 presents an overview photograph of TR3, post-excavation. No archaeological materials or features were found in TR3 excavations.

Two profile locales (PL12 and PL13) were documented in TR3. The stratigraphic sequences in these two profile locales are presented below.

Profile Locale 12

Profile Locale 12 (PL12) was documented on the west face of TR3. The base of excavation at this locale was 140 cmbs.

A total of four stratigraphic layers were identified at PL12, and designated as Layers I-IV. Table 10 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 18 presents the profile drawing at PL12 and a photograph. No archaeological materials or features were encountered in Layers I-IV at PL12.

Table 10. Stratigraphic Layer Descriptions for Profile Locale 12 in Trench 3.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/18	14-18 cm thick; very dark gray (10YR 3/1, moist) silt loam; slightly hard, firm, slightly sticky, plastic; abundant, fine, interstitial roots; abrupt, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	14/102	84-88 cm thick; dark brown (7.5YR 3/2, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; few, fine interstitial roots; abrupt, wavy lower boundary.
III	97/134	30-34 cm thick; very dark brown (10YR 2/2, moist) silty clay; slightly hard, firm, slightly sticky, very slightly plastic; no roots; abrupt, wavy lower boundary.
IV	130/140+	8-10+ cm thick; dark brown to dark yellowish brown (10YR 3/3.5, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no roots; lower boundary not reached.

Profile Locale 13

Profile Locale 13 (PL13) was documented on the west face of TR3. The base of excavation at this locale was 140 cmbs.

A total of five stratigraphic layers were identified at PL13, and designated as Layers I-V. Table 11 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 19 presents the profile drawing at PL13 and a photograph. Layer V at PL13 is a silt deposit. A piece of black plastic, the type of material frequently observed in sugar cane fields, was found at the base of Layer II in this locale. Samples of Layer IV had strong brown (10YR 5/8, moist) staining on ped surfaces. No archaeological materials or features were encountered in Layers I-V at PL13.



Trench 3, post-excavation with large boulders visible within Layer II; view to northeast.

Figure 17. Overview Photograph of Trench 3.

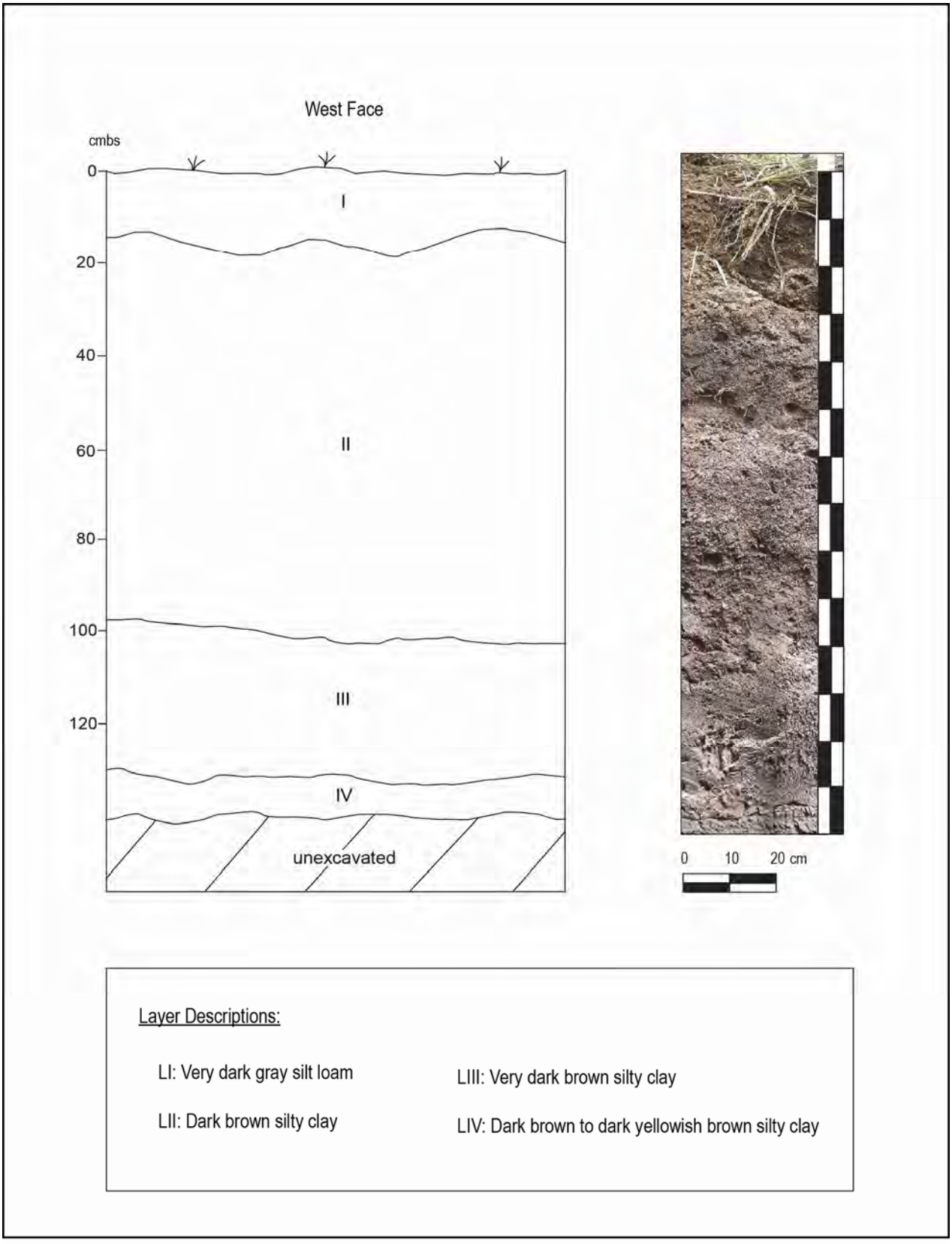


Figure 18. Profile and Photograph of West Face of Trench 3 at Profile Locale 12.

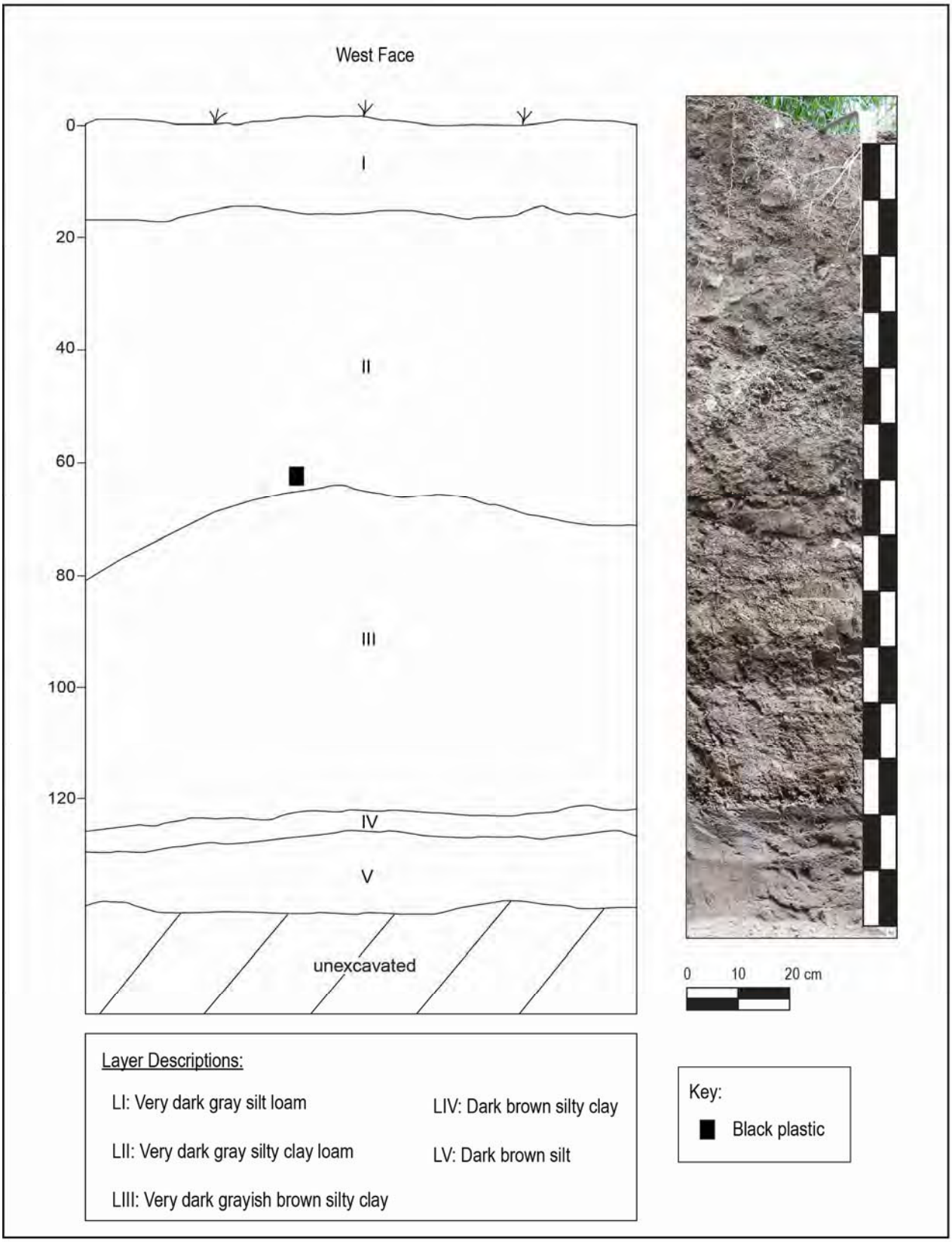


Figure 19. Profile and Photograph of West Face of Trench 3 at Profile Locale 13.

Table 11. Stratigraphic Layer Descriptions for Profile Locale 13 in Trench 3.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/18	16-18 cm thick; very dark gray (10YR 3/1, moist) silt loam; slightly hard, firm, slightly sticky, slightly plastic; abundant, fine, interstitial roots; abrupt, smooth lower boundary; contains recent rubbish items (glass, metal, plastic).
II	16/82	30-64 cm thick; very dark gray (10YR 3/1 , moist) silty clay loam; slightly hard, firm, very slightly sticky, slightly plastic; few, fine interstitial roots; abrupt, wavy lower boundary; contains black plastic fragments.
III	66/127	44-58 cm thick; very dark grayish brown (10YR 3/2, moist) silty clay; slightly hard, firm, slightly sticky, very slightly plastic; no roots; abrupt, smooth lower boundary.
IV	122/130	4-6 cm thick; dark brown (10YR 3/3, moist) silty clay; hard, firm, slightly sticky, slightly plastic; contains strong brown (10YR 5/8, moist) staining on ped surfaces; no roots; abrupt, smooth boundary
V	127/140+	10-14+ cm thick; dark brown (10YR 3/3, moist) silt; firm, friable, nonsticky, nonplastic; no roots; lower boundary not reached.

TRENCH 4

Trench 4 (TR4) was excavated in the southwest quadrant of the project area (see Figure 9; see Table 4). Trench 4 was one of four trenches excavated deeper in an attempt to reach the cobble/pebbble layer observed along the banks of ʻĪao Stream; it excavated to depths ranging from 190 to 230 cmbs. Figure 20 presents an overview photograph of TR4, post-excavation. A total of nine stratigraphic layers were identified (Layers I-IX) in TR4. No archaeological materials or features were found in TR4 excavations.

Two profile locales (PL14 and PL15) were documented on the east face of TR4. The stratigraphic sequences observed at PL14 and PL15 are presented below.

Profile Locale 14

Profile Locale 14 was documented on the west face of TR4. The base of excavation at this locale was approximately 230 cmbs.

A total of nine stratigraphic layers were identified at PL14, and designated as Layers I-IX. Table 12 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 21 presents the profile drawing at PL14 and a photograph. Layers IV, V, and VII consist of clayey silts and silts. Layer IX at PL14 has been identified as the cobble/pebbble layer observed along the banks of ʻĪao Stream. No archaeological materials or features were encountered in Layers I-IX at PL14.

Profile Locale 15

Profile Locale 15 was documented on the east face of TR4. The base of excavation at this locale was approximately 190 cmbs.

A total of five stratigraphic layers were identified at PL15, and designated as Layers I-V. Table 13 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 22 presents the profile drawing at PL15 and a photograph.



Trench 4 with stepped excavation; post-excavation; view to southeast.

Figure 20. Overview Photograph of Trench 4.

Table 12. Stratigraphic Layer Descriptions for Profile Locale 14 in Trench 4.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/14	12-14 cm thick; very dark gray (10YR 3/1, moist) silt loam; slightly hard, firm, slightly sticky, slightly plastic; abundant, fine, interstitial roots; abrupt, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	12/58	46-48 cm thick; very dark gray (10YR 3/1, moist) silty clay; slightly hard, firm, very slightly sticky, slightly plastic; few, fine interstitial roots; abrupt, wavy lower boundary.
III	58/76	16-18 cm thick; dark brown (10YR 3/3, moist) silty clay; slightly hard, firm, slightly sticky, very slightly plastic; no roots; abrupt, smooth lower boundary.
IV	76/132	54-56 cm thick; very dark gray to black (10YR 2.5/1, moist) clayey silt; slightly hard, firm, very slightly sticky, nonplastic; no roots; abrupt, wavy lower boundary.
V	128/158	16-28 cm thick; dark brown (10YR 3/3, moist) silt; slightly hard, friable, nonsticky, nonplastic; no roots; abrupt, wavy lower boundary.
VI	146/165	7-10 cm thick; dark reddish brown (5YR 3/4, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no roots; abrupt, wavy lower boundary.
VII	155/188	12-27 cm thick; dark gray (10YR 3/1, moist) silt; slightly hard, friable, nonsticky, nonplastic; no roots; abrupt, smooth lower boundary.
VIII	166/200	10-33 cm thick; dark brown (7.5YR 3/2, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no roots; abrupt, smooth boundary.
IX	200/230+	30+ cm thick; dark brown (7.5YR 3/4, moist) extremely cobbly, pebbly silt loam; contains 50-60%, by volume, decomposing, rounded to subrounded basalt cobbles and pebbles; slightly hard, firm, very slightly sticky, nonplastic; no roots; lower boundary not reached.

Table 13. Stratigraphic Layer Descriptions for Profile Locale 15 in Trench 4.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/12	11-12 cm thick; very dark gray (10YR 3/1, moist) silt loam; slightly hard, firm, slightly sticky, slightly plastic; abundant, fine, interstitial roots; abrupt, smooth lower boundary; contains recent rubbish items (glass, metal, plastic).
II	11/130	112-119 cm thick; very dark grayish brown (10YR 3/2, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; few, fine interstitial roots; abrupt, wavy lower boundary.
III	124/170	39-44 cm thick; very dark brown (10YR 2/2, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no roots; abrupt, wavy lower boundary.
IV	168/174	3-4 cm thick; dark brown to dark yellowish brown (10YR 3/3.5, moist) silty clay with strong brown (10YR5/8, moist) staining on ped surfaces; slightly hard, firm, slightly sticky, slightly plastic; no roots; abrupt, wavy lower boundary.
V	172/190+	17-20+ cm thick; dark brown (10YR 3/3, moist) extremely cobbly, pebbly, sandy silt; slightly hard, friable, nonsticky, nonplastic; contains coarse basalt sands and fine gravels and approximately 50%, by volume, decomposing rounded basalt cobbles and pebbles; no roots; lower boundary not reached.

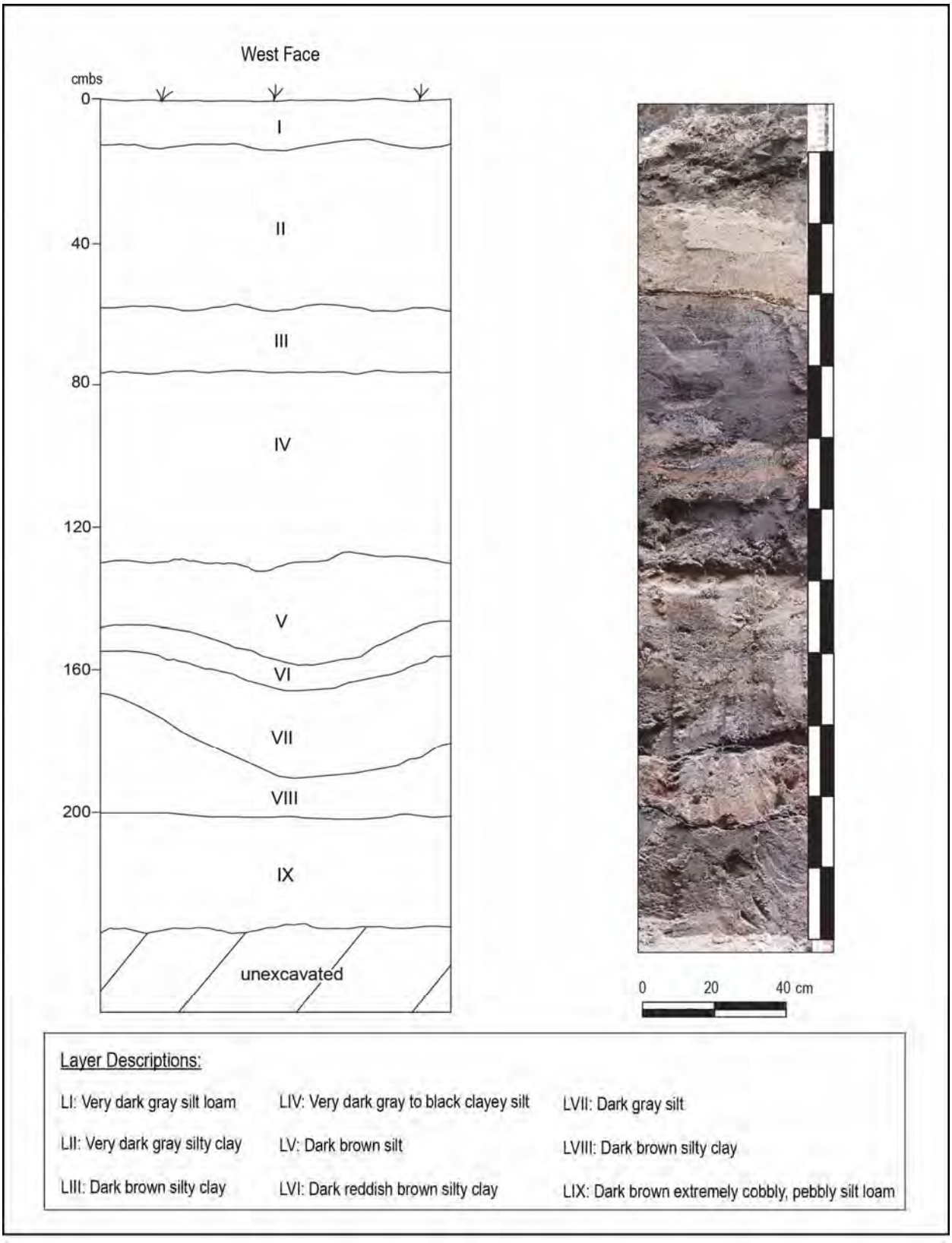


Figure 21. Profile and Photograph of West Face of Trench 4 at Profile Locale 14.

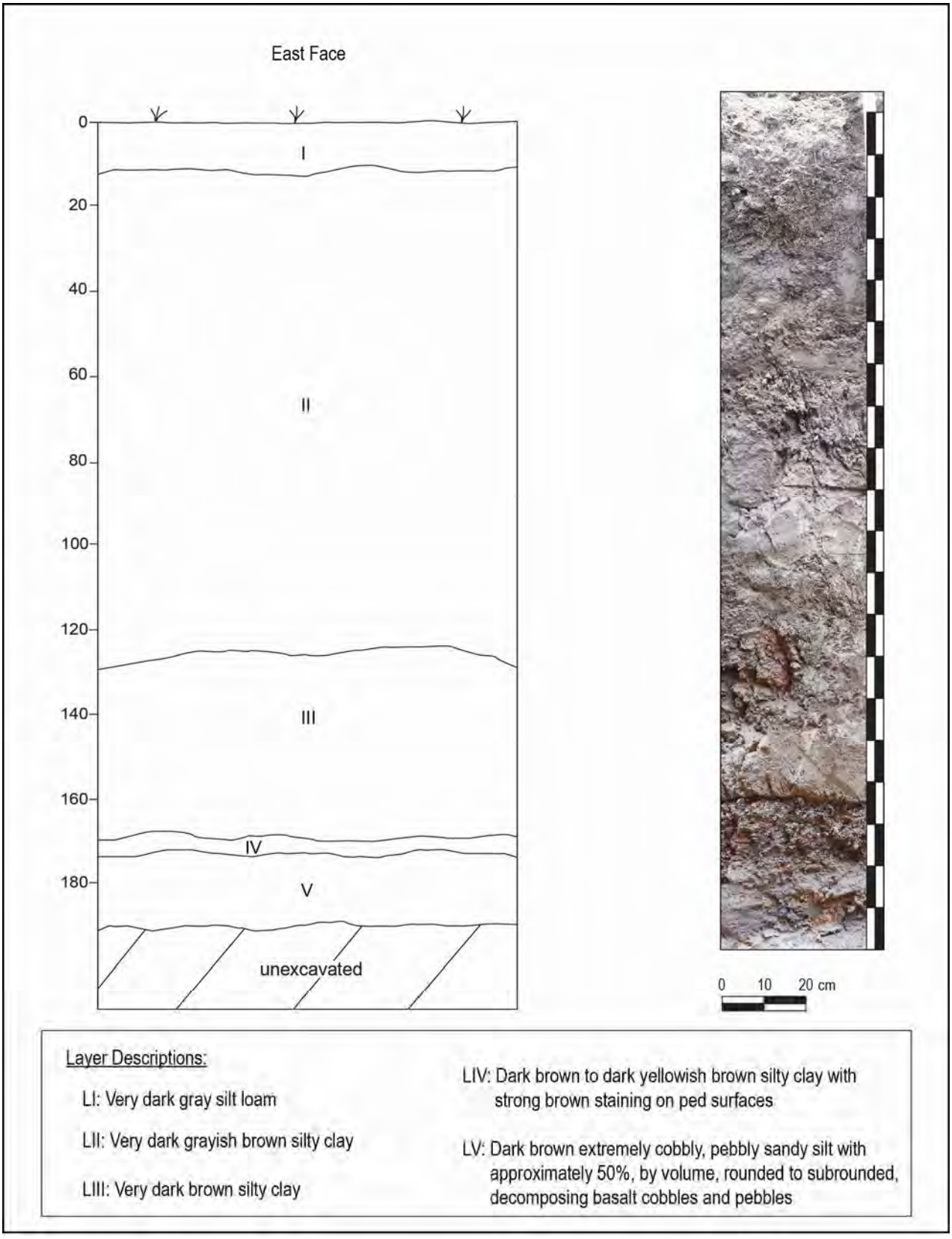


Figure 22. Profile and Photograph of East Face of Trench 4 at Profile Locale 15.

At PL15, Layer II thickness is significantly greater in the north end of the trench at PL15 (112-119 cm) than in the south end (46-48 cm). Layer IV had strong brown (10YR5/8, moist) staining on ped surfaces. Layer V is a sandy silt deposit. No archaeological materials or features were encountered in Layers I-V at PL15.

TRENCH 5

Trench 5 (TR5) was excavated in the southwest quadrant of the project area (see Figure 9; see Table 4), just west of TR4. Trench 5, one of three of the deeper trenches, was excavated to approximately 260 cmbs. Figure 23 presents an overview photograph of TR5, post excavation. A total of ten stratigraphic layers were identified (Layers I-X) in TR5. No archaeological materials or features were found in TR5 excavations.

One profile locale (PL17) was documented in TR5. The stratigraphic sequence observed at PL17 is presented below.

Profile Locale 17

Profile Locale 17 was documented on the west face of TR5. The base of excavation at this locale was approximately 260 cmbs.

A total of ten stratigraphic layers were identified at PL17, and designated as Layers I-X. Table 14 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 24 presents the profile drawing at PL17 and a photograph. The stratigraphic sequence in TR5 appears to be void of layers associated with sugar cane agriculture. This is based on the presence of microstratigraphy in the thicker layers in TR5. The number of layers may reflect TR5's proximity to ʻĪao Stream, which is situated less than 10 meters from TR5. No archaeological materials or features were encountered in Layers I-X at PL17. Layer X in TR5 is the cobble/pebble layer observed along the banks of ʻĪao Stream.

TRENCH 6

Trench 6 was excavated in the northeast quadrant of the project area (see Figure 9; see Table 4), just east of TR1. Trench 6 was excavated to depths ranging from 140 to 248 cmbs. The western portion of TR6 was excavated deeper than the eastern portion in order to reach the cobble/pebble layer observed along the banks of ʻĪao Stream. An intact PVC utility line was encountered while excavating TR6. Figure 25 presents overview photographs of TR6.

A total of seven stratigraphic layers were identified in TR6 (Layers I-VII). No archaeological materials or features were found in TR6 excavations.

Two profile locales (PL4 and PL5) were documented in TR6. The stratigraphic sequence observed at PL4 and PL5 are presented below.

Profile Locale 4

Profile Locale 4 (PL4) was documented on the east face of TR6. The base of excavation at this locale was approximately 140 cmbs.

A total of five stratigraphic layers were identified at PL4, and designated as Layers I-V. Table 15 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 26 presents the profile drawing at PL4 and a photograph. Layers IV and V are sandy silt and silt deposits, respectively. No archaeological materials or features were encountered in Layers I-V at PL4.

Table 14. Stratigraphic Layer Descriptions for Profile Locale 17 in Trench 5.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/35	14-35 cm thick; very dark grayish brown (10YR 3/2, moist) silty clay; slightly hard, firm, slightly sticky, plastic; contains sparse decomposing, rounded boulders; common, fine, interstitial roots; clear, wavy boundary; contains recent rubbish (glass, metal, plastic).
II	14/56	14-38 cm thick; very dark gray (10YR 3/1, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; few, fine interstitial roots; abrupt, wavy lower boundary.
III	50/72	3-16 cm thick; dusky red (2.5YR 3/2, moist) to dark reddish brown (2.5YR 3/4, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no roots; abrupt, wavy lower boundary.
IV	53/140	56-68 cm thick; very dark gray (5YR 3/1, moist) clayey silt; soft, friable, very slightly sticky, slightly plastic; no roots; abrupt, wavy lower boundary.
V	120/148	8-18 cm thick; very dark gray (7.5YR 3/1, moist) silt; soft, very friable, nonsticky, nonplastic; no roots; abrupt, smooth boundary.
VI	138/156	8-12 cm thick; brown (7.5YR 4/3, moist) silt; soft, very friable, nonsticky, nonplastic; no roots; abrupt, smooth lower boundary
VII	150/174	18-20 cm thick; black (10YR 2/1, moist) silt; soft, very friable, nonsticky, nonplastic; no roots; abrupt, smooth boundary
VIII	168/178	6-10 cm thick; very dark gray (10YR 3/1, moist) silty clay; soft, very friable, very slightly sticky, nonplastic; no roots; abrupt, smooth boundary
IX	178/185	2-6 cm thick; dark reddish brown (5YR 3/3, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no roots; abrupt, smooth lower boundary.
X	180/260+	76-80+ cm thick; dark yellowish brown (10YR 3/4, moist) extremely cobbly, pebbly silt loam; contains decomposing, rounded to subrounded basalt cobbles and pebbles; slightly hard, firm, very slightly sticky, nonplastic; no roots; lower boundary not reached.

Table 15. Stratigraphic Layer Descriptions for Profile Locale 4 in Trench 6.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/11	8-11 cm thick; very dark grayish brown (10YR 3/2, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; contains less than 2%, by volume, rounded to subrounded basalt pebbles and cobbles; common, fine to medium, interstitial roots; abrupt, smooth lower boundary; contains recent rubbish items (glass, metal, plastic).
II	8/71	57-60 cm thick; dark reddish brown (5YR 3/3, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; few, fine interstitial roots; abrupt, smooth lower boundary.
III	66/98	23-30 cm thick; dark brown (10YR 3/3, moist) silt loam with rounded to subrounded basalt gravels and medium to fine sands; slightly hard, friable, very slightly sticky, nonplastic; very few, fine, interstitial roots; abrupt, smooth lower boundary.
IV	91/130	27-37 cm thick; dark yellowish brown (10YR 4/4, moist) sandy silt; slightly hard, friable, nonsticky, nonplastic; contains less than 2%, by volume, rounded to subrounded basalt pebbles; few, fine interstitial roots; abrupt, smooth lower boundary.
V	124/140+	10-16+ cm thick; dark brown to dark yellowish brown (10YR 3/3.5, moist) sandy silt; slightly hard, friable, nonsticky, nonplastic; no rock inclusions; no roots; lower boundary not reached.



Trench 5 stepped excavation; post-excavation; view to northeast.

Figure 23. Overview of Trench 5.

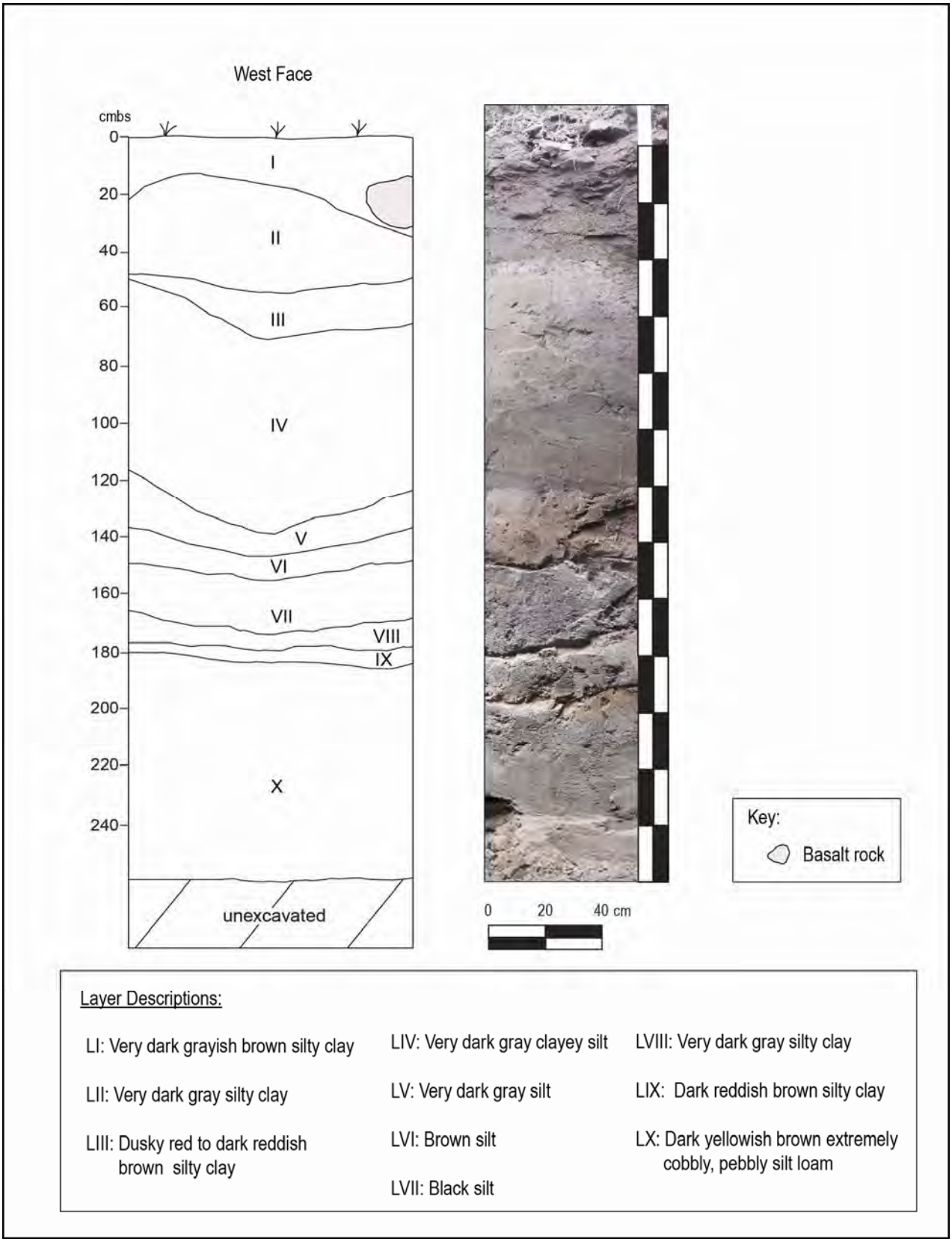


Figure 24. Profile and Photograph of West Face of Trench 5 at Profile Locale 17.



Trench 6, post excavation with active utility line; view to southeast.



Trench 6, post excavation; view to northeast.

Figure 25. Overview Photographs of Trench 6.

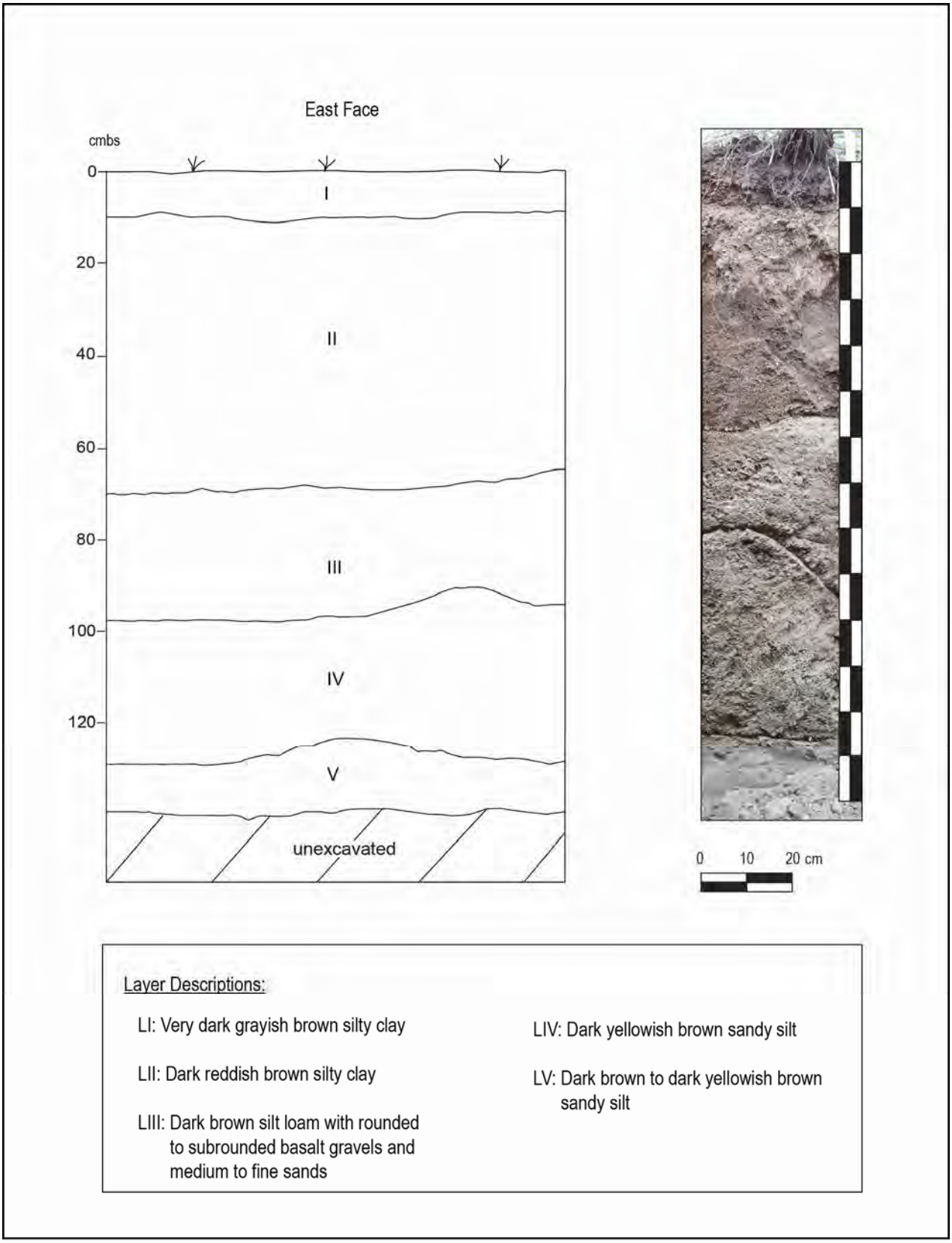


Figure 26. Profile and Photograph of East Face of Trench 6 at Profile Locale 4.

Profile Locale 5

Profile Locale 5 was documented on the east face of TR6. The base of excavation at this locale was approximately 248 cmbs.

A total of seven stratigraphic layers were identified at PL5, and designated as Layers I-VII. Table 16 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 27 presents the profile drawing at PL5 and a photograph. Layer IV contained strong brown (10YR 5/8, moist) staining on ped surfaces. Layers V and VI are silt and sandy silt deposits, respectively. No archaeological materials or features were encountered in Layers I-VII at PL5.

Table 16. Stratigraphic Layer Descriptions for Profile Locale 5 in Trench 6.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/30	23-30 cm thick; very dark grayish brown (10YR 3/2, moist) silty clay loam; slightly hard, firm, slightly sticky, slightly plastic; common, fine to medium, interstitial roots; clear, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	23/100	70-74 cm thick; very dark gray (10YR 3/1, moist) clay; hard, firm, sticky, plastic; few, fine interstitial roots; abrupt, smooth lower boundary.
III	92/111	12-20 cm thick; dark reddish brown (2.5YR 3/4, moist) clay; hard, firm, sticky, plastic; very few, fine, interstitial roots; clear, smooth lower boundary.
IV	109/129	16-20 cm thick; very dark grayish brown (10YR 3/2, moist) silty clay with strong brown (10YR 5/8, moist) staining on ped surfaces; hard, firm, slightly sticky, slightly plastic; no roots; abrupt, smooth lower boundary.
V	129/200	68-72 cm thick; dark reddish brown (5YR 3/3, moist) silt; slightly hard, friable, very slightly sticky, nonplastic; no rock inclusions; no roots; abrupt, wavy lower boundary.
VI	196/210	8-13 cm thick; dark yellowish brown (10YR 3/3, moist) sandy silt; slightly hard, friable, nonsticky, nonplastic; no rock inclusions; no roots; abrupt, broken, lower boundary.
VII	208/248+	38-40+ cm thick; dark brown (7.5YR 3/2, moist) extremely cobbly, pebbly silty sand with approximately 50-60%, by volume, decomposing, rounded to subrounded basalt cobbles and pebbles; slightly hard, friable, nonsticky, nonplastic; no roots; lower boundary not reached.

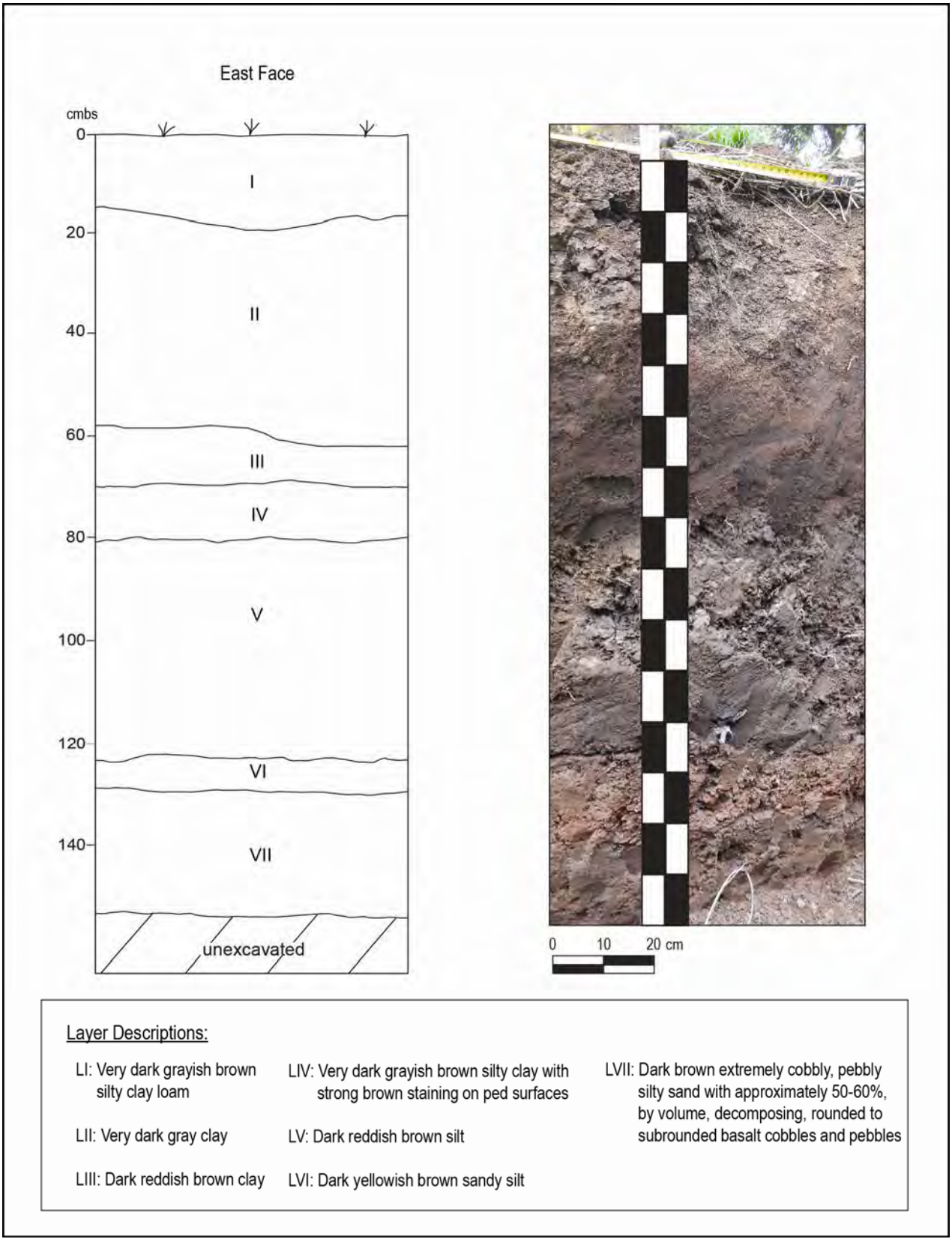


Figure 27. Profile and Photograph of East Face of Trench 6 at Profile Locale 5.

TRENCH 7

Trench 7 was excavated in the northeast quadrant of the project area (see Figure 9; see Table 4), just south of TR6. Trench 7 was excavated to depths ranging from 120 to 136 cmbs. Figure 28 presents an overview photograph of TR7, post-excavation. A total of six stratigraphic layers were identified in TR7 (Layers I-VI). One piece of historic glass was found and collected in TR6 (see PL7 below).

Two profile locales (PL6 and PL7) was documented in TR7. The stratigraphic sequence observed at PL6 and PL7 are presented below.

Profile Locale 6

Profile Locale 6 was documented on the south face of TR7. The base of excavation at this locale was approximately 120 cmbs.

A total of six stratigraphic layers, designated as Layers I-VI, and one lens, Lens A, were identified at PL6. Table 17 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 29 presents the profile drawing at PL6 and a photograph.

Lens A is a 4.0 cm thick, black silt loam lens present near the upper boundary of Layer V dark reddish brown silty clay sediments. No charcoal or other materials were observed within Lens A. Layer VI contained strong brown (10YR 5/8, moist) staining on ped surfaces. No archaeological materials or features were encountered in Layers I-VI at PL6.

Table 17. Stratigraphic Layer Descriptions for Profile Locale 6 in Trench 7.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/34	29-34 cm thick; very dark brown (10YR 2/2, moist) silty clay loam; hard, firm, slightly sticky, slightly plastic; common, fine to medium, interstitial roots; gradual, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	29/48	7-20 cm thick; dark yellowish brown (10YR 3/4, moist) silty clay; slightly hard, firm, very slightly sticky, slightly plastic; few, fine interstitial roots; clear, wavy lower boundary.
III	40/66	12-26 cm thick; dark reddish brown (5YR 3/3, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; very few, fine, interstitial roots; abrupt, wavy lower boundary.
IV	60/80	7-16 cm thick; dark brown (7.5YR 3/4, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no roots; abrupt, wavy lower boundary.
V	67/102	20-33 cm thick; dark reddish brown (5YR 3/3, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no rock inclusions; no roots; abrupt, smooth lower boundary.
Lens A	76/83	4 cm thick; black (7.5YR 2.5/1, moist) silt loam; slightly hard, friable, slightly sticky, nonplastic; no rock inclusions; no roots; abrupt, smooth lower boundary; lens is approximately 47.0 cm in length; non-cultural.
VI	98/120+	16-21+ cm thick; very dark grayish brown (10YR 3/2, moist) silty clay with strong brown (10YR 5/8, moist) staining on ped surfaces; slightly hard, firm, slightly sticky, slightly plastic; no rock inclusions; no roots; lower boundary not reached.



Trench 7, post- excavation; view to southwest.

Figure 28. Overview Photograph of Trench 7.

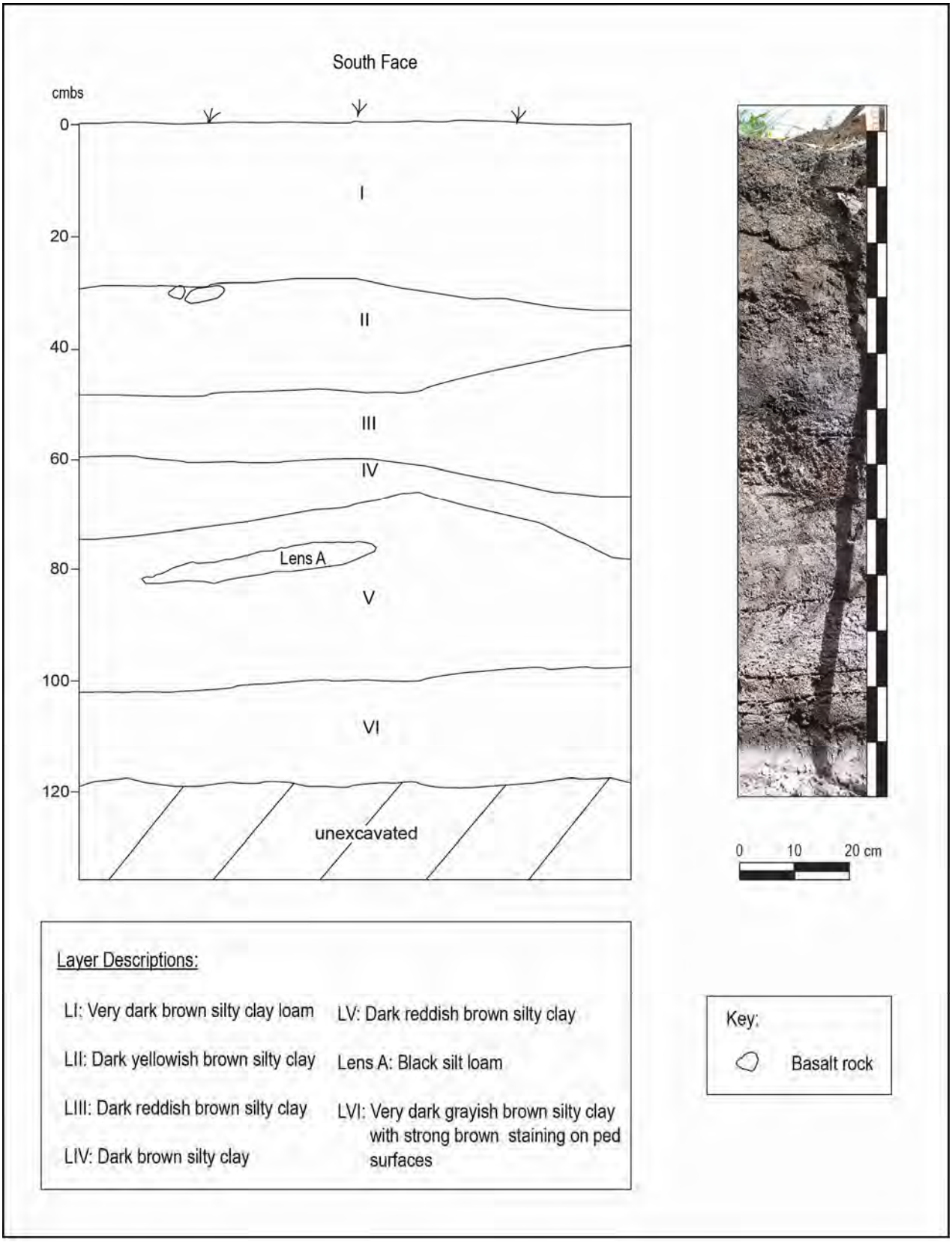


Figure 29. Profile and Photograph of South Face of Trench 7 at Profile Locale 6.

Profile Locale 7

Profile Locale 7 (PL7) was documented on the south face of TR7. The base of excavation at this locale was approximately 136 cmbs.

A total of four stratigraphic layers were identified at PL7, and designated as Layers I-IV. Table 18 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 30 presents the profile drawing at PL7 and a photograph.

One clear glass fragment was found protruding from the south face in Layer III deposits, at 82-84 cmbs (see Figure 30). No other archaeological materials or features were encountered in Layers I-IV at PL7.

Table 18. Stratigraphic Layer Descriptions for Profile Locale 7 in Trench 7.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/31	21-31 cm thick; very dark brown (10YR 2/2, moist) silty clay loam; hard, firm, slightly sticky, plastic; common, fine to medium, interstitial roots; diffuse, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	21/68	39-46 cm thick; very dark brown (10YR 2/2, moist) silty clay; slightly hard, firm, very slightly sticky, slightly plastic; no roots; abrupt, wavy lower boundary.
III	60/104	20-36 cm thick; dark brown (7.5YR 3/4, moist) silty clay; slightly hard, firm, slightly sticky, very slightly plastic; very few, fine, interstitial roots; clear, smooth lower boundary; one clear glass fragment was collected at 82-84 cmbs from profile face.
IV	80/136+	36-52+ cm thick; very dark grayish brown (10YR 3/2, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no roots; abrupt, lower boundary not reached.

TRENCH 8

Trench 8 (TR8) was excavated in the central-east portion of the project area (see Figure 9; see Table 4). Trench 8 was excavated to depths ranging from 134 to 140 cmbs. Figure 31 presents an overview photograph of TR8, post-excavation. A total of ten stratigraphic layers were identified in TR8 (Layers I-X). No archaeological materials or features were found in TR6 excavations.

Two profile locales (PL8 and PL9) were documented in TR8. The stratigraphic sequence observed at PL8 and PL9 are presented below.

Profile Locale 8

Profile Locale 8 (PL8) was documented on the north face of TR8. The base of excavation at this locale was approximately 140 cmbs.

A total of seven stratigraphic layers were identified at PL8, and designated as Layers I-VII. Table 19 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 32 presents the profile drawing at PL8 and a photograph. Layer III contained strong brown (10YR 5/8, moist) stains on ped surfaces. Layers II-VII are all silty clay deposits; no silt layers were identified at PL8. No archaeological materials or features were encountered in Layers I-VII at PL8.

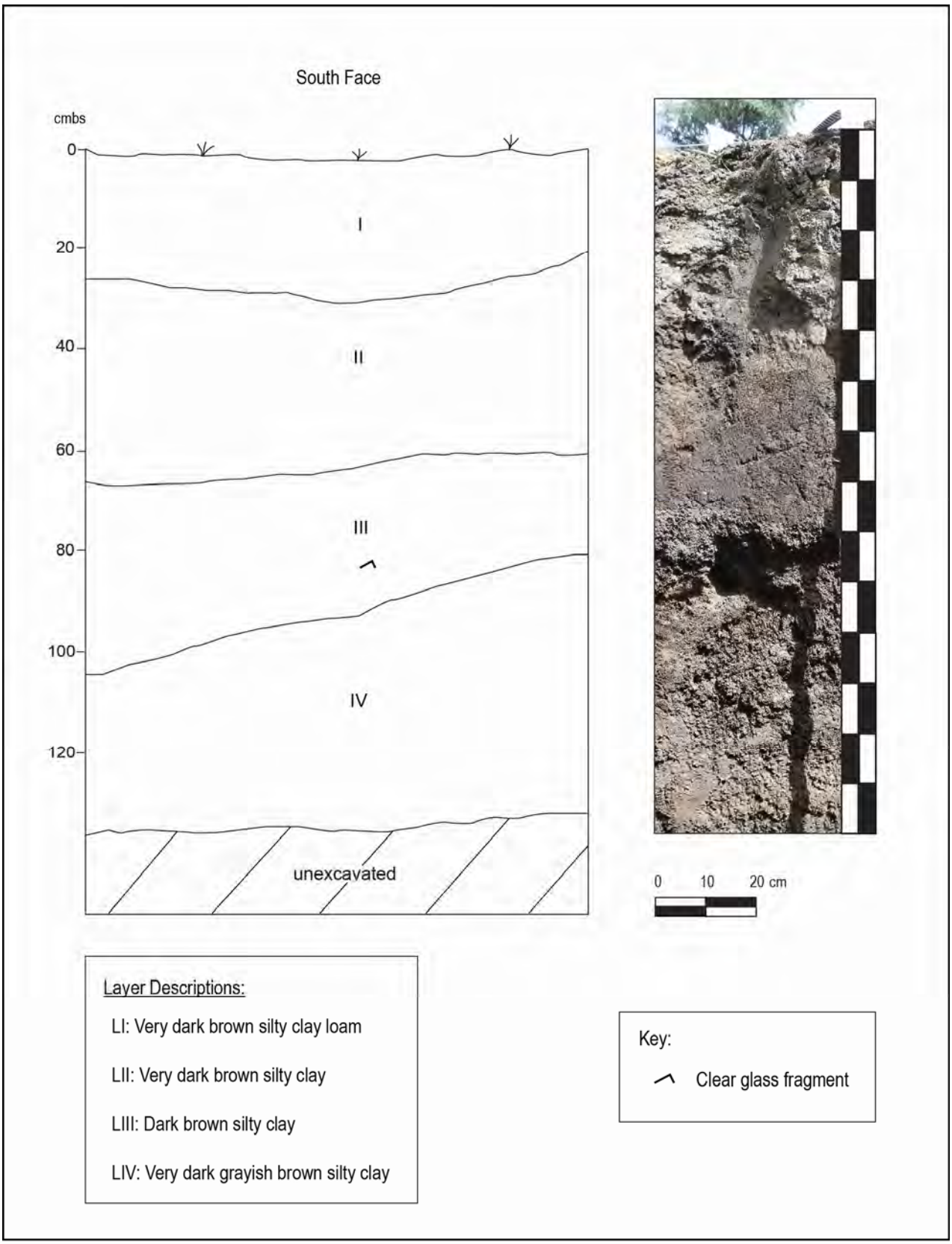


Figure 30. Profile and Photograph of South Face of Trench 7 at Profile Locale 7.



Trench 8, post-excavation; view to northwest.

Figure 32. Overview Photograph of Trench 8.

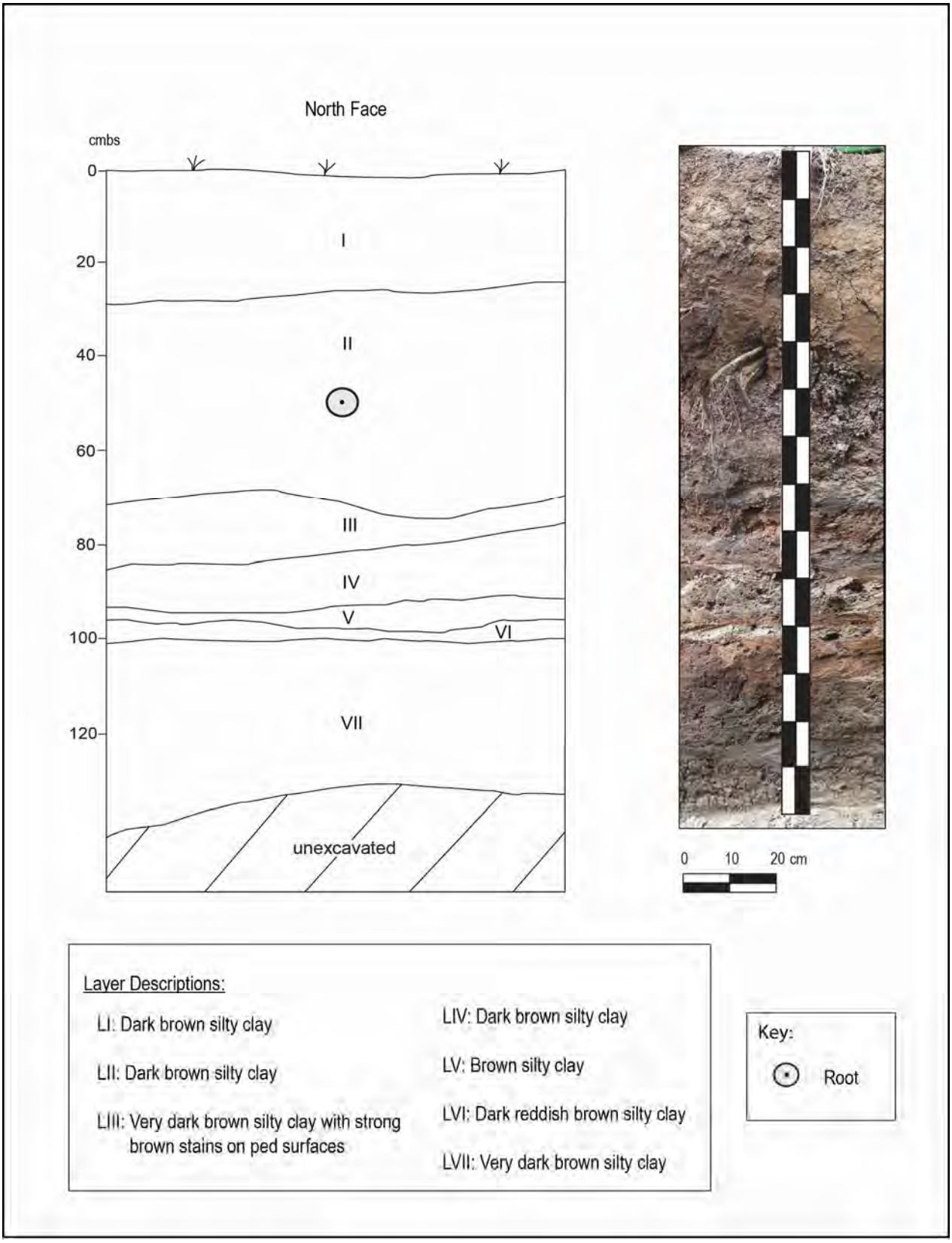


Figure 32. Profile and Photograph of North Face of Trench 8 at Profile Locale 8.

Table 19. Stratigraphic Layer Descriptions for Profile Locale 8 in Trench 8.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/29	25-29 cm thick; dark brown (10YR 3/3, moist) silty clay loam; slightly hard, firm, slightly sticky, slightly plastic; common, fine to medium, interstitial roots; diffuse, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	25/74	43-46 cm thick; dark brown (10YR 3/3, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; few, fine to very fine interstitial roots and few large tubular roots; diffuse, wavy lower boundary.
III	68/85	6-16 cm thick; very dark brown (10YR 2/2, moist) silty clay with strong brown (10YR 5/8, moist) stains on ped surfaces; slightly hard, firm, slightly sticky, slightly plastic; very few, fine, interstitial roots; gradual, wavy lower boundary.
IV	76/94	8-16 cm thick; dark brown (7.5YR 3/4, moist) silty clay; slightly hared, firm, slightly sticky, slightly plastic; few, fine, interstitial roots; gradual, smooth boundary.
V	92/98	1-6 cm thick; brown (10YR 4/3, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; few, fine interstitial roots; clear, wavy lower boundary.
VI	93/100	2-4 cm thick; dark reddish brown (5YR 3/4, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no rock inclusions; few, fine, interstitial roots; diffuse, wavy lower boundary.
VII	96/140+	36-44+ cm think; very dark brown (10YR 2/2, moist) silty clay; slightly hard, firm, nonsticky, nonplastic; no rock inclusions; few, fine, interstitial roots; lower boundary not reached.

Profile Locale 9

Profile Locale 9 was documented on the north face of TR8. The base of excavation at this locale was approximately 134 cmbs.

A total of ten stratigraphic layers were identified at PL9, and designated as Layers I-X. Table 20 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 33 presents the profile drawing at PL9 and a photograph. Layer III contained strong brown (10YR 5/8, moist) stains on ped surfaces. Layer VIII at this locale is a silt deposit. No archaeological materials or features were encountered in Layers I-X at PL9.

TRENCH 9

Trench 9 was excavated in the south-central portion of the project area (see Figure 9; see Table 4), between TR4 and TR10. Trench 9 was excavated to depths ranging from 132 to 134 cmbs. Figure 34 presents an overview photograph of TR9, post-excavation. A total of four stratigraphic layers were identified in TR9 (Layers I-IV). No archaeological materials or features were found in TR6 excavations.

Two profile locales (PL10 and PL11) were documented in TR9. The stratigraphic sequences observed at PL10 and PL11 are presented below.

Table 20. Stratigraphic Layer Descriptions for Profile Locale 9 in Trench 8.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/33	22-33 cm thick; dark brown (10YR 3/3, moist) silty clay; slightly hard, firm, slightly sticky, plastic; common, fine to medium, interstitial roots; gradual, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	22/58	28-36 cm thick; very dark gray (10YR 3/1 , moist) silty clay; slightly hard, firm, very slightly sticky, slightly plastic; few, fine to very fine interstitial roots; abrupt, wavy lower boundary.
III	48/77	19-22 cm thick; very dark grayish brown (10YR 3/2, moist) silty clay with strong brown (10YR 5/8, moist) staining on ped surfaces; slightly hard, firm, slightly sticky, slightly plastic; very few, fine, interstitial roots; abrupt, smooth lower boundary.
IV	70/85	4-10 cm thick; very dark brown (10YR 2/2, moist) to dark brown (10YR 3/3, moist) silt; soft, friable, nonsticky, nonplastic; few, very fine, interstitial roots; abrupt, wavy boundary.
V	74/89	2-6 cm thick; very dark gray (10YR 3/1, moist) silty clay; slightly hard, firm, sticky, plastic; few, very fine, interstitial roots; gradual, broken boundary.
VI	76/100	Dark brown to dark yellowish brown (10YR 3/3.5, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; very few, very fine interstitial roots; abrupt, broken lower boundary.
VII	80/113	16-20 cm thick; dark brown (7.5YR 3/3, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no rock inclusions; very few, very fine, interstitial roots; abrupt, smooth lower boundary.
VIII	100/120	6-8 cm thick; dark brown (10YR 3/3, moist) silt; slightly hard, friable, nonsticky, nonplastic; no rock inclusions; no roots; clear, wavy lower boundary.
IX	106/132	12-24 cm thick; dark brown to very dark grayish brown (10YR 3/2.5, moist) silty clay; slightly hard, firm, very slightly sticky, very slightly plastic; no rock inclusions; no roots; lower boundary not reached
X	132/134+	2 + cm thick; very dark brown (10YR 2/2, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; no rock inclusions; no roots; lower boundary not reached.

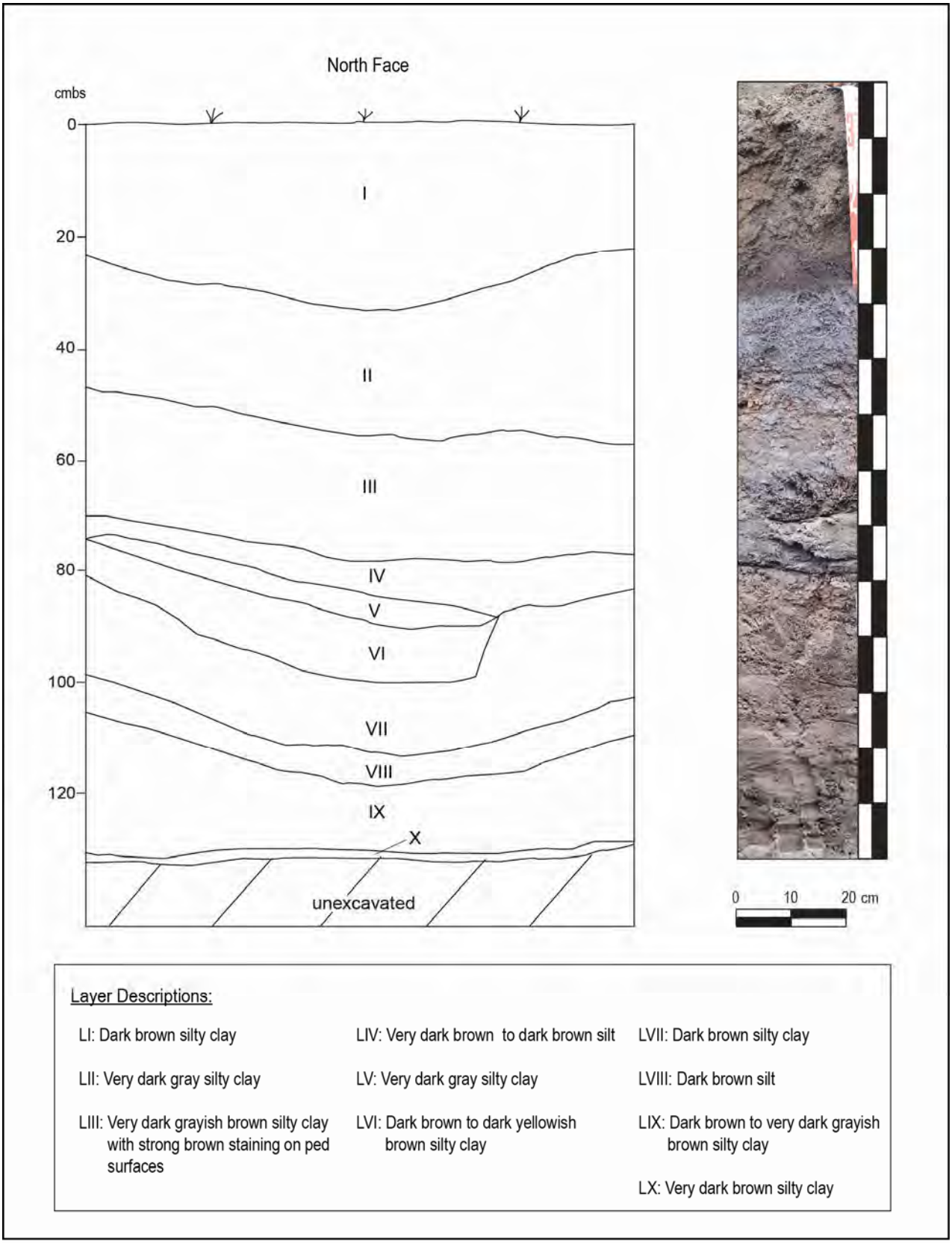


Figure 33. Profile and Photograph of North Face of Trench 8 at Profile Locale 9.



Trench 9, post-excavation; view to northeast.

Figure 34. Overview Photograph of Trench 9.

Profile Locale 10

Profile Locale 10 (PL10) was documented on the west face of TR9. The base of excavation at this locale was approximately 132 cmbs.

A total of four stratigraphic layers were identified at PL10, and designated as Layers I-IV. Table 21 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 35 presents the profile drawing at PL10 and a photograph. Layer II dark brown silty clay loam deposits are 92-104 cm thick. Layer IV is a sandy silt deposit.

A piece of sugar cane slag was found and collected at approximately 80 cmbs in Layer II deposits. No other archaeological materials or features were encountered in Layers I-IV at PL10.

Table 21. Stratigraphic Layer Descriptions for Profile Locale 10 in Trench 9.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/18	12-18 cm thick; dark brown (10YR 3/3, moist) silty clay loam; firm, slightly sticky, slightly plastic; common, fine to medium, interstitial roots; gradual, smooth lower boundary; contains recent rubbish items (glass, metal, plastic).
II	12/120	92-104 cm thick; dark brown (7.5YR 3/2 , moist) silty clay loam; slightly hard, firm, very slightly sticky, slightly plastic; very few, very fine interstitial roots; diffuse, wavy lower boundary.
III	102/131	8-56 cm thick; brown (10YR 4/3, moist) silty clay; slightly hard, firm, slightly sticky, very slightly plastic; no roots; abrupt, wavy lower boundary.
IV	124/132+	2-8+ cm thick; dark yellowish brown (10YR 3/4, moist) sandy silt; soft, very friable, nonsticky, nonplastic; no roots; lower boundary not reached.

Profile Locale 11

Profile Locale 11 was documented on the east face of TR9. The base of excavation at this locale was approximately 134 cmbs.

A total of four stratigraphic layers were identified at PL11, and designated as Layers I-IV. In addition, a dark reddish brown lens, designated as Lens B, was present near the surface of Layer II. Table 22 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 36 presents the profile drawing at PL11 and a photograph.

Layer IV at PL11 appears to have been impacted by some type of disturbance, possibly excavation associated with sugar cane agriculture. A roughly vertical section of Layer IV dark yellowish brown sandy silt extends up into Layer III brown silty clay deposits (see Figure 36). No archaeological materials or features were encountered in Layers I-IV at PL11.

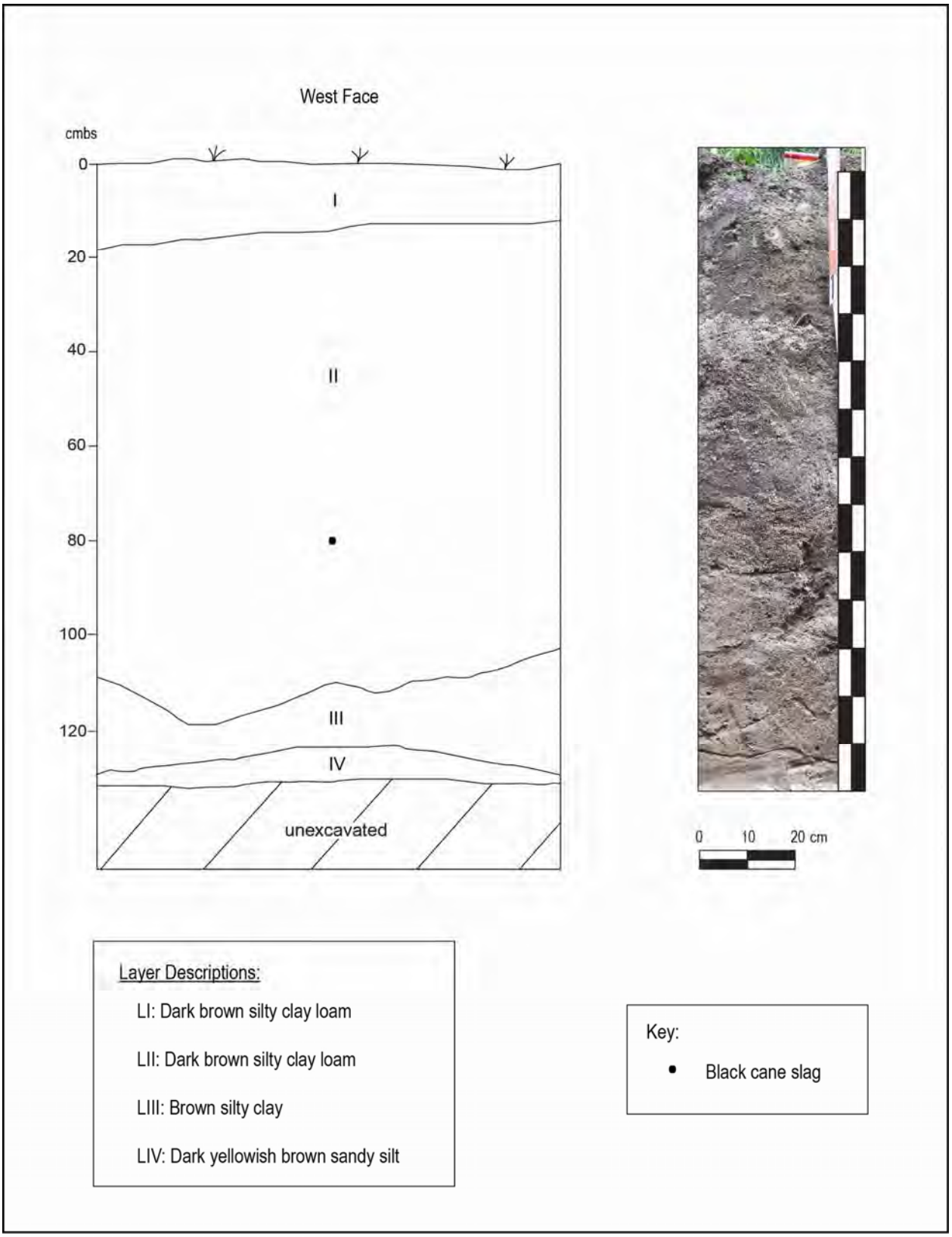


Figure 35. Profile and Photograph of West Face of Trench 9 at Profile Locale 10.

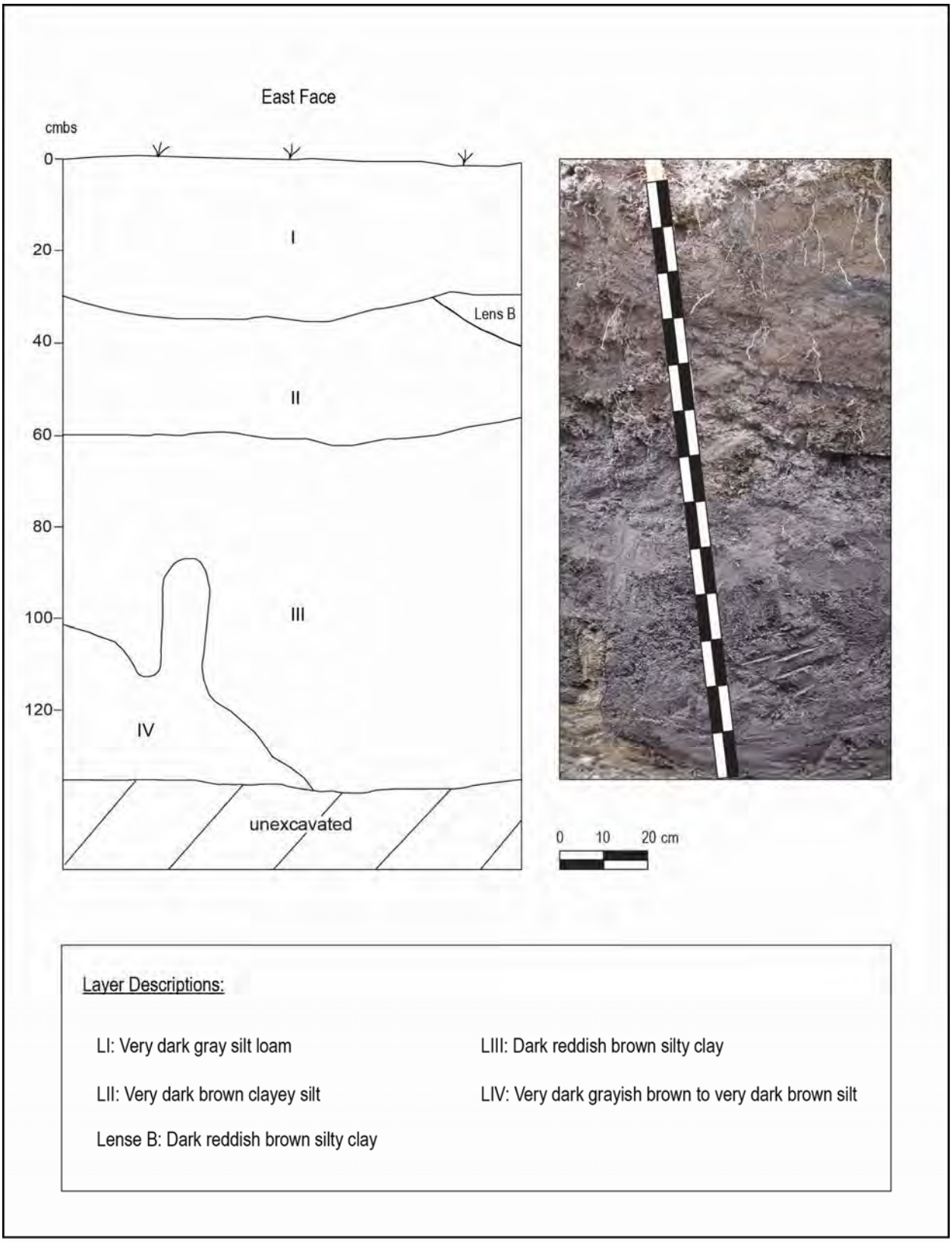


Figure 36. Profile and Photograph of East Face of Trench 9 at Profile Locale 11.

Table 22. Stratigraphic Layer Descriptions for Profile Locale 11 in Trench 9.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/35	24-35 cm thick; very dark gray (10YR 3/1, moist) silt loam; hard, firm, slightly sticky, plastic; common, fine, interstitial roots; diffuse, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	24/62	26-31 cm thick; very dark brown (10YR 2/2 , moist) clayey silt; slightly hard, firm, very slightly sticky, slightly plastic; common, fine interstitial roots; diffuse, wavy lower boundary.
Lens B	24/40	2-12 cm thick; dark reddish brown (5YR 3/2 , moist) silty clay; slightly hard, firm, sticky, slightly plastic; few, fine interstitial roots; clear, wavy lower boundary.
III	56/134+	40-75+ cm thick; dark reddish brown (5YR 2.5/2, moist) silty clay; slightly hard, firm, sticky, plastic; few, fine, interstitial roots; clear, irregular lower boundary where Layer IV is present; lower boundary not reached where Layer IV is absent.
IV	92/134+	4-40+ cm thick; Very dark grayish brown to very dark brown (10YR 2.5/2, moist) silt; slightly hard, friable, nonsticky, nonplastic; no roots; lower boundary not reached

TRENCH 10

Trench 10 (TR10) was excavated in the southeast quadrant of the project area (see Figure 9; see Table 4), east of TR9. Trench 10 was excavated to depths ranging from 152 to 160 cmbs. Figure 37 presents an overview photograph of TR10, post-excavation. A total of eight stratigraphic layers were identified in TR10 (Layers I-VIII). No archaeological materials or features were found in TR10 excavations.

Two profile locales (PL18 and PL19) were documented in TR10. The stratigraphic sequences observed at PL18 and PL19 are presented below.

Profile Locale 18

Profile Locale 18 (PL18) was documented on the south face of TR10. The base of excavation at this locale was approximately 160 cmbs.

A total of eight stratigraphic layers were identified at PL18, and designated as Layers I-VIII. Table 23 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 38 presents the profile drawing at PL18 and a photograph. Layers VI, VII and VIII consist of silt and clayey silt deposits. No archaeological materials or features were found in Layers I-VII at PL18.



Trench 10, post-excavation; view to northwest.

Figure 37. Overview Photograph of Trench 10.

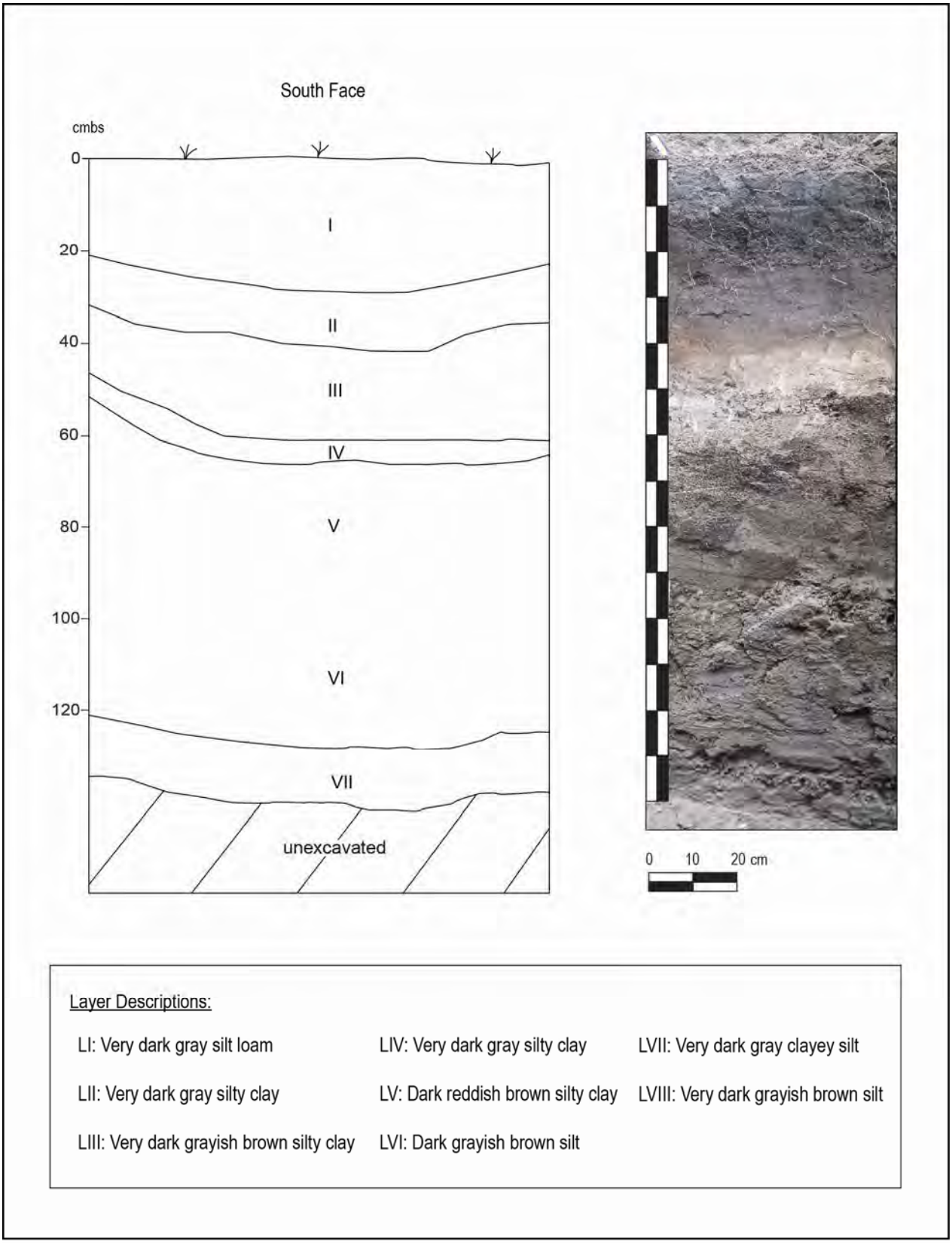


Figure 38. Profile and Photograph of South Face of Trench 10 at Profile Locale 18.

Table 23. Stratigraphic Layer Descriptions for Profile Locale 18 in Trench 10.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/28	20-28 cm thick; very dark gray (10YR 3/1, moist) silt loam; slightly hard, firm, slightly sticky, plastic; common, fine, interstitial roots; gradual, wavy lower boundary; contains recent rubbish items (glass, metal, plastic).
II	20/40	10-12 cm thick; very dark gray (10YR 3/1, moist) silty clay; slightly hard, firm, sticky, plastic; common, fine interstitial roots; diffuse, wavy, lower boundary.
III	32/60	14-26 cm thick; very dark grayish brown (10YR 3/3, moist) silty clay; slightly hard, firm, slightly sticky, very slightly plastic; common, fine, interstitial roots; clear, wavy lower boundary.
IV	47/64	3-4 cm thick; very dark gray (10YR 3/1, moist) silty clay; slightly hard, friable, slightly sticky, slightly plastic; very few, fine, interstitial roots; clear, wavy, lower boundary.
V	52/106	18-46 cm thick; dark reddish brown (5YR 3/3, moist) silty clay; slightly hard, slightly sticky, slightly plastic; very few, fine, interstitial roots; clear, wavy lower boundary.
VI	70/124	14-50 cm thick; dark grayish brown (10YR 4/2, moist) silt; soft, very friable, nonsticky, nonplastic; few, fine, interstitial roots; diffuse, wavy lower boundary.
VII	118/136	12-14 cm thick; very dark gray (10YR 3/1, moist) clayey silt; slightly hard, slightly sticky, slightly plastic; no roots; diffuse, wavy lower boundary.
VIII	130/160+	28-30+ cm thick; very dark grayish brown (10YR 3/2, moist) silt; slightly hard, nonsticky, nonplastic; few, fine, interstitial roots; lower boundary not reached.

Profile Locale 19

Profile Locale 19 was documented on the south face of TR10, approximately 7 m south of PL18. The base of excavation at PL19 ranged from 120 to 152 cmbs.

A total of five stratigraphic layers were identified at PL19, and designated as Layers I-V. Table 24 presents the maximum layer depths (top/bottom) and stratigraphic layer descriptions for these layers. Figure 39 presents the profile drawing at PL19 and a photograph. Layer IV at this locale appears to have been impacted, possibly by excavations associated with sugar cane agriculture. The surface of Layer IV slopes down to the east.

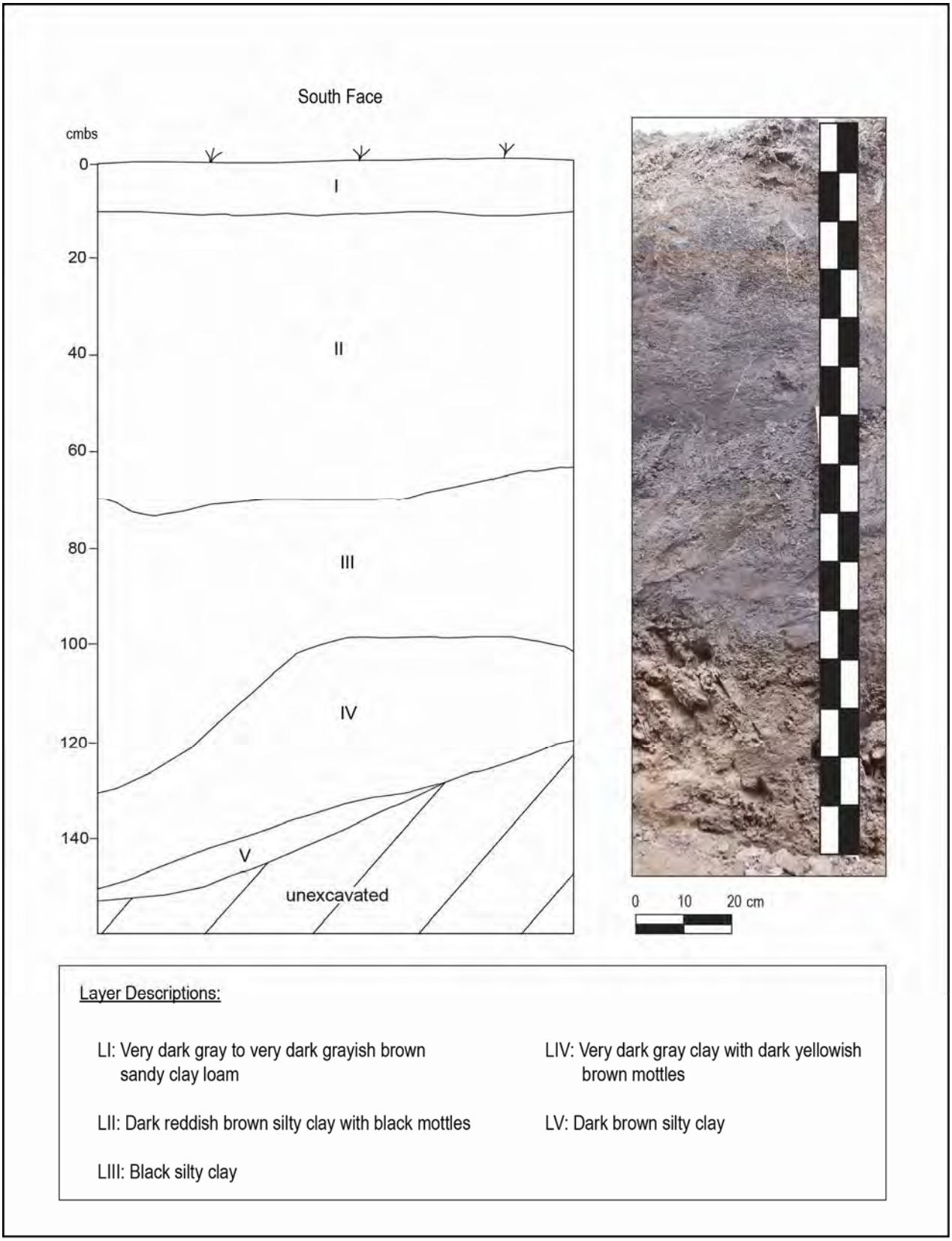


Figure 39. Profile and Photograph of South Face of Trench 10 at Profile Locale 19.

Table 24. Stratigraphic Layer Descriptions for Profile Locale 19 in Trench 10.

Layer	Maximum Layer Depths (cmbs)	Layer Descriptions
I	0/12	11-12 cm thick; very dark gray to very dark grayish brown (10YR 3/1.5, moist) sandy clay loam; slightly hard, firm, slightly sticky, plastic; common, fine to medium, interstitial roots; gradual, smooth lower boundary; contains recent rubbish items (glass, metal, plastic).
II	11/70	52-60 cm thick; dark reddish brown (5YR 3/2 , moist) silty clay; black (10YR 2/1, moist) mottles present; slightly hard, firm, very slightly sticky, slightly plastic; common, fine, interstitial roots; clear, wavy lower boundary.
III	64/130	36-60 cm thick; black (7.5YR 2.5/1, moist) silty clay; slightly hard, firm, slightly sticky, slightly plastic; few, fine, interstitial roots; abrupt, wavy lower boundary.
IV	99/150	20-28 cm thick; very dark gray (7.5YR 3/1, moist) clay with dark yellowish brown (10YR 3/4, moist) mottles; hard, firm, sticky, plastic; very few, fine, interstitial roots; gradual, wavy, lower boundary.
V	130/152+	2-8+ cm thick; dark brown (7.5YR 3/3, moist) silty clay; slightly hard, friable, slightly sticky, slightly plastic; no roots; lower boundary not reached.

LABORATORY RESULTS

This section presents the analysis of a single historic artifact, a sample of wood charcoal, and a piece of sugar cane slag.

Historic Artifact

A single historic glass artifact was recovered during subsurface testing in the ʻĪao Stream project area. It was recovered in situ from Layer III deposits on the south face of TR7 at PL7. This specimen is a clear glass fragment that is likely from a bottle or a jar.

The glass fragment has a flattened facet on the exterior surface, and measures 3.5 long, from 0.7 to 2.0 cm wide, and is 0.40 cm thick. Figure 40 presents a photograph of the glass fragment.

Floral Materials

A bulk sample of Layer VI silt deposits in TR1 was collected to examine the charcoal flecking observed on the west side of TR1 at PL1. When the sample was examined in the lab, three thin flakes of what appeared to be wood charcoal were observed. Using forceps, the charcoal flakes were so fragile that two of the flakes disintegrated when first touched. Based on the size and thickness of these flakes, their weight was estimated to be less than 0.01 grams.

Sugar Cane Slag

A single piece of sugar cane slag was recovered in situ from Layer II deposits on the west face of TR9 at PL10. Slag is created during the burning of sugar. During these intense fires, the sediments in the soils get super-heated and melt. With the right mixture of minerals in the soils and the sugar, cane slag forms. Cane slag has been observed in sugar cane fields in Kahuku on O`ahu by the authors.



Top view.



Side view

Figure 40, Photographs of Clear Glass Fragment from TR7 at Profile Locale 7.

SUMMARY AND INTERPRETIVE DISCUSSION

Under contract to GSI Pacific, Inc. (GSI), Pacific Consulting Services, Inc. (PCSI) conducted a subsurface archaeological inventory survey (AIS) on an approximate 0.7-hectare (1.7-acre) project area located along the north bank of ʻĪao Stream, about 2.1 km (1.3-miles) inland (southwest) of Nehe Point in Wailuku Ahupuaʻa.

Background research has determined that the historic land use of the project area included both wetland taro (*loʻi*) and sugar cane agriculture. LCAs in and near the project area indicate that *loʻi* systems may have been present in this locale (see Table 1).

Sugar was grown in this region as early as 1880s and based on Figure 5 may have been well established in the project area by the early 1900s. After the devastation caused by the 1916 flood, sugar was replanted. Based on Figures 6 and 7, sugar was flourishing during the 1950s and 1960s in this locale. A sugar mill was constructed close to the project area.

To address research questions pertaining to the presence/absence of features associated with pre-Contact *loʻi* systems and sugar cane agriculture, as well as a 1916 flooding event that caused devastation in this region, a program of subsurface archaeological testing was implemented (Vernon and Gosser 2014). The research questions are addressed later in this section.

Ten backhoe trenches (TR1-10) were excavated within the project area (see Figure 9). These averaged approximately 20 m long and 1.2 m wide, and were excavated to depths ranging from 60 to 260 cmbs. Four of the trenches, TR2, TR4, TR5, and TR6, exposed a cobble/pebble layer observed along the banks at the base of ʻĪao Stream. The assumption related to exposing this cobble/pebble layer in some of the trenches is that this layer likely predates the settlement of ʻĪao Valley by Hawaiians.

In all of the trenches, the upper proveniences of the stratigraphic sequence are disturbed. This is due to two factors: (1) the recent bulldozing of this area to remove expediently built structures on the property, and (2) sugar cane agriculture.

Trench 5, situated closest to ʻĪao Stream, exhibits a stratigraphic sequence that does not appear to have been impacted by sugar cane agriculture. The absence of evidence of sugar cane agriculture in TR5 is based on the presence of internal bedding (microstratigraphy) observed in the thicker layers within this trench. This trench is also quite close to (within 10 meters) ʻĪao Stream, which may have been too close to plant sugar cane.

No definitive pre-Contact archaeological materials or features were found during excavations. One piece of non-diagnostic, clear historic glass was found in situ in Layer III, TR7. Very sparse charcoal flecking was found in Layer VI silt deposits in TR1 (PL1).

STRATIGRAPHY

A total of ten stratigraphic layers, designated as Layers I-X, and two lenses (Lens A and Lens B) were identified and documented through 19 profile drawings (see profile drawings for PL1-20) in TR1-10.

The environment of deposition for the documented stratigraphic layers is the flood plain associated with ʻĪao stream. This is based on the topography of the project area and surrounding lands, the presence of the adjacent ʻĪao Stream, and the fine-textured sediments (clays, silty clays, silts, clayey silts sandy silts) that comprise the layers.

The mode of deposition for these layers is alluvial deposition, specifically, ʻĪao Stream flooding events that resulted in overflowing stream waters transporting fine-textured sediments onto the flood plain. One flooding event had sufficient force to transport basalt cobbles and

pebbles. This flooding event is evident by the cobble/pebble layer visible along the banks of the stream.

The color and texture variations documented in the stratigraphic sequences in TR1-10 were immediately visible. These variations were so extensive that the sequences varied from one end of a trench to the other. In addition, layers in any given stratigraphic position varied from one trench to the next. For example, in the fourth stratigraphic position, Layer IV color and texture variations included (but were not limited to) dark yellowish brown (10YR 3/4) silt in TR1 (PL1), dark brown (7.5YR 3/4) silty clay in TR7 (PL6), dark reddish brown (5YR 2.5/2) silty clay in TR9 (PL11), very dark grayish brown (10YR 3/2) sandy silt in TR1 (PL3), very dark gray (5YR 3/1) clayey silt in TR5 (PL17), and black (10YR 2/1) clay in TR2 (PL20).

While there are extensive textural variations in the stratigraphic layers in all stratigraphic positions, it is noted that stratigraphic layers comprising the upper proveniences of the sequences (Layers I-III) are primarily silty clays, silty clay loams, clays, and silt loams. In lower proveniences, starting with the fourth stratigraphic position (Layer IV), it was observed that the number of layers containing primarily silt deposits increased. These deposits, including silts, sandy silts, and clayey silts (as opposed to silty clays, clays, silt loams, and silty clay loams in Layers I-III) are present in layers that frequently do not exceed 20 cm in thickness.

With this extensive variation in color and texture, it was decided not to attempt definitive correlations of individual layers within the sequences across the project area. Figure 41 therefore presents preliminary interpretive correlations on a general level using 17 of the 19 documented stratigraphic sequences in TR1-10. These interpretive correlations are shown on the composite stratigraphic sequence in Figure 10. A general discussion of the layers observed in the stratigraphic sequences is presented below.

Layer I

In the first stratigraphic position, Layer I deposits represent the modern A Horizon-an organic rich surface layer that supports vegetation. In the project area, Layer I consists predominantly of dark grayish brown, dark gray, and dark brown silty clay loams and silty clays. Observations indicate that Layer I is also a disturbed and mixed zone, probably due to the recent grading of the project area in support of cleaning a homeless camp (Kanalei Shun, personal communication). The depth of recent grading/bulldozing, defined as the base of Layer I, ranges from 11 to 40 cmbs (see Figure 41).

Recent trash items were found in Layer I deposits, including items of rusted metal, plastic, glass, ceramic, aluminum cans, and broken segments of PVC pipe. None of these items were collected.

The Sugar Cane Agriculture Zone

Prior to fieldwork, it was anticipated that layers near the surface would reflect sugar cane agriculture. Based on stratigraphic position, as well as on the presence of items like black plastic and sugar cane slag, Layers II and III, and *possibly* Layer IV, are believed to be associated with sugar cane agriculture (see Figure 41). The predominantly dark sediments of these layers also support this interpretation.

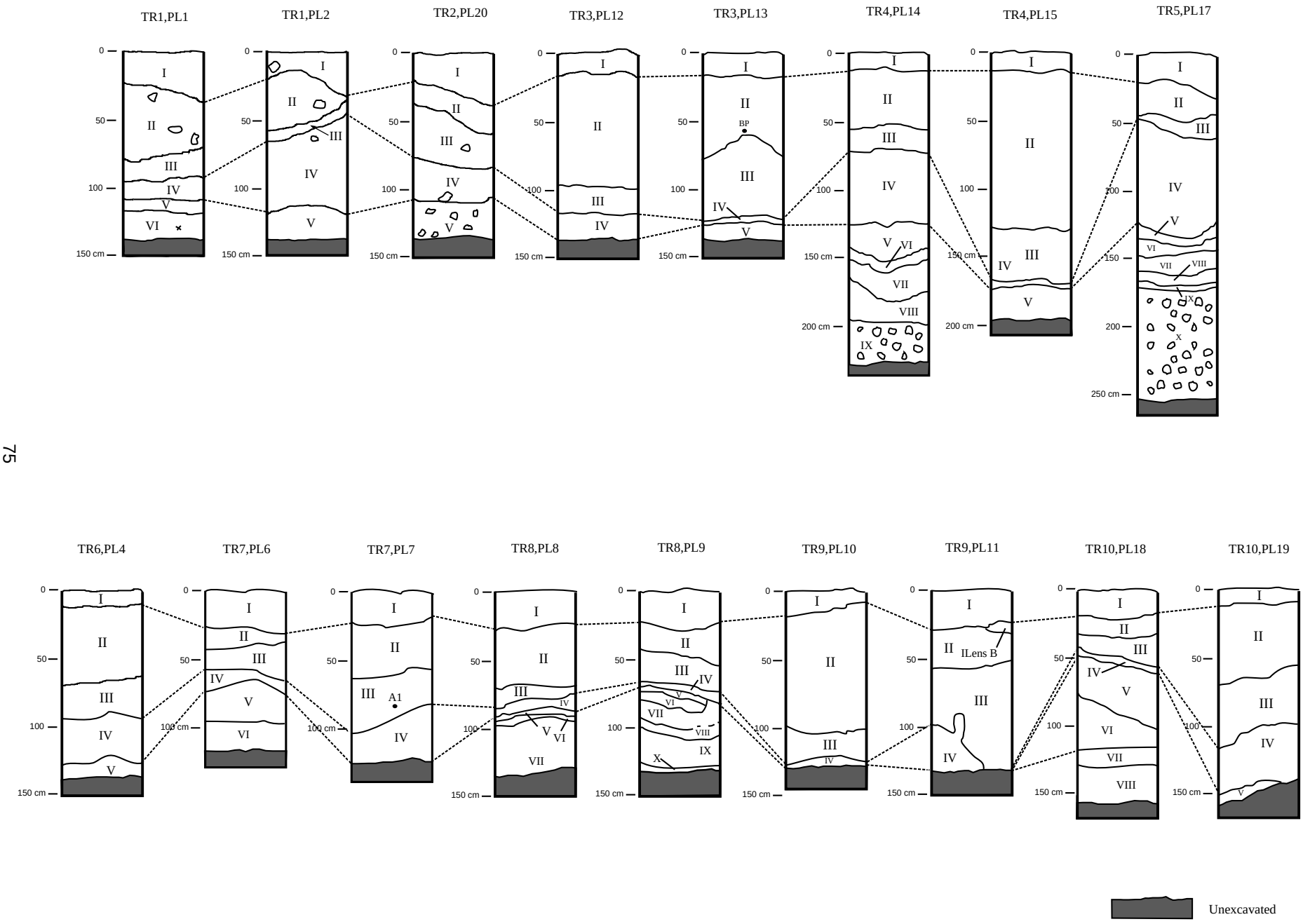


Figure 41. Preliminary Stratigraphic Correlations.

Layers II and III

Layer II consists predominantly of dark soils/sediments- very dark gray, very dark brown, and dark brown silty clays, silty clay loams, clayey silts, clays, and silt loams. Pieces of black plastic and sugar cane slag were found in Layer II deposits in TR3 (PL13) and TR9 (PL10), respectively. Black plastic was used, and is still being used today in sugar cane agriculture to control weeds after initial plantings. Sugar cane slag is sometimes created during the burning of sugar cane. Slag is created by the burning of sugar and super heating of the sediments in the soils. With the right mixture of minerals in the soils and the sugar, cane slag forms. This has been seen in sugar cane fields in Kahuku on O‘ahu by the authors.

Layer III also consists of dark soils and sediments-dark brown, very dark brown, and dark reddish brown silty clays, silty clay loams, silt loams, clays, clayey silts, and sandy silts. While no plastic or cane slag was observed in Layer III, a piece of clear glass, from a bottle or jar, was found in situ in the dark brown silty clay deposits of Layer III in TR7 (PL7). This glass fragment is, unfortunately, small and non-diagnostic. Its presence in situ, however, does place Layer III in the post-Contact period (post A.D. 1778), most likely between the late 1800s and the mid-twentieth century, and possibly as late as 1988 (Wilcox 1996:125).

The presence of strong brown staining of ped surfaces observed in Layer III may also be evidence that Layer III is associated with sugar cane agriculture. Peds are the basic structural units of soil, and iron in the soil often leaves a reddish residue on the roots of plants. These residues were observed in Layer III soil samples collected from PL8 and PL9 in TR8.

The thicknesses of Layer II and III deposits across the project area also support the interpretation of sugar cane agriculture. The average thickness of Layer II is 54 cm (thickness range is 12 to 119 cm), while the average thickness of Layer III is 37 cm (thickness range is 10 to 75 cm). When combined the average thickness of these two layers is 91 cm, which is approximately 3 feet, which is within the range of plow zone thickness for sugar cane fields.

The depth of the sugar cane plow zone, defined as the base of Layer III, ranges from 48 to 170 cmbs. If Layer IV is included in the sugar cane plow zone, the maximum depth of this plow zone would extend to 174 cmbs, representing only a slight increase in depth.

Layer IV

It is quite possible that Layer IV is also associated with sugar cane agriculture. Layer IV consists of darker sediments, including very dark brown, dark brown, dark gray, very dark grayish brown, dark yellowish brown, and dark reddish brown silty clays, clays, sandy silts, clayey silts and silts. Considering the historic clear glass fragment found in Layer III and the impacts to Layer IV believed to be caused by grading/excavation by heavy machinery associated with Layer III, it is postulated that Layer IV is associated with early sugar cane production in the project area (late 1800s-early 1900s). The presence of strong brown staining of ped surfaces observed in Layer IV at in TR3 (PL13), TR4 (PL15), and TR6 (PL5) supports an interpretation of sugar cane agriculture.

Profile Locales 11 (TR9) and 19 (TR10) suggest that grading or excavations associated with Layer III impacted not only the surface the Layer IV (see Figure 29; see Figure 41), but middle to lower proveniences of Layer IV as well (see Figure 27; see Figure 41). These impacts to Layer IV are believed to be associated with grading and replanting of sugar cane sometime during the early twentieth century. A more precise date of these impacts to Layer IV cannot be determined at this time.

The Anticipated *Lo‘i* Zone: Layers V-IX

The search for evidence of pre-Contact *lo‘i* systems and associated subsurface habitation features focused on subsurface proveniences at the base of the sugar cane plow zone, or directly underlying the plow zone. Thus, if there were pre-Contact subsurface agricultural and habitation features, these would likely be visible between Layers III/IV and as deep as Layer VI (see Figure 41). There may even have even a remote possibility that these subsurface features would be present as deep as the layers that directly overlying the cobble/pebble layer noted in the banks of ‘Īao Stream.

All 10 trenches reached Layer IV deposits. Eight of the 10 trenches reached Layer V deposits. Only seven profile locales reached deposits below Layer V. As can be seen in Figure 41, many of the layers below Layer IV are relatively thin compared to Layers II-IV. It is in these lower proveniences that PCSI anticipated finding evidence of the 1916 flooding event as well as evidence of *lo‘i* agriculture.

The presence of very sparse charcoal flecking (no fragments observed) in Layer VI in TR1 (PL1) is the only material observed that could be construed as evidence for pre-Contact *lo‘i* agriculture. However, this charcoal flecking was observed *only* in this locale; no other charcoal was seen in Layers V-IX. Layer VI is an alluvially deposited silt, and the charcoal was within the layer matrix, not within a subsurface feature. Therefore, the charcoal could have originated anywhere upstream from the project area and deposited in the project area. A bulk sample was collected where the charcoal flecking was observed, but the weight of the charcoal (less than 0.01 g) was insufficient for radiocarbon dating.

Since no *definitive* evidence of *lo‘i* agriculture or associated habitation features were identified anywhere in the stratigraphic sequences, Layers V-IX identified above the cobble/pebble layer, are interpreted as non-cultural in situ alluvial deposits comprised of fine-textured terrigenous sediments.

The Cobble/Pebble Layer

While three of the trenches, TR4, TR5, and TR6, were excavated deeper (190-260) in order to reach a cobble/pebble layer observed along the banks of ‘Īao Stream, this deposit was also encountered in TR2. This is due to the fact that the area where TR2 was excavated was a depression and was approximately 0.50 m lower than the surrounding areas. As stated previously, the assumption related to exposing this cobble/pebble layer in TR4-6 is that this layer likely predates the settlement of ‘Īao Valley by Hawaiians.

This layer contains approximately 50-60%, by volume, decomposing, rounded to subrounded basalt cobbles and pebbles. Small boulders and gravels are also present. The fine sediments present in the cobble/pebble layer vary and include silts, silty sands, and silt loams. The cobble/pebble layer was identified in the fifth stratigraphic position (Layer V, TR2, PL20; Layer V, TR4, PL15), the seventh stratigraphic position, (Layer VII, TR6, PL5), the ninth stratigraphic position (Layer IX, TR4, PL14), and the tenth stratigraphic position (Layer X, TR5, PL15).

RESEARCH QUESTIONS.

Three research questions that drove the sampling strategy and fieldwork are restated here:

1. *Is there evidence of pre-Contact/early post-Contact lo‘i in the project area? If so, is there sufficient evidence to determine the age and integrity of the historic properties?*

2. *Is there evidence of temporary pre-Contact occupation associated with lo‘i or post-Contact occupation associated with sugarcane cultivation?*
3. *Is there stratigraphic evidence of the 1916 flood episode and if so can subsurface features be temporally correlated with this episode?*

Questions 1 and 2:

1. *Is there evidence of pre-Contact/early post-Contact lo‘i in the project area? If so, is there sufficient evidence to determine the age and integrity of the historic properties?*
2. *Is there evidence of temporary pre-Contact occupation associated with lo‘i or post-Contact occupation associated with sugarcane cultivation?*

The subsurface testing yielded no definitive evidence of pre-Contact/early post-Contact *lo‘i* in the project area, nor was there evidence of temporary pre-Contact occupation associated with *lo‘i* or post-Contact occupation associated with sugar cane cultivation. There was no sign of subsurface features (pits, post molds, fire features, etc.) at the base of the sugar cane plow zone, or associated with layers below the plow zone. There were no buried *lo‘i* walls present, and no evidence of decomposing taro corms in the any of the layers. There was an insignificant amount of charcoal flecking in an insecure context (Layer VI, an alluvially-deposited silt layer) that cannot be construed as evidence because it could have originated anywhere upstream from the project area.

It is suspected that sugar cane agriculture may have obliterated any evidence for subsurface (buried) features associated with *lo‘i* systems or temporary habitation. It is also possible that the 1916 flooding event may have contributed to the destruction of such evidence.

Question 3: *Is there stratigraphic evidence of the 1916 flood episode and if so can subsurface features be temporally correlated with this episode?*

There was no definitive evidence that could be attributed to the 1916 flooding event that occurred in this region. Based on background research, after this flooding event, sugar cane was replanted and the damaged infrastructure was rebuilt. It is therefore likely that any evidence of the 1916 flooding event was obliterated by sugar cane agriculture.

RECOMMENDATIONS

Although no definitive evidence of pre-Contact use of the area was found during subsurface testing in the project area for Alternative F, background and archival documentation indicate that pre-Contact or early historic *lo‘i* agriculture occurred in the general region. There is also a potential for pre-Contact native Hawaiian burials to be present along the base of the sand dunes near Pihana Heiau. Therefore, it is recommended that archaeological monitoring be conducted during all ground disturbing activities to insure that any potential historic properties encountered are appropriately recorded and documented. It is also recommended that an archaeological monitoring plan (AMP) be prepared that includes anticipated finds as well as a summary discussion of the types (and interpretations) of the soil stratigraphic sequences likely to be encountered.

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APPENDIX A: LAND CLAIM AWARD DOCUMENTS

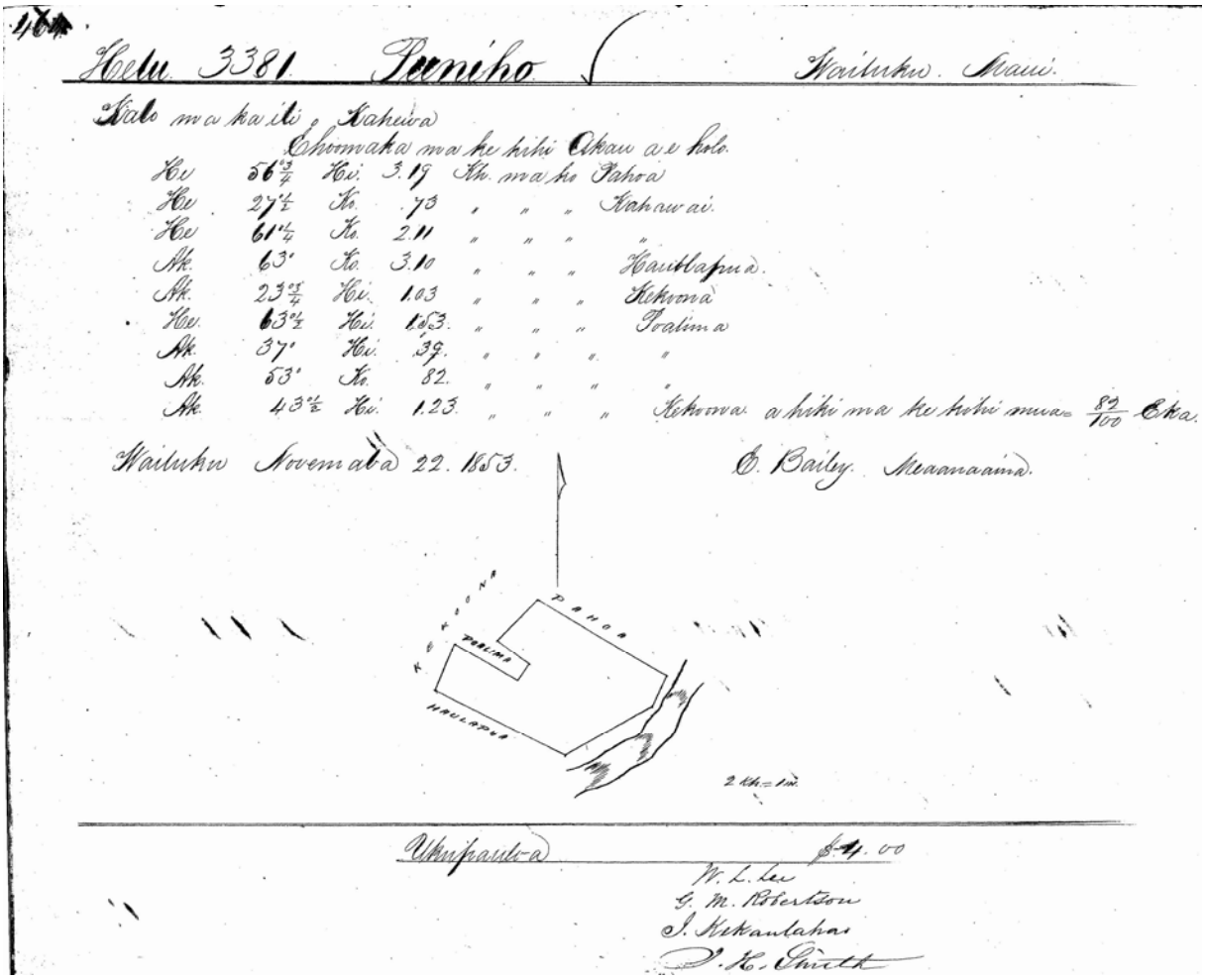
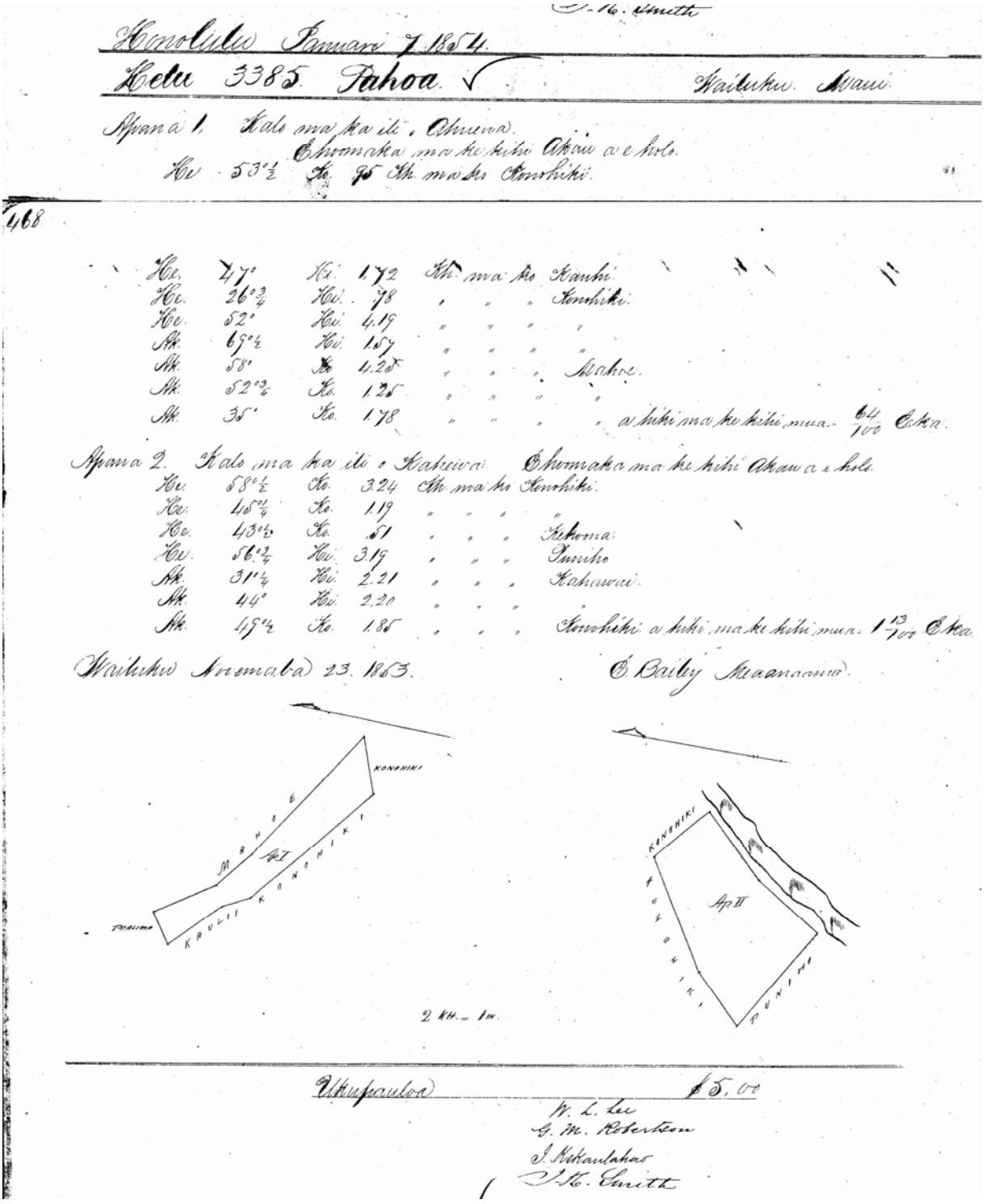


Figure A42. **LCA 3381 (Māhele Book 1848:464).**



Honolulu Januari 7 1854.

Helu 3385 Pahoa. Wailuku. Maui.

Apana 1. Kalo ma ka ili o Ahuewa.
Ehoomaka ma ke kihi Akau a e holo.
He 53°½ Ko. 95 Kh. ma ko Konohiki.

468

He. 47° Hi. 1.72 Kh. ma ko Kauhi.
He. 26°¾ Hi. .78 " " " Konohiki.
He. 52° Hi. 4.19 " " " "
Ak. 69°½ Hi. 1.57 " " " "
Ak. 58° Ko. 4.25 " " " Mahoe.
Ak. 52°¾ Ko. 1.25 " " " "
Ak. 35° Ko. 1.78 " " " " a hiki ma ke kihi mua. 64/100 Eka.

Apana 2. Kalo ma ka ili o Kahewa. Ehoomaka ma ke kihi Akau a e holo.
He. 58°½ Ko. 3.24 Kh. ma ko Konohiki.
He. 45°¼ Ko. 1.19 " " " "
He. 43°½ Ko. .51 " " " Kekoma.
He. 56°¾ Hi. 3.19 " " " Puniho
Ak. 31°¼ Hi. 2.21 " " " Kahawai.
Ak. 44° Hi. 2.20 " " " "
Ak. 49°½ Ko. 1.85 " " " Konohiki. a hiki ma ke kihi mua. 1 13/100 Eka.

Wailuku Novemaba 23. 1853. E. Bailey Meaanaama.

Ukupaulua $5.00

W. L. Lee
G. M. Robertson
J. Kekaulahao
J. K. Smith

Figure A43. LCA 3385 (Māhele Book 1848:467–8).

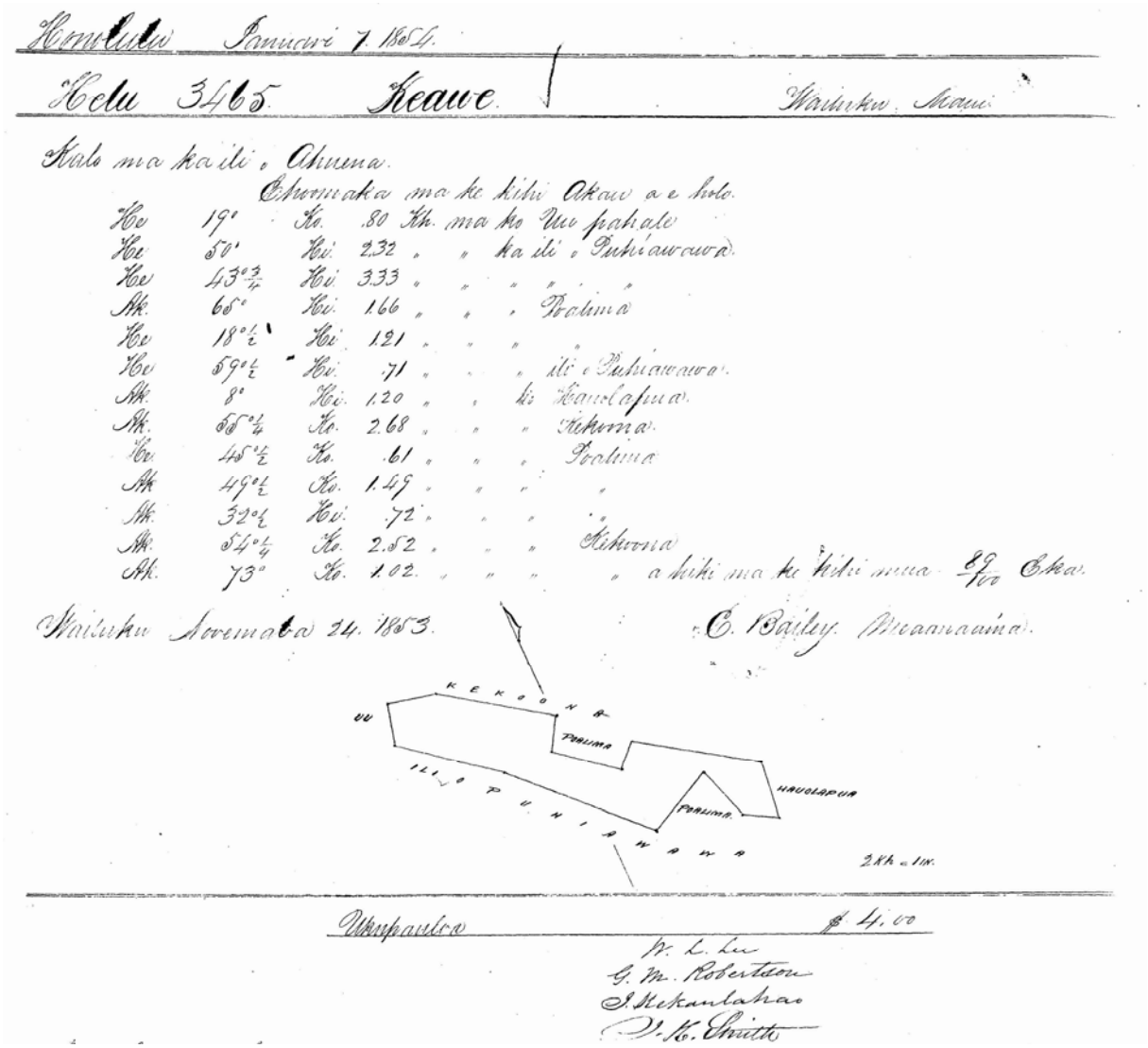


Figure A44. LCA 3465 (Māhele Book 1848:484).

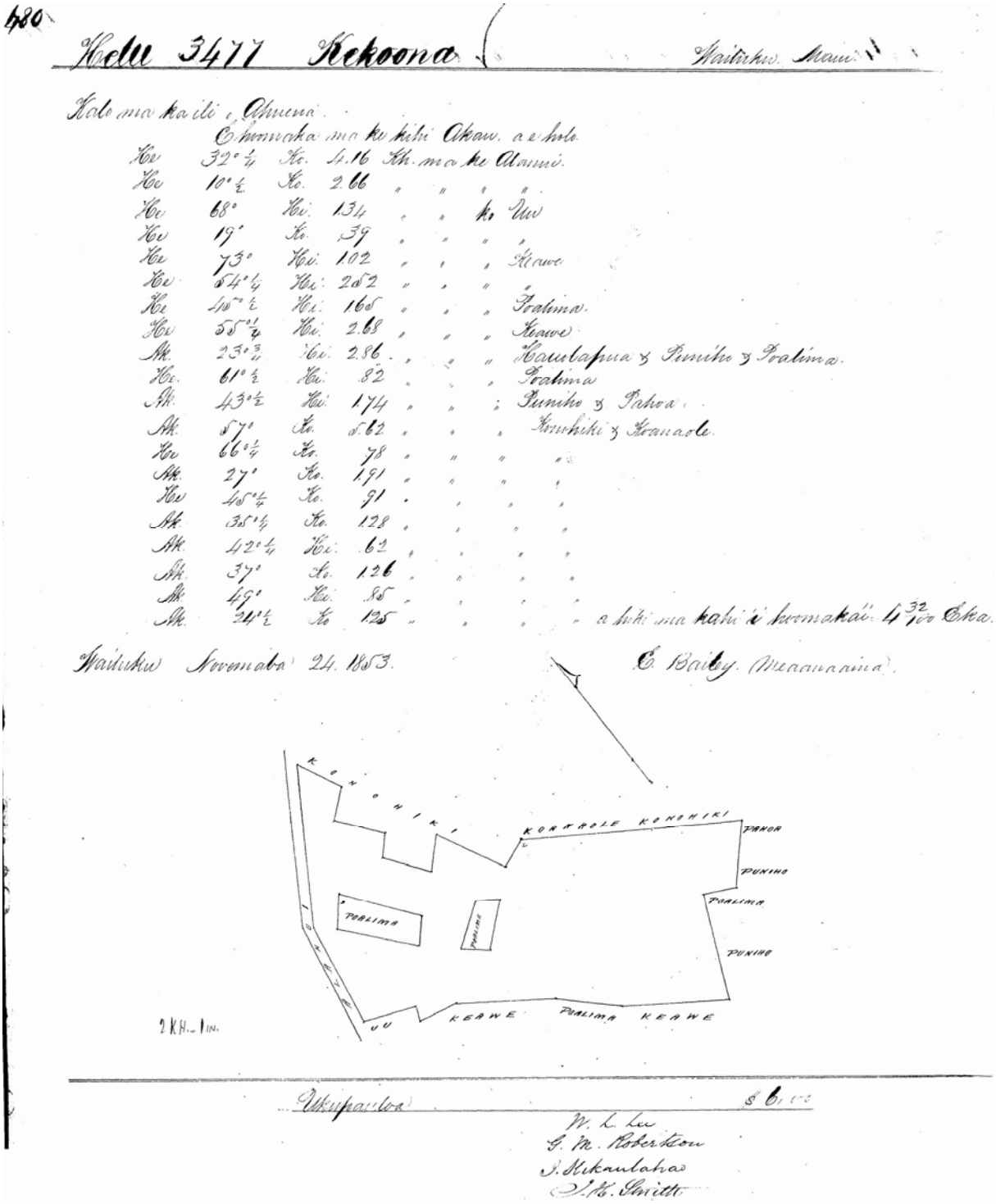


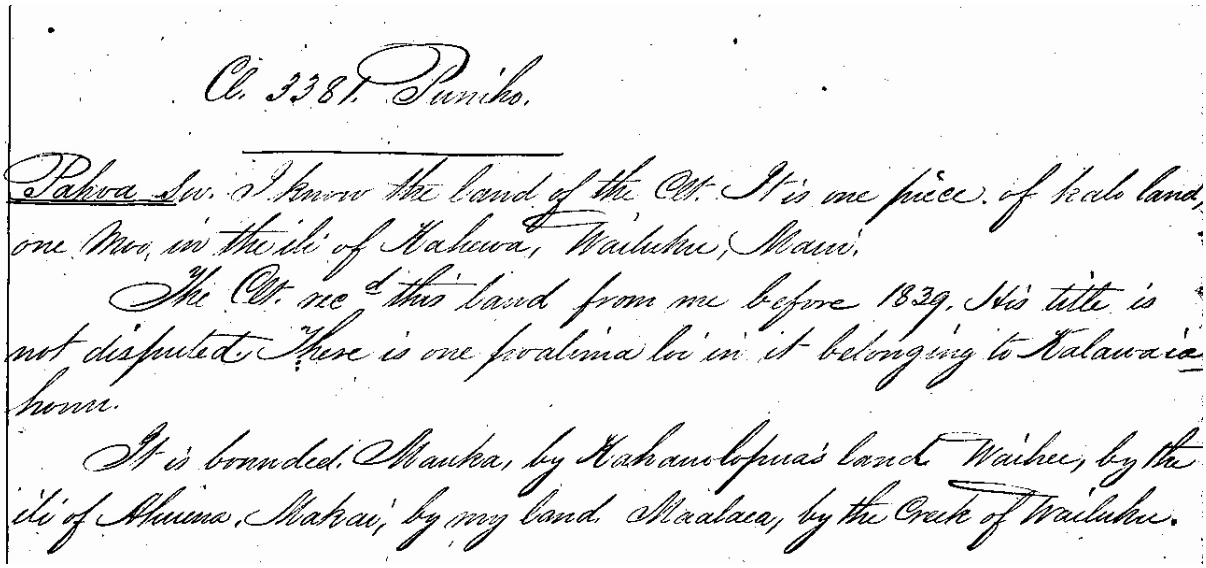
Figure A45. LCA 3477 (Māhele Book1848:480).

Reference

Buke Mahele

1948 *Buke Māhele*. http://www.avakonohiki.org/buke-mahele.html. Accessed 27 March 2014.

APPENDIX B: FOREIGN TESTIMONY DOCUMENTS



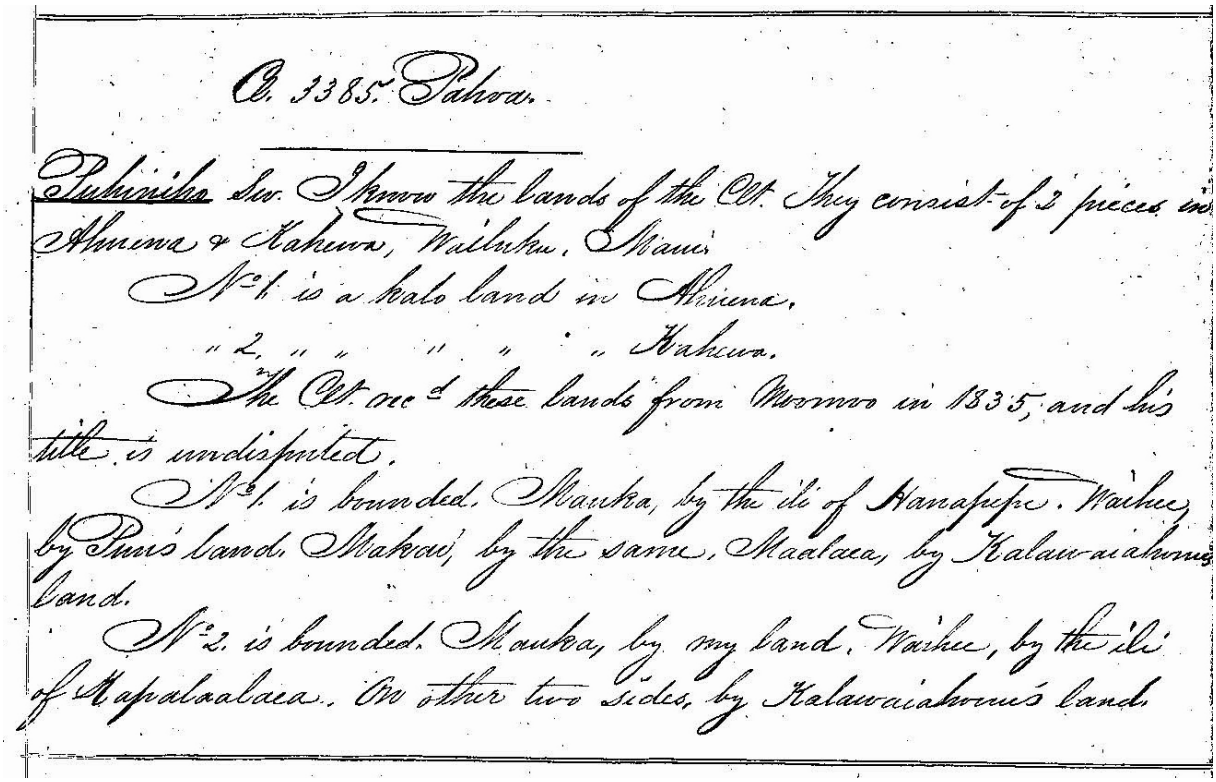
Cl. 3381. Puniho.

Pahoa Sw. I know the land of the Clt. It is one piece of kalo land, one Moo, in the ili of Kahewa, Wailuku, Maui.

The Clt. recd this land from me before 1839. His title is not disputed. There is one poalima loi in it belonging to Kalawaiahonu.

It is bounded. Mauka, by Kahauolopua's land. Waihee, by the ili of Ahuena. Makai, by my land. Maalaea, by the Creek of Wailuku.

Figure B1. F.T. for Claim 3381 (Foreign Testimony 1846-53:421).



Cl. 3385. Pahoa.

Puhiniho Sw. I know the lands of the Clt. They consist of 2 pieces in Ahuena & Kahewa, Wailuku. Maui.

No. 1. is a kalo land in Ahuena.

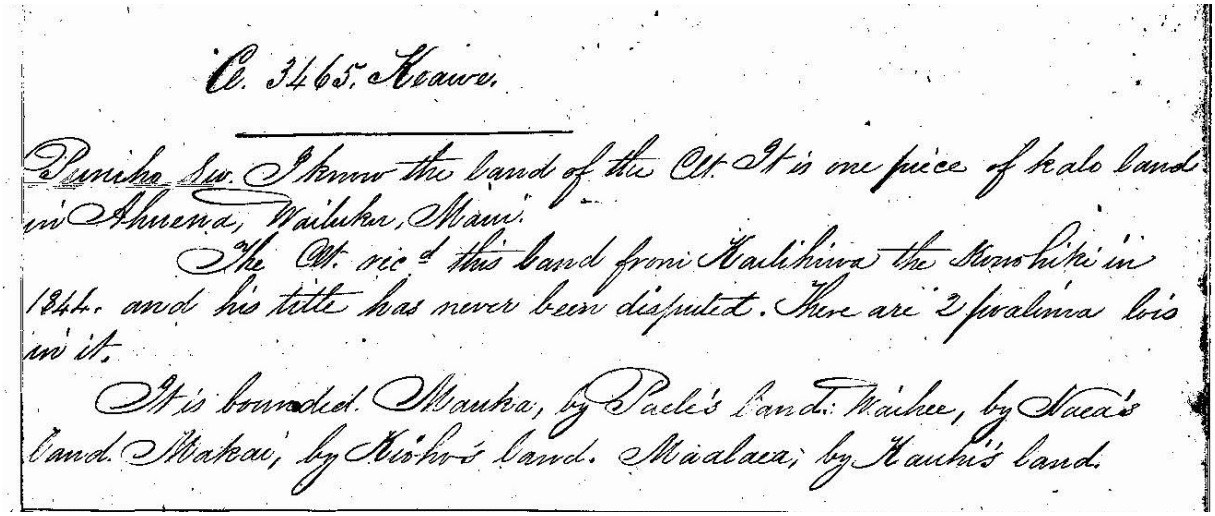
" 2. " " " " " Kahewa.

The Clt. recd these lands from Moomoo in 1835, and his title is undisputed.

No. 1. is bounded. Mauka, by the ili of Hanapepe. Waihee, by Puni's land. Makai, by the same. Maalaea, by Kalawaiahonu's land.

No. 2. is bounded. Mauka, by my land. Waihee, by the ili of Kapalaalaea. On other two sides, by Kalawaiahonu's land.

Figure B2. F.T. for Claim 3385 (Foreign Testimony 1846-53:413).



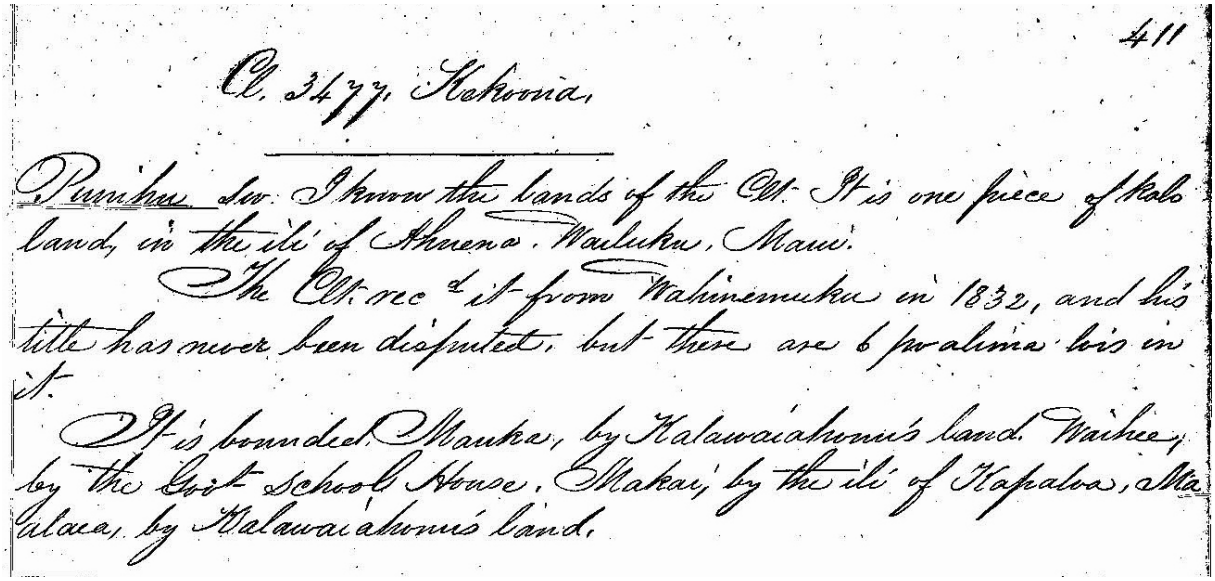
Cl. 3465. Keawe.

Puniho Sw. I know the land of the Clt. It is one piece of kalo land in Ahuena, Wailuku, Maui.

The Clt. rec^d this land from Kailihiwa the Konohiki in 1844. and his title has never been disputed. There are 2 pwalima lois in it.

It is bounded. Mauka, by Paele's land. Waihee, by Naea's land. Makai, by Kioho's land. Maalaea, by Kauhi's land.

Figure B3. F.T. for Claim 3465 (Foreign Testimony 1846-53:413).



411

Cl. 3477. Kekoona.

Puniho Sw. I know the lands of the Clt. It is one piece of kalo land, in the ili of Ahuena. Wailuku, Maui.

The Clt. rec^d it from Wahinemuku in 1832, and his title has never been disputed. but there are 6 pwalima lois in it.

It is bounded. Mauka, by Kalawaiahonu's land. Waihee, by the Govt School House. Makai, by the ili of Kapaloa, Maalaea, by Kalawaiahonu's land.

Figure B4. F.T. for Claim 3477 (Foreign Testimony 1846-53:411).

Reference

Foreign Testimony

1846-53 *Foreign Testimony of Kuleana Claims to Quiet Land Titles in the Hawaii Islands*. http://www.avakonohiki.org/foreign-testimonies.html. Accessed 27 March 2014.

APPENDIX C: SUMMARY OF PROFILE LOCALES IN TRENCHES 1-10

Table C-1. Summary of Profile Locales in Trenches 1-10.

Profile Locale No.	Trench No.	Face Profiled	Layers Present	Depth at BOE* (cmbs)	Layer(s) present at BOE	Comments
1	TR1	East	I-VI	131	VI	Very sparse charcoal flecking observed in Layer VI
2	TR1	West	I-V	140	V	
3	TR1	West	I-VI	140	VI	
4	TR6	East	I-V	140	V	
5	TR6	East	I-VII	248	VII	Layer VII has 50-60% decomposing basalt cobbles and pebbles
6	TR7	South	I-VI, Lens A	120	VI	
7	TR7	South	I-IV	136	IV	Clear glass fragment found in Layer III at 82-84 cmbs
8	TR8	North	I-VII	140	VII	
9	TR8	North	I-X	134	X	
10	TR9	West	I-IV	132	IV	Cane slag found in Layer II at 80 cmbs
11	TR9	East	I-IV, Lens B	134	III, IV	Lens B is within Layer II
12	TR3	West	I-IV	140	IV	
13	TR3	West	I-V	140	V	Black plastic at base of Layer II
14	TR4	West	I-IX	230	IX	Layer IX has 50-60% decomposing basalt cobbles and pebbles
15	TR4	East	I-V	190	V	Layer V has 50-60% decomposing basalt cobbles and pebbles
17	TR5	West	I-X	260	X	No evidence of sugar cane agriculture in TR5; Layer X has 50-60% decomposing basalt cobbles and pebbles
18	TR10	South	I-VIII	160	VIII	
19	TR10	South	I-V	152	IV, V	
20	TR2	South	I-V	152	V	Surface elevation approximately 0.5 m lower in elevation, and thus Layer V has 50-60% decomposing basalt cobbles and pebbles

* BOE - Base of Excavation

Appendix K:

Cultural Impact Assessment

Draft Report

Oral History Studies for the Determination of Traditional Cultural Properties and Cultural Impact Assessment for the `Iao Flood Control Project, Maui Island, Hawaii

Contract No. DACA83-02-D-0005
Task Order 0004

Prepared for
E&C, Environmental Tech Branch
United States Army Engineer District, Honolulu, Bldg. 230
Fort Shafter, Hawaii 96858-5440

Prepared by

Social Research Pacific, Inc.
667 Old Mokapu Road
Kailua, HI 96734

December 5, 2003

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1.0 Introduction

At the request of the U.S. Army Corps of Engineers, Honolulu Engineer District, under Contract No. DACA83-02-D-0005 (Task Order 0004), Social Research Pacific, Inc., completed "Oral History Studies for the Determination of Traditional Cultural Properties and Cultural Impact Assessment for the ʻĪʻao Flood Control Project, Maui Island, Hawaii." The study was done between August 12 and November 15, 2003. This draft report presents the findings of this study.

The U.S. Army Corps of Engineers is conducting a Feasibility Study and Environmental Assessment (EA) for flood control measures in the ʻĪʻao Stream Drainage on the southern end of Maui Island. The determination of Traditional Cultural Properties (TCPs) and Cultural Impact Assessment (CIA) partially fulfill the requirements for an EA as specified by Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and Chapter 343 of the State Constitution of Hawai`i (HRS and Act 50).

The major tasks involved in completion of this TCP/CIA included: 1) preparation of a Work Plan (WP); 2) archival and record searches; 3) field study (collection of oral histories from native Hawaiians knowledgeable about traditional uses of the area, survey of area residents to identify potential cultural impacts, and attendance at scoping and public meetings); 4) description and assessment of Traditional Cultural Properties (TCPs) identified during field studies; and 5) preparation of this report.

1.1 Goal and Purpose of Study

The goal of this project was twofold: 1) to identify potential TCPs through archival searches and oral histories; and 2) to complete a CIA that addresses the potential impacts of the proposed project. The completed TCP/CIA study also meets both federal and State of Hawaii NEPA requirements for the ʻĪʻao Flood Control Project in the documentation of an Environmental Assessment.

Archaeological work completed for an earlier phase of this project by Scientific Consultant Services, Inc. (SCS 1999), indicated that potentially significant Native Hawaiian cultural remnants, eligible for the National Register of Historic Places, were likely to be present in the project area. More recent archaeological investigations upstream of the current project area (Haun and Associates 2002), found traditional Hawaiian residential and agricultural sites. Along with known historical uses and

archaeological sites in the vicinity of the project area, portions of the flood plains within the streambed are presently used as for small-scale agricultural and subsistence purposes. There also remain a handful of land owners on parcels originally given during the Land Commission Awards [LCA); most of these are located north (*mauka*) of the project area. Knowledge about traditional and historic land uses along ʻĪʻao Stream made it likely that TCPs would be found in the vicinity of the project area.

Land use along ʻĪʻao Stream is primarily residential. This is particularly true for the upper and lower portions of the stream. Within the immediate vicinity of the project area, particularly along the southern flanks of the stream, there are a large number of commercial interests. Based on observations of current impacts, the residents and businesses along the southern flanks will be most directly impacted by any future flood control measures. This area also forms the primary user group identified by this study. The potential impacts and cultural concerns that area residents (and other user groups) relate directly to the proposed project forms the basis for the cultural impact assessment.

1.2 Project Location

ʻĪʻao Valley lies within Wailuku a*hupuaʻa*, in the northeastern portion of Maui Island (Figure 1). The project area includes only that portion of ʻĪʻao Stream which has not previously been upgraded; it extends approximately 7,200 lineal feet between Market Street and Waiehu Beach Road, in Wailuku town. The remainder of the stream, immediately above and downstream of the project area, is already lined in concrete (previous improvements). Among the options being considered in the present EA, is concrete lining of the portion of the stream that forms the project area.

While the stream proper runs as a fairly narrow channel, the width of the streambed (floor) varies significantly. In the north-central portion of the project area (between Pihana Street and the active stream flow channel) lays a flood plain that is currently used as both pastureland and for growing vegetables (Burgett and Dega 1999:5). Along with a very large banana patch, newly planted cultivars such as taro can also be seen in the flood plain area. Along the upper, westernmost portion of Pihana Street are residential units; a few small businesses can be found along Market Street, on either side of the bridge. A Hawaiian Homes Lands subdivision lies along the eastern, lower portion, of Pihana Street, ending at Waiehu Beach Road.

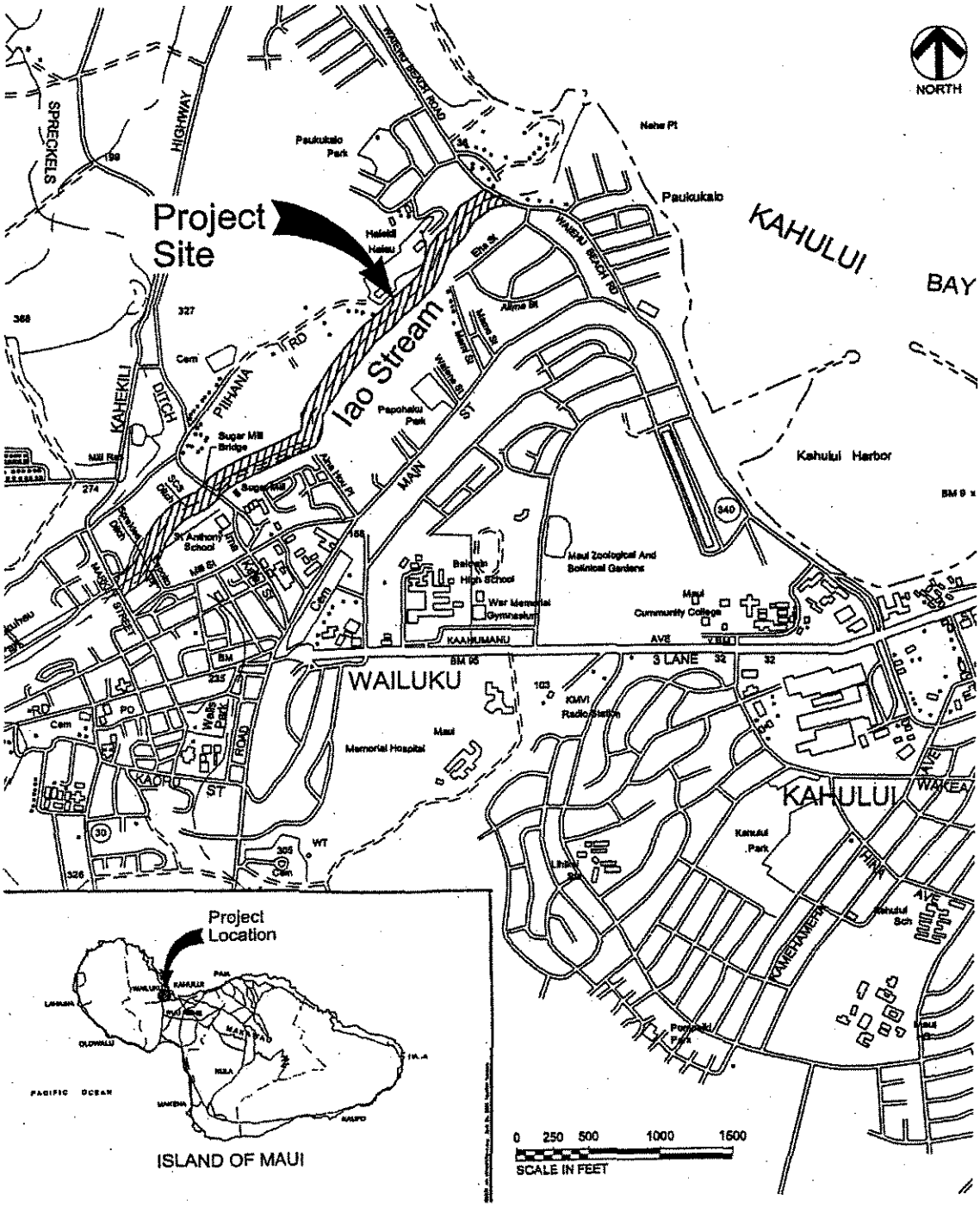

Figure 1. Map of Project Area showing the Iao Stream Hydraulic Design (M&E Pacific, Inc. 2000).

The area along the southern flanks of ʻĪʻao Stream is a mixture of residences and business/commercial interests. Part of this area makes up the Wailuku Industrial Park and the Millyard (formerly Mill Camp) business complex (Figure 2). Residential units are found nestled

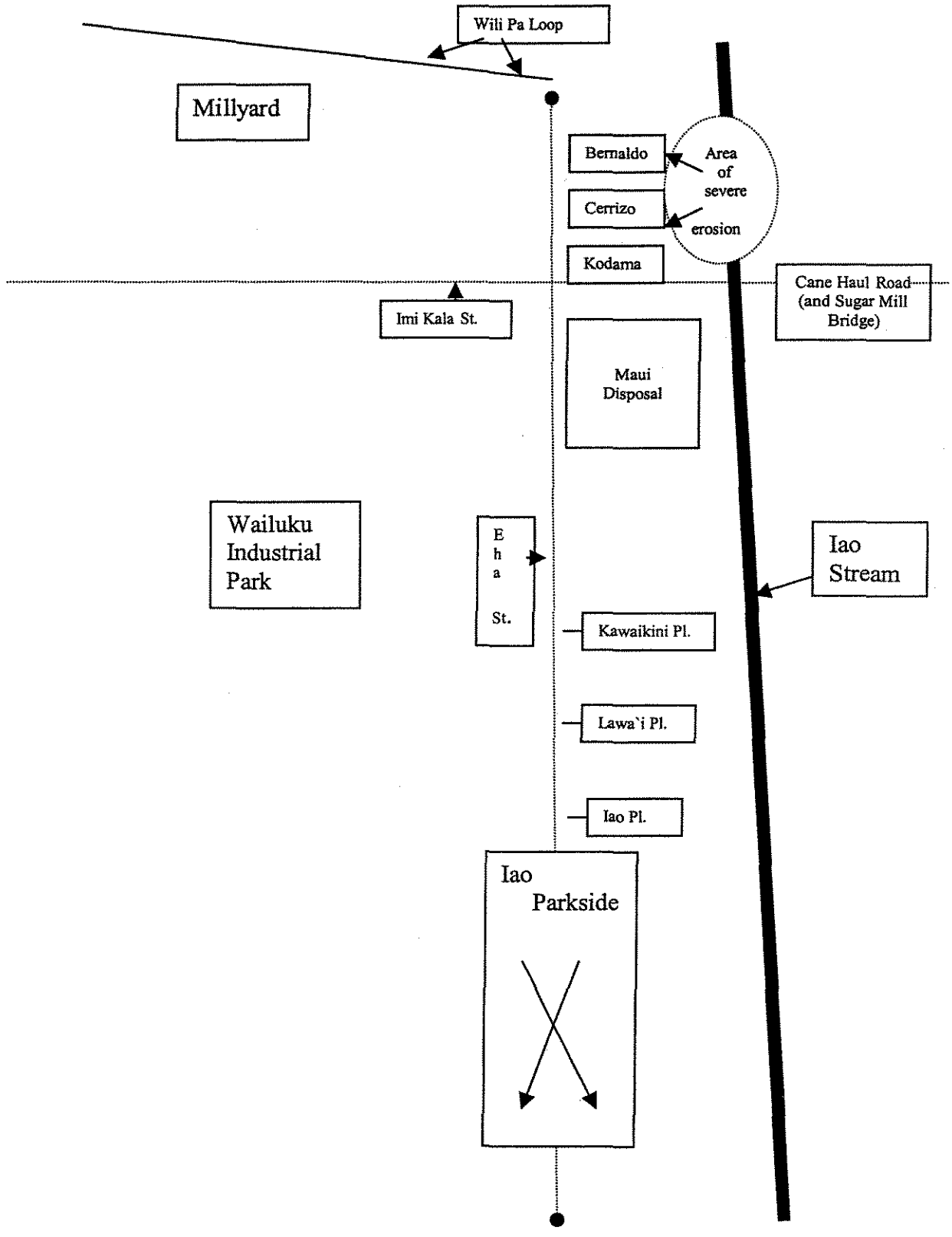

Figure 2. Location of Selected Sites in the Project Area

between commercial buildings and ʻĪao Parkside; the latter is an extensive condominium development that borders on the southeastern flanks of the project area.

1.3 Federal Guidelines for Identifying TCPs

Federal guidelines define (identify) what properties constitute a TCP. In the *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (National Register Bulletin No.38) a TCP is defined as:

> "...[a traditional cultural property is generally] one that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identify of the community" (Parker and King 1995:2).

The process of identifying a Traditional Cultural Property calls for a "systematic study, just as most other kinds of historic properties" (Parker and King 1995:5). The ultimate goal of identifying a TCP is to evaluate its eligibility to the National Register of Historic Places... "its significance (former and present) must be at the very least, mentioned in planning federal, federally assisted, and federally licensed undertakings" (ibid 1995:4). An interview with knowledgeable sources is among the primary method for identifying TCPs. Among the individuals contacted were *kūpuna* (Hawaiian elders) from Maui Island who can identify properties of cultural/historical significance in ʻĪao Valley. Along with interviews, information about TCPs was gathered from written and archival (mostly photographic) sources. These data helped identify areas/properties in ʻĪao Valley that have cultural/historical significance and satisfy the criteria established for TCPs, and areas/properties of local cultural importance that do not meet the criteria. Both categories are discussed in later sections of this report.

1.4 State of Hawai'i Guidelines for Cultural Impact Assessments

Articles IX and XII of the State Constitution of Hawai'i (Chapter 343, HRS), require government agencies to promote and preserve cultural beliefs, practices, and resources of native Hawaiians and other ethnic groups. As such, preparers of environmental impact assessments and statements need to study the impacts of a proposed action on cultural practices and features associated with a project area. The "Guidelines for Assessing Cultural Impacts", (Appendix A) adopted by the Environmental Council of the State of Hawai'i, on November 19, 1997, identifies the protocol for conducting

cultural assessments. The impacts addressed by this study look at the potential cultural impacts of the proposed flood control project on the resident community. The evaluation of potential cultural impact(s) of the flood control project is based primarily on the results of a questionnaire-based survey done among residents and organizations in the Wailuku area. Some of these individuals participated in the EA Scoping Meeting, held in Wailuku on August 12, 2003. The results of this survey are presented in Section 4.0 of this report.

2.0 The Study Approach

Since the purpose of this study was twofold - identification of TCPs and completion of a CIA – the data needed to complete the project involved gathering information from both historical and present sources. Hence, the study approach taken was both ethnohistorical and ethnographic in nature. The categories of data gathered included: 1) historical information from written/archival sources; 2) oral information (on TCPs and traditional land uses) from Hawaiian *küpuna* familiar with the project area; and 3) a questionnaire-based survey of individuals and groups who are current "users" of the project area.

The primary objective of the TCP study was to:

- identify potential areas, features and/or sites of traditional (Native Hawaiian) significance within the vicinity of the project area.

The primary objectives of this CIA was to:

- identify current cultural uses of the ʻĪʻao Flood Control Project area;
- identify user groups at that would be affected (culturally impacted) by the proposed project;
- conduct interviews with individuals and groups to identify these potential affects; and
- assess the level of impact(s) from these potential affects on cultural practices in the area.

2.1 Tasks Completed

Data gathered for this study combined available background information on the cultural and historical make-up of the project area, with results of the oral interviews and the questionnaire-based survey. Specifically, the following tasks were completed:

1. gathering of background data (written traditional/cultural and historical data on the project area)
2. designing a survey questionnaire
3. field research
   - identification of primary user/interest groups and stakeholders, particularly residents and businesses that were most likely to be directly impacted by the proposed project
   - administration of survey questionnaire
   - oral interviews (individual and group meetings)
   - general community observations
   - field visits to the project area.
4. quantitative and qualitative analyses of data gathered from field research and general background information
5. development of recommendations based on the findings
6. preparation of this draft report

2.1.1 Background Data

Background data was gathered from the initial stages of the project up to the present. Interviews were completed on the island of Maui between the months of September and November 2003 (see Appendix B for transcripts of the interviews). The survey of residents, households, businesses and other potentially affected 'user groups' for the CIA survey was completed alongside the field site visits and oral interviews. All but two oral interviews were held in person; the remaining two were completed via telephone.

2.1.2 Survey Questionnaire

A one-page survey questionnaire (Appendix C) was developed to gather information for the CIA component of this study. Its primary purpose was to gather responses about the possible cultural impacts any individual and/or business may experience as a result of the proposed flood control project; secondarily, it served as a tool for obtaining information about TCPs in the project area. The questionnaire was administered in person, as well as via telephone (a few individuals were unable to

meet in person). Individuals attending the ʻĪʻao Flood Control Project Scoping Meeting, held in Wailuku on August 12, 2003, were also contacted.

2.1.3 Field Research

One of the initial tasks of this study was to identify (a) *kūpuna* and knowledgeable others about TCPs in the area, and (b) individuals and groups likely to be impacted by the proposed project. Most of the contacts for identifying TCPs did not live in the immediate vicinity of the project area, while nearly all of the individuals to whom the questionnaire was administered, lived and/or worked immediately adjacent to the project area. The latter included residents and businesses along ʻĪʻao Stream. Interviews were held at individual residences, at places of business as well as at other convenient meeting places. In some cases, meetings were completed in group settings. Throughout the field research phase, general observations were made within and around the project area (several individuals were approached after being observed in the immediate vicinity of the project area).

2.1.3.1 Oral Interviews

All individuals who provided oral interviews about TCPs in the project area have consented to the sharing of their information (the CIA did not entail formal interviews). Two of these interviews were recorded on audiocassette (see Appendix B); the remainder was recorded in written form. The identification of Hawaiian *kūpuna* for the island of Maui came from previous oral history research on the island, the Office of Hawaiian Affairs (OHA), the State Historic Preservation Office (SHPO) on Maui, and the Maui Historical Society (Appendix D). Additionally, there were residents who have taken an interest in the TCPs of ʻĪʻao Valley that provided useful information.

3.0 Traditional and Current Land Uses of ʻĪʻao Flood Control Project Area and Surrounding Vicinities

ʻĪʻao Valley, as with the remainder of Wailuku *ahupuaʻa* is known to have numerous traditional and historic sites of significance. Many of these are not located within the project area however, they may have had significant association with features in the project area. The next two sections review the significance of Wailuku *ahupuaʻa* and ʻĪʻao Valley, first in its historical context, and second in its present day.

3.1 Traditional Hawaiian Uses of ʻÏ`ao Valley and Wailuku *ahupua`a*: Written and Oral Accounts

In a recent historical literature review of the traditional land uses of Kahului Harbor, Tomonari-Tuggle and Welch (in Prasad and Tomonari-Tuggle 1999) discuss the importance of the Wailuku area. The project area falls within the traditional *ahupua'a* of Wailuku in the district of Wailuku. The district encompasses the eastern flank of the West Maui Mountains and all of the isthmus between east and west Maui, including the coastal stretches of both Kahului Bay on the north and Mä'alaea Bay on the south. The *ahupua'a* of Wailuku covers the coastal area of Kahului Bay, all of ʻÏ`ao Valley, and the north half of the isthmus.

Handy and Handy (1972:272) call Wailuku district *Na Wai 'Eha*, "The Four Waters," after the four major streams and taro-growing areas of windward West Maui: Waikapü, Wailuku, Waiehu, and Waihe'e. Based on the account of a native Hawaiian of "considerable age," a writer at the turn-of-the-century described the district (Paradise of the Pacific, September 1900, in Silva n.d.,10):

> The district was called Nawaieha (the four streams) and was famous throughout the group, not only for the magnificence of Kahekili's court but for the vastness of its products. The shores of Kahului harbor, from Waihee Point to Haiku, were surrounded with the grass huts of the fishermen and of those connected with the innumerable war canoes of the king. Myriads of cocoanut [sic] trees lined the beach from Kahakuloa to Wailuku, the trunks of many of which are found in the marshes at Wailuku at this day, the trees having been destroyed by a conquering army from Hawaii.

In the late prehistoric period, a time of frequent warfare among the chiefs of Maui, O'ahu, and Hawai'i, Wailuku was a chiefly center and a site of decisive battles. In 1736, the fatally ill Maui chief Kekaulike heard that the Hawai'i chief Alapa'i was planning to invade his island. He and his retinue retreated from Kaupo to Kula and then to Wailuku where the Maui chief died at Haleki'i Heiau. There, his body was burned and his ashes thrown into ʻÏ`ao Stream (Speakman 1978:13, in Kennedy et al. 1993).

Between 1765 and 1793, Kahekili was chief of the island (as well as O'ahu, Moloka'i, and Läna'i). Late in his rule, war broke out between Kahekili and the chief of Hawai'i, who led a force of special warriors in an invasion of Maui. Kahekili awaited the outcome of the battle at his residence in Wailuku. Kamehameha fought one of his first battles with European weapons on the plains of

Wailuku. "The bay from Kahului to Hopukoa was filled with war canoes. For two days there was constant fighting in which many of the most skillful warriors of Maui took part, but Kamehameha brought up the cannon, Lopaka, with men to haul it and the white men, John Young and Isaac Davis, to handle it; and there was great slaughter (Kamakau 1961:148). But Wailuku was also a place where chiefs passed their quiet times. In the 1760s, "the chiefs of Wailuku passed their time in the surf of Kehu and Ka'akau" (Kamakau (1961:83). 'Ī'ī (1959:135) identifies "the surfs of Kaleholeho, Kaakau-pohaku, and Paukukalo" in Wailuku as some of the attractive locations for this sport.

Written and oral traditions associated with 'Ī`ao Valley clearly point out the area's unique significance to Native Hawaiian culture. 'Ī`ao was the name of Maui and Hina's daughter, whose lover was turned into a pillar of salt ('Ī`ao Needle) by Maui. Numerous chiefs are said to be buried at Oloeio, a cave located in 'Ī`ao Valley (Fornander 1996) that served as a royal burial grounds (*kapela*). Some of the biggest battles in Hawaiian history (Battle of'Ī`ao, Battle of Kepaniwai, Kamehameha I's victory in 'Ī`ao) were fought within and around 'Ī`ao Valley. Wailuku *ahupua`a*, which translates to "water [of] destruction" (Pukui et al. 1976:225), and Wailuku District were ceremonial and political centers for Hawaiian chiefs (Kirch 1985). Wailuku was considered a "chiefly center" (Sterling 1998:90), with many of the chiefs and area's population residing near or within portions of 'Ī`ao Valley.

Traditional land use of 'Ī`ao included intense cultivation of taro; many *lo`i* systems line the stream banks of 'Ī`ao Valley. A total of sixty-six LCAs, primarily taro patch *kuleana*, and thirty-nine *po`alima* are located between the old Wailuku Mill site and Paukūkalo, on the southern side of 'Ī`ao Stream (Fredericksen 2001:4). Two *`auwai* (prehistoric ditches), were "constructed for the purpose of irrigating *kalo* on the plains which stretch away to the northward and southward of the ['Ī`ao] river" (Sterling 1998:86). Much of the historical literature supports extensive taro cultivation in greater Wailuku Valley. Habitation sites along Lower Main Street in Wailuku "are associated with the rich taro producing lands in the Lower 'Iao River flood plain, and the extensive cultivation systems present in `Iao Valley" (Burgett and Dega 1999:14). Taro from Wailuku *ahupua`a* also supplied other areas of the island. For instance, areas such as Kahikinui were not suitable for taro cultivation, therefore its people would trade ocean food sources for taro with their distant neighbors in Wailuku. It is highly likely that similar trade arrangements existed with other parts of the island that were unsuitable for cultivating taro.

A maps prepared by Monsarrat in the 1880s offer 'snapshots' of late 19th century history of Wailuku *ahupua`a* and 'Ï`ao Valley. Figure 3 is a portion of Monsarrat's 1888 map that shows 'Ï`ao Stream



Figure 3. Portion of Monsarrat's 1888 map showing 'Ï`ao Stream and Paukükalo.

curving around *kuleana* lots in the Paukükalo area, and emptying into Kahului Bay. An earlier map (1882) shows all the traditional Hawaiian land divisions are shown on this map – district, *kalana, ahupua`a, ili, mo`o (mo`o `āina)* and *paukū (kuleana*). There are also a large number of subdivisions (areas with names that are no longer known or used) along either side of 'Ï`ao Stream. According to Bob Hobdy (pers. comm.) who has done extensive research relocating sites identified on early historic maps, these were likely to be *mo`o*. Altogether, he identified a total of twenty-six *mo`o* along 'Ï`ao Stream. The *mo`o* are attached to wetland taro cultivation; each one is serviced by its

own *`auwai*, and includes several *kuleana* (ibid). In a similar map of Honokohau from the 1930s, Hobdy saw complete descriptions of *kuleana, mo`o* and the *`auwai*. Each *`auwai* coming off Honokohau Stream showed a cluster of *lo`i* and multiple *kuleana* within the *mo`o*.

In addition to *lo`i*, there are two *heiau* in the immediate vicinity of the project area. The Haleki`i-Pihana Heiau State Monument can be easily seen on the northwest flank of 'Ï`ao Stream, along the lower portion of the project area. This is the third largest structure on Maui, after Pi`ilanihale *Heiau* in Hana, and Loaloa *Heiau* in Kaupo (Kolb and Keau 1990:5). Other heiau are known to have existed in the area, however, as noted by Winslow Walker, all but two (Haleki`i and Pihana) of the known *heiau* were still standing during his initial archaeological survey of Wailuku. Keahuku, Olokua, Olopio, Malena, Pohakuokahi, Lelemako, Kawelowelo, Kaulupala, Palamaihiki, and Oloolokalani could not be found (Walker 1931:146-148, in Fredericksen 2001:11-12). Halekii-Pihana *heiau* sits at the edge of lithified sand dunes, which itself is a significant prehistoric burial site that runs semi-parallel to 'Ï`ao Stream and mid-way up Wailuku *ahupua`a*. Early historic burials are also known from Mahalani Cemetery, located between the *Pu`u One Dunes* and the flood plains along the project area portion of 'Ï`ao Stream. According to its President, King Kekaulike's wife is buried at the cemetery along with burials are from the later historic, plantation period (W. Cockett, pers. comm.).

Traditional uses of the land area can also be seen in the travel routes taken by people. At least one prehistoric-historic trail, crossing the saddle to the western side of the island, is known to exist in the back of Wailuku Valley. The trail is believed to have been used by a fighting chief who escaped by taking it to cross the saddle to Olowalu. Na Ala Hele, the group tasked with locating/identifying ancient trails throughout the islands, has found many similar trails in and out of the gulches of Maui. As a member of Na Ala Hele, Bob Hobdy (pers. comm.) says that trails along the gulches are most visible due to the terrain on which they sit; those in flat areas or bottom lands are less known since they were most likely to have been converted into roadways for buggies and cars.

Many of the elders, including long-term area residents, discuss what was likely found in the Wailuku before changes were introduced by the sugar plantations. These are sites and features that no longer exist or have been greatly disturbed. *Küpuna* Charlie Keau knows of many previous traditional sites throughout the Wailuku area, including *heiau*, fishing shrines (*ko`a*), trails, and *lo`i*. Charlie grew up in Paukükalo, which was good for fishing and picking *limu*. He recalls that the old folks really liked Paukükalo and how dramatically the area has changed since construction of the Maui Community

Center. Charlie remembers that old timers used to put their canoes out from "Kalo Grounds," the present day location of Maui Beach Hotel in Kahului. Some of these people also lived underneath the nearby trees. Members of the Duarte family, with multiple generations living in ʻĪʻao Valley, recall some prehistoric and historic features used by Hawaiian families; these, too however, no longer exist. Kaahumanu Church, the oldest church in Wailuku, was deliberately built on the foundation of Kahekili's *heiau*. (Ashdown 1970:34). More recently, Bob Hobdy has seen areas that contained extensive rock walls, delineating small units of land, bulldozed in Waikapuʻu. Likewise, the old *ʻauwai* system was most likely destroyed when irrigation ditches were placed for sugar plantations.

Recent studies within the immediate vicinity of the project area indicate that traditional, prehistoric features and sites are not likely to be found. During the Phase I archaeological survey of the Flood-Control Project Area, Connolly (1974) noted that "no positive structural evidence of a prehistoric occupation was observed...all of these structural remains–considered with the surface-artifact and midden remains, and the known ethno-historical materials appeared to be principally historic (post-European contact) in age" (1974:Abstract). The boundaries of Phase I border on the eastern-most boundary of the current project area.

3.1.1 Land-Use Changes resulting from Changes in Land Ownership

The first commercial activity in the Wailuku area appears to have been cattle ranching. As early as 1845, large herds of cattle were roaming the Kahului Isthmus (Barrere 1975:52). The cattle, under royal *kapu* which kept the herd from being harmed, were very destructive to the environment (ibid). In the 1830s, there was also an attempt to grow cotton. Although the environment was additionally impacted by the attempt, cotton growing also met with little success (Fredericksen 2001:4).

During the mid-19th century Mahele or division of lands, Wailuku was designated as Crown Lands claimed by the Kamehameha III. Numerous Land Commission awards to commoners were given out in the area around Wailuku and ʻIao Valley. In 1878, through his friendship with King Kalākaua, Claus Speckles secured a lease of 40,000 acres of land, among which was a portion of Wailuku *ahupuaʻa*. In 1882, he acquired fee simple title to all of the *ahupuaʻa* through Grant 3343 (Kennedy et al. 1992:12). That same year, Speckles built the Waiheʻe ditch and founded the Hawaiian Commercial and Sugar Company (HC&S), which quickly became the largest and best-equipped

sugar plantation in the islands (Kuykendall 1967:60). Figure 4 shows that by 1937, the majority of Wailuku was designated as "ranch land", being used primarily for sugar.

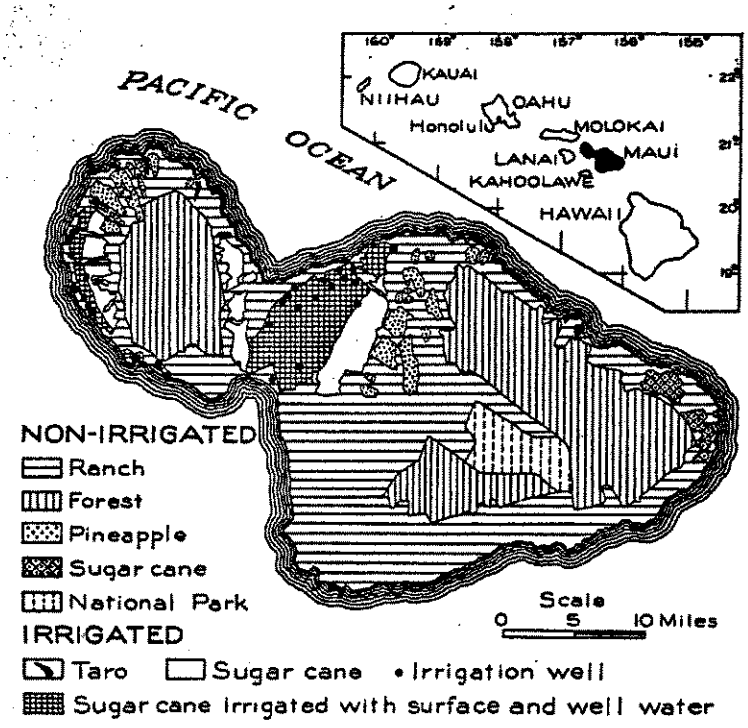

Figure 4. Land Utilization on Maui in 1937 (Source: Territorial Planning Board 1939, in Stearns and MacDonald 1942).

On a smaller-scale, change to land use has also been brought about by the U.S. military's use of the Wailuku area. As with many areas on Maui (e.g. Pu`unene Air Station, Naval Air Station Kahului [NASKA], the U.S. Marine Camp in Hailemaile), military use of the island intensified during World War II. Like the commercial farming ventures before them, the military has brought about fairly permanent changes to land use. Gordon and W. Cockett recall the Army Camp that was set up in Paukūkalo, bordering Pihana and near the Haleki`i-Pihana heiau, shortly after World War II. The area is now mostly Hawaiian homesteads. A portion of this earlier camp may also be the present day location of the Hawaii National Guard Camp Site and Rifle Range (c.f. Yent 1995:2-3). An undated photo below (Figure 5) shows another camp set up along Kahului Harbor, before reaching Waiehu and Paukūkalo. Kahului Harbor served as the main port of entry for military ships during WWII.

Written and oral histories tell of the traditional significance of Wailuku. Once an area of great traditional significance to Native Hawaiians, Wailuku went on to become a major sugar



Figure 5. Village at Paukükalo c.1946, showing military barracks at upper left, fronting the Pu`u One Dunes (Courtesy of Bailey House Museum).

cultivation/production area, to its present day residential and business use. Sugar plantations dominated the Wailuku landscape, especially along ʻĪʻao Stream, for much of the very late 19th and early 20th centuries. These changes in land use have significantly compromised the existence of prehistoric, traditional archaeological features. According to Haun and Henry (2002), the density per acre value of archaeological sites and features are relatively low due to the extensive impact of plantation agriculture and urbanization (Hahn and Henry 2002:17). The following section briefly discusses current land use within the immediate vicinity of the project area.

3.2 Current Uses of the Project Area

Current uses of the project area differ dramatically from its traditional uses. The change has come about in several stages. If for instance, the maps prepared by Monsarrat in the late 19th century depict a true picture of land use in that day, than along with the prehistoric uses, the intermediate phase of land use is also long gone. Sugar has left its imprint primarily in the form of water diversions (dikes, ditches), and other structural remnants such as bridges and a few old buildings. But these are becoming less obvious with the rather rapid level of urban development in the Wailuku area. Present day land uses identified during this study fall into three categories:

Residential

Commercial

Recreational

Farming

Residential development along ʻÏʻao Stream extends from Kahului Bay to the far western (*mauka*) sections of the valley. The most dense residential settlement is along the lower (*makai*) portions of the stream, in the areas of Waiehu, ʻIao Parkside, Happy Valley, Pihana, Millyard and the Hawaiian Homestead bordering on the Halekiʻi-Pihana Heiau. Along the northern corridor of the project area, which extends from Millyard to Waiehu Beach Road (see Fig. 2), there is continuous housing except for within the flood plain bordering Pihana. The southern corridor of the project area consists of both residential and commercial properties. Many of the homes in Pihana date back to the plantation period; there are three known *kuleana* lots. According to Winifred Cockett, a third generation Pihana resident and *kuleana* lot owner, the remaining two lots are between her property and the *heiau*. The remainder of the Pihana area is largely settled by non-Hawaiians whose ancestors may have once worked for the sugar plantation.

Commercial development is restricted largely to the southern corridor of the project area. (There are a few older businesses such as Takamiya Store, in upper Pihana, just outside the northern corridor of the project area). Eha Street (Fig. 2) which runs parallel to the project area, is a mixture of newly built homes (within last three years), the ʻIao Parkside condominium complex, and several businesses at either end of the project area portion of this roadway. Older homes exist on both the *mauka* (above Millyard) and *makai* (below Waiehu Beach Road) ends of the southern corridor of the project area. The types of businesses vary significantly. At the eastern most end of the project area is Sak & Save Supermarket; at the western most end, is Maui Waste Disposal and several legal, accounting and real estate firms. A levee, which also serves as the maintenance road for Maui County vehicles, separates many of the homes from the stream. It is this levee and maintenance road, along with the streambed, that also serves as a recreational area.

Farming is occurring within the flood plain area in Pihana; it is restricted to the northern corridor of the stream. A total of four farms, all on leasehold land, were identified. These are mostly banana and papaya patches owned by farmers of Filipino descent. A newly established horse stable, operated by one of the Hawaiian homeowners, lies adjacent to a *kuleana* lot. Several families have backyard/kitchen gardens but none of these are near the stream area.

Recreational uses of the project area consist primarily of walking/jogging (on the maintenance road), bicycling and dirt bike/small motorcycle use. There are occasional boogie boarders and swimmers in the stream but they are confined to areas where water level gets high enough to be used for these activities. Of the area residents interviewed, only two used the levee maintenance road for leisure walks; the majority of those who appear to use the area regularly for recreational purposes do not live adjacent to the stream. Fishing within the project area portion of ʻĪʻao Stream does not seem to take place.

This mixture of land use along the project area does not seem to be in conflict with one another in any way. While noise from the dirt bikes and their use of people's backyards has been a problem, most individuals have put up fences and would be pleased to see the area improved for further recreational use.

4.0 Identification of Traditional Cultural Properties and Cultural Impacts

One of the two goals of this project was to identify TCPs and oral traditions associated with ʻĪʻao Valley that meet the criteria established in the National Register; the second was to complete a CIA of the potential effects of the proposed project. While no TCPs were identified in the project area, oral and written history indicates TCPs within the general vicinity of the project area; they also identify historic properties that hold local cultural significance. The following sections present the findings of this study, first addressing TCPs, and second, the CIA.

4.1 Traditional Cultural Properties in the Project Area: Findings

Although no specific features that can be classified as a TCP were located within the project area, the overall traditional significance of Wailuku is to be noted. There has been substantial change to this cultural landscape, yet remnants of its highly significant past remain. The following discussion on TCPs is presented in a question/answer format to simplify the essential findings of this study.

Were any new Traditional Cultural Properties identified within the Project area?

No, not any that can be identified. This question was asked during each field interview, especially with Hawaiian *kūpuna*. At present, no one can identify any TCPs within the immediate vicinity of the project area.

Are there any existing TCPs within the general vicinity of the project area?

Yes, there are *heiau*, fresh water springs, burials, and *loi.* While some have already been labeled as a TCP, the remaining qualify based on significance criteria. These are as follows:

1. Haleki`i-Pihana Heiau State Monument lies above the northeastern corridor of the project area, in the *ahupua`a* of Paukūkalo. *Haleki`i* means the "house of images", and *Pihana* means "fullness", is believed to be the only complex remaining of pre-contact Hawaiian structure of religious and historical importance in the Wailuku-Kahului area (Yent 1995:1). Some area residents refer to Pihana as "Pi`ihanakalani", which means "ascending into heaven" (M.J.K. Kolb and G.M. Murakami 1994:61). The *heiau* (Figure 6), State of Hawaii Site number 50-50-04-592, is under the jurisdiction of the Division of State Parks.

2. A second *heiau* or *ko`a* (fishing shrine) is believed to have been located at Mele-ha`a-ko`a, the Singing Reef. According to Ashdown, whose father had a house, corrals and slaughterhouse near the shrine, it was "along the old road between Wailuku and Kahului by the present Maui Dry Goods building in the area called Kawela" (Ashdown 1970:38). She adds that the shrines and temple were ruined, and "most of the buildings taken out to sea" in the tidal wave of 1946 (ibid). According to D. Sevilla, the remnants of this *heiau* may presently lie on private property near the shoreline.

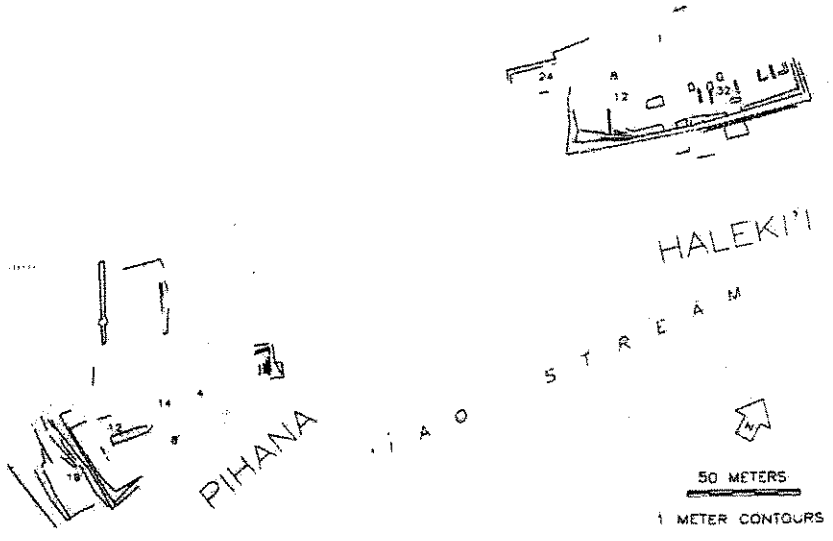

Figure 6. Location of the Halekii-Pihana Complex, along ʻĪ`ao Stream (Source: Kolb and Murakami 1994).

3. A fresh water spring, presently known as Waiola, located on the Sevilla property in Waiehu (Tax Map Key No. 3-3001-054), is believed to be part of an ancient fish pond (Commission on Water Resource Management, 1990). The true name of the spring is no longer known (C. Keau and D. Sevilla, pers. comm.) but some refer to it as Waiola. C. Keau believes the name may have been "Wailuku" (pers. comm..). The spring measures six feet wide and five feet deep. There are three main sections to the spring, most of which are separated by stone walls (Fig. 7). The spring was dry

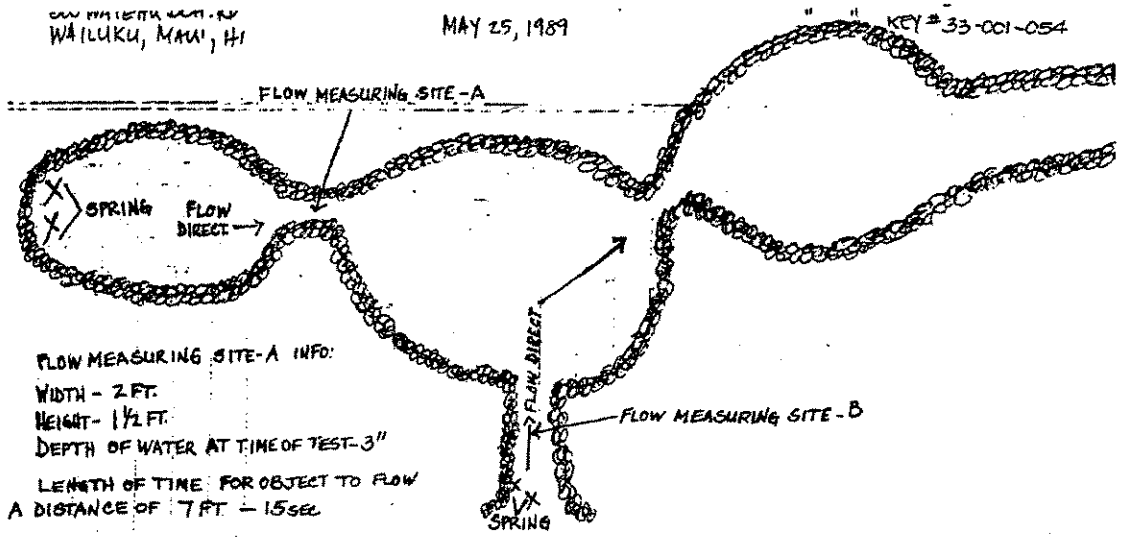

Figure 7. Waiola Spring, Waiehu, Maui (Source: Commission on Water Resource Management, 1990).

during the time this study was being conducted. According to D. Sevilla (pers. comm.), a mullet (fish) pond lay immediately east (*makai*) of Waiola, on the Kekona property. However, "Uncle Kekona filled up the pond once the water started to dry up" (ibid). The absence of water in both Waiola and the mullet pond are believed to have occurred after the diversion was placed in 'Ï'ao Stream.

4. Burials in the *ahupua'a* of Waiehu and Wailuku. As briefly discussed in section 3.1, prehistoric and historic burials are known from the vicinity of the project area. Most of these have been identified from the *Pu'u One* sand dunes that lie north of the project area; some are also known from Mahalani Cemetery (the majority of these burials are believed to be from the plantation era). A recent excavation a *kuleana* lot in the north easternmost corner of the flood plain area (down slope from the *heiau* complex), led to the discovery of several burials. According to W. Cockett (pers. comm.), who identified the area in which the burials were located, there will be no further ground disturbance for the sake of the burials.

5. Ancient and historic period *loi* are known to exist upstream of the project area. M. Duarte (pers. comm.) recalls several Hawaiians who used to grow taro nearby the Duarte residence. Many of these individuals had *kuleana* lots and *kuleana* water rights. As observed behind the 'Tropical Gardens of Maui', many of these *kuleana* still have *po`alima* within their boundaries. At present, *loi* are known from several family lots but the majority of taro appears to be grown in the adjacent *ahupua`a* of Waihee and Kahakuloa.

Based on observations and the information gathered fro *kūpuna* and knowledgeable individuals/residents, traditional land uses of the project area have been discontinued. 'Ï`ao Stream, or Wailuku River as once called by some of the older area residents, was known as a source for *o`opu* and *opai*, water for *loi*, and swimming/washing. However, none of these activities are currently taking place. While development along the stream's banks has changed accessibility to 'Ï`ao, earlier diversion measures have also brought about significant changes. The latter will be briefly addressed as known impacts to the project area in this report (c.f. the Environmental Assessment being prepared for the current project for a more detailed, in-depth review of diversion-related impacts).

As with traditional uses of the project area, land uses associated with the historic period also no longer take place. Both fishing and recreational uses (swimming/washing) were known to take place during the early to mid-1900s. Farming along the stream banks (raising hogs and cattle) was known up until shortly after the initial diversion measures. (The Duarte family, who live further upstream of the project area, maintained a hog farm until approximately two months ago). Historic uses of the project area, such as washing cars in the stream near Waiehu Beach Road, also appear to have been fairly common until recently. Rose Duey (pers. comm.) recalls that Waiehu Beach Road was at one time a rock and pebble roadway that crossed through 'Ï`ao Stream. In the event the water was too high, cars had to pull over and wait until their vehicles could safely cross the stream (ibid). Often on such occasions, their father would pull over the car/truck so it could be washed in the stream. Several other individuals recall Waiehu Beach Road before it was cemented; many remember driving across or having to wait for the water level in 'Ï`ao to go down. Kanji Wakamatsu, present owner of the Wakamatsu Fish Store in Wailuku, recalls catching *o`opu* and catfish, and picking *hi`iwai*, between Market Street and Waiehu Beach Road (K. Wakamatsu, pers. comm.). He would sell his catch to the Chinese families that lived in a camp near Paukūkalo. "The fish were large size, and the *hi`iwai* were 'big enough to use as whistles" (ibid).

4.2 Cultural Impacts from the Proposed Flood Control Project

The following section summarizes the major issues or cultural impacts identified through the survey questionnaire and interviews; it is presented in both quantitative and qualitative format. First, the issues and/or impacts are addressed in question/answer format; these were not questions asked directly but are the result of people's perceptions of the proposed project. (Many of the people interviewed were not aware of the flood control project until approached for this survey). Second, results of the questionnaire are presented in table format to show a numerical breakdown of the survey population's responses.

4.2.1 Is flooding of 'Ï`ao Stream a concern (fear) for area residents?

Generally, no. While most area residents have witnessed the 'flash' floods that can occur of 'Ï`ao Stream, they do not feel further channelization is necessary. This was true of both the relatively new short-term residents, and the long-term, older residents who have witnessed at least one or two large floods. K. Wakamatsu, now 84 years old, recalls a young boy being swept away during the flood in the 1940s. The Cocketts remember a storm in the 1950s when pigs were floating in the stream, and the water level reached their doorstep (at their current home in the floodplain). In this undated photo (Figure 8), Ashdown captured the impact of a major flood/storm on a house in the flood plain area, and the cane haul bridge (possibly the same location as the bridge shown in Figure 2). The photograph notes 'cane'and 'part of Iao Mts.', in the upper left corner.

Several present day residents have become familiar with the 'tell-tale' signs of impending floods. John Duey who lives in the upper portion of 'Ï`ao Valley, and Emmett Rodrigues who lives in the lower portion of the valley within the project area, know that when gray clouds and heavy rains occur up in the mountains, it is time to watch for the water to come rushing downstream. Some of these individuals have timed the sequence of events (development of clouds, rainfall) in order to prepare for the heavy flow that passes near their residence.



Figure 8. Aftermath of the 1950 Flood, photo taken by Inez Ashdown (Courtesy of Bailey House Museum).

Unlike the upper portions of the valley where flooding can impact homes along the stream banks, in the project area itself, there does not appear to be great concern about flooding. Previous flood control measures have acted to protect the stream banks from overflowing, but it is also a matter of experience. Residences (and residents) in the upper portion of the valley have likely been there for several generations, whereas most of the residences and businesses along the project area portion of ʻĪʻao Stream have been built within the past three to ten years. The people higher up in the valley have witnessed many more flood related events, whereas, the people in the lower portion have likely been present only since the initial flood control measures were put in place. Many of the present day residents who live off of Eha Street, are new to the area...hence they are not aware of the potential dangers from major floods. Most, however, have witnessed flash floods that periodically occur.

While flooding may not be a major concern, the erosion caused by heavy, rapid moving stream water, is. This is particularly true for the businesses located in the immediate 'erosion path', along Wili Pa Loop (Figure 2). Much of the area adjacent (immediately downstream) to these businesses are somewhat protected by concrete lining along the streambanks. However, there are no protective barriers lining the streambank behind the buildings housing these businesses.

Tables 1 through 6 present the quantitative results of the survey questionnaire. Included in the survey population are individuals with whom interviews were held for the identification of TCPs. A total of thirty two residents/business owners were approached and/or interviewed about the proposed project, including representatives of the four primary businesses within and across Wili Pa Loop (two of which have experienced severe erosion by the present stream flow). And important factor to note is that the majority of the people interviewed/surveyed were not aware of the proposed Flood Control Project. This will be discussed further in the conclusions.

Table 1. Population Surveyed, by Approximate Area of Residence

Participants in the Survey	Total
Men	21
Women	11
Total	32
Place of Residence	
Within immediate vicinity of Project Area	21
Wailuku side	15
Pihana side	06
Wailuku (general)	07
Outside of Wailuku *ahupua`a*	04

Table 2. Quantifiable Responses to Survey Questions[1]

	Yes	No	Unable to comment
Do you live near *ʻĪʻao* Stream	15	17	
Do you use *ʻĪʻao* Stream for recreational and/or subsistence purposes?	02	29	
Have you witnessed any changes to the stream over the years (e.g. stream flow, erosion, floods, etc.)?	11	21	
Are you familiar with the proposed flood control project (and or measures)?	05	27	
Are you familiar with any or all of the alignments (alternatives) proposed?	05[1]	27	
Do you have a preference for any one alterative	07[2]	17	8

[1] All of these individuals had either attended or were aware of the Public Scoping Meeting, or had red newspaper announcements about the proposed project.

[2] Includes individuals to whom the diagrams of the proposed alternatives were shown for the first time.

Table 3. Uses of *'Ï`ao* Stream in the Vicinity of the Project Area[1]

1.	Recreational (bicycling, dirt biking, jogging, swimming, boogie boarding)
2.	Farming (presently done only in the flood plain)
3.	Fishing and food gathering (catching/gathering *O`opu, opai,* or *hi`iwai* in the stream beds)

[1] Activities identified as either known about or personally performed, in order of occurrence.

Table 4. Knowledge about Traditional Uses and/or Sites along *'Ï`ao* Stream[1]

	Yes	No
Do you know of any traditional uses of *'Ï`ao* Stream?	07	25
Are you familiar with any traditional sites/features along the stream and/or within the flood plains area?	02	30
Would the proposed flood control affect/impact any of these traditional sites or features	0	

[1] The sites known to most people are *Haleki`i-Pihana Heiau,* the *Pu`u One Sand Dunes,* and the spring located behind the Sevilla property; all of these are outside of the project area.

4.2.2 *Are further flood control measures perceived as being needed?*

While the survey questionnaire did not include this question, based on the responses and inquiries made by the interviewees, the issue of whether or not further flood control measures are necessary became important. This question was formulated based on the lack of response or absence of knowledge about the proposed project. Table 5 summarizes the general response that was received.

Table 5. How would you Characterize the Effect(s) of Further Flood Control Measures for 'Ï`ao Stream?

Necessary (Positive)	09
Not necessary (Negative)	21[1]
No opinion/unable to judge	02

[1] five individuals saw negative effects as a result of the "cumulative" impacts of stream channelization and/or diversion techniques.

An overwhelming number of the people interviewed saw no need for further stream channelization and/or alignment. Part of this judgment appears to be based on past and existing experiences and observations of 'Ï`ao Stream; there is also great support for wanting the stream to be reverted back to its more original form. The latter includes many newcomers to the area, several of whom enjoy

and/or chose to live along the stream. Perhaps not so surprisingly, it also includes a significant number of the *kūpuna* and long term residents.

Table 6. Suggestions/Observations on how the Corps of Engineers can help the Community better Understand the Flood Control Project

		Frequency
1.	Provide further information about the proposed project[1]	16
2.	Hold [another] public meeting where the alternatives can be reviewed	07
3.	Help stop the erosion	11
4.	Identify who will benefit for these measures	04
5.	Restore the stream by placing back the animals that once lived in it	14

[1] seven individuals acknowledged that they were aware of the Public Scoping Meeting but just were not able to or did not attend.

The following is a summary of the potential negative and positive cultural impacts identified:

4.3 Summary and Recommendations: Cultural [impact] Mitigations and Enhancements

Potential Long-term "Direct" Cultural Impacts (Negative) from the Proposed 'Ï`ao Flood Control Project

1. Continued reduction or additional decrease in water flow. Most people would like to see a return of some regular flow of water. Further flood measures are seen as possibly further reducing water flow.
2. Additional concrete/cementing within streambed will add aggravate existing hazards, e.g. further compounding erosion action along stream banks. At present, physical impacts of erosion are greatest along the southeastern portion of the project area. (Many doubt the potential positive impacts from new flood control measures based on these impacts that are likely from previous channelization measures).
3. Further channelization measures will further discourage the return of original stream biota (e.g. *o`opu, opai* and *hi`iwai*). For people who are familiar with the biota of 'Ï`ao Stream, or know of the various animals that are found in fresh water, there is a desire to see these return to the stream. This is part of the greater desire to help return the stream to its earlier, pre-channelization, stage. There are also a few people who would like to enhance the stream by [re]introducing some of these species (some of this has already been done by the Hawaii Division of Aquatic Resources).

Potential Short-term "Indirect" Cultural Impacts (Negative) from the Proposed 'Ï`ao Flood Control Project

1. Inconveniences to area residents as a result of construction activities in the streambed, e.g. re-directing of traffic, dust and noise.
2. Restricted access to the maintenance road and stream for walking, biking and other recreational uses.

No Cultural Impacts (Positive) from the Proposed 'Ï`ao Flood Control Project

1. Threat of potential floods will be further removed.
2. Recreational features can be included as part of the flood control measures, e.g. walkways and safer guidelines for kids whom swim/bike within and along the streambed
3. Aesthetic value of the stream will increase with safer and more pleasant surroundings.
4. Measures can include improvements to existing water flow patterns, thereby allowing some of the original stream fauna to return. (While there isn't a direct desire to fish/gather in the stream, there is a strong desire to have it return to a more natural, biologically thriving system).

No Cultural Impacts to known Traditional Cultural Properties in the Vicinity of the Proposed 'Ï`ao Flood Control Project Area

No immediate/direct changes are foreseen to known Traditional Cultural Properties within the vicinity of the project area as a result of the proposed project. The only TCP that lies immediately along the banks of the 'Ï`ao Stream is the Haleki`i-Pihana Heiau State Monument. This site is situated well above the stream bank. However, if flood control measures lead to severe erosion along the stream bank that lies directly below the monument, the land area on which the *heiau* sits may be compromised. The potential impacts to the heiau should be monitored on a continuous basis. Other features and sites such as Mahalani Cemetery and the *Pu`u One* Sand Dunes are not likely to be affected by future flood control measures.

4.3.1 Recommendations

Based on requests made and observations, the following are recommended:

- Repair cement cracking along existing wall (off `Iao Place). At least two residents pointed to these cracks that lie behind their property. Both have concerns about the further widening of the cracks and the potential for water-flow to be compromised during heavy flows (e.g. flash floods).
- Help contain (repair) the eroding of the streambank along Wili Pa Loop.

- Incorporate recreational features and/or visual enhancement to the stream's levee. This can be done with the community's input and assistance.
- Schedule another meeting prior to implementation of any measures. While this may not dramatically increase the attendance of area residents, it allows individuals a second opportunity to participate in the 'decision-making' process.
- Clarify which agency is responsible for maintaining the stream (clearing of debris, etc.), and general contact information for area residents.

4.3.2 General Concerns/Issues

It would appear that most people who live and work along 'Ï`ao Stream have become familiar with the stream's somewhat 'predictable' nature as it concerns the occasional flash floods. As discussed earlier, a few people have become rather savvy to the expectations resulting from heavy rain pours can lead to.

No one interviewed currently uses the streambed for recreational activities; at least two residents use the access/levee road for leisurely walks but this is on a limited basis. The majority of individuals who seem to use the streambed are either children or from homes located away from the levee road. Some people expressed concerns over who will maintain/upkeep the stream in the event there is debris build-up. There isn't a clear knowledge about who is responsible; the question of whether it's the County, the State or the Corps of Engineers often arose. Most are concerned about erosion and/or feel sympathy with the owners of the land being impacted, several see it as the owner's responsibility for purchasing lands that had the potential to erode. Several have questioned diversion of water by the large companies and the county, and water rights access. There is a fair amount of distrust of the companies requesting water diversions (e.g. Wailuku Sugar Company), and their future intentions (e.g. directing water towards Kihei/Makena side, for further housing development, etc.).

In general, flood control does not seem to be a concern/issue, including for those residents and businesses living along the access/levee road. The concern over erosion is far greater, particularly for the two businesses directly affected. The community appears to be more concerned (or desires) about the social/recreational values of the stream. If control measures are enacted, there would be a greater sense of accomplishment (and cooperation) if it was done in consideration of the community's present needs and desires. This opinion was fairly common, from both the newcomers and the individuals who have experienced flooding, either at 'Ï`ao or elsewhere.

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APPENDIX A

GUIDELINES FOR ASSESSING CULTURAL IMPACTS Adopted by the Environmental Council, State of Hawaii November 19, 1997

I.

INTRODUCTION

It is the policy of the State of Hawaii under Chapter 343, HRS, to alert decision makers, through the environmental assessment process, about significant environmental effects which may result from the implementation of certain actions. An environmental assessment of cultural impacts gathers information about cultural practices and cultural features that may be affected by actions subject to Chapter 343, and promotes responsible decision making. Articles IX and XII of the State Constitution, other state laws, and the courts of the state require government agencies to promote and preserve cultural beliefs, practices, and resources of native Hawaiians and other ethnic groups. Chapter 343 also requires environmental assessment of cultural resources, in determining the significance of a proposed project.

The Environmental Council encourages preparers of environmental assessments and environmental impact statements to analyze the impact of a proposed action on cultural practices and features associated with the project area. The Council provides the following methodology and content protocol as guidance for any assessment of a project that may significantly affect cultural resources.

II.

CULTURAL IMPACT ASSESSMENT METHODOLOGY

Cultural impacts differ from other types of impacts assessed in environmental assessments or environmental impact statements. A cultural impact assessment includes information relating to the practices and beliefs of a particular cultural or ethnic group or groups.

Such information may be obtained through scoping, community meetings, ethnographic interviews and oral histories. Information provided by knowledgeable informants, including traditional cultural practitioners, can be applied to the analysis of cultural impacts in conjunction with information concerning cultural practices and features obtained through consultation and from documentary research.

In scoping the cultural portion of an environmental assessment, the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment. Thus, for example, a proposed action that may not physically alter gathering practices, but may affect access to gathering areas would be included in the assessment. An ahupua'a is usually the appropriate geographical unit to begin an assessment of cultural impacts of a proposed action, particularly if it includes all of the types of cultural practices associated with the project area. In some cases, cultural practices are likely to extend
beyond the ahupua'a and the geographical extent of the study area should take into account those cultural practices.

The historical period studied in a cultural impact assessment should commence with the initial presence in the area of the particular group whose cultural practices and features are being assessed. The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs.

The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural, including submerged cultural resources, which support such cultural practices and beliefs.

The Environmental Council recommends that preparers of assessments analyzing cultural impacts adopt the following protocol:

(1) identify and consult with individuals and organizations with expertise concerning the types of cultural resources, practices and beliefs found within the broad geographical area, e.g., district or ahupua 'a;

(2) identify and consult with individuals and organizations with knowledge of the area potentially affected by the proposed action;

(3) receive information from or conduct ethnographic interviews and oral histories with persons having knowledge of the potentially affected area;

(4) conduct ethnographic, historical, anthropological, sociological, and other culturally related documentary research;

(5) identify and describe the cultural resources, practices and beliefs located within the potentially affected area; and

(6) assess the impact of the proposed action, alternatives to the proposed action, and mitigation measures, on the cultural resources, practices and beliefs identified.

Interviews and oral histories with knowledgeable individuals may be recorded, if consent is given, and field visits by preparers accompanied by informants are encouraged. Persons interviewed should be afforded an opportunity to review the record of the interview, and consent to publish the record should be obtained whenever possible. For example, the precise location of human burials are likely to be withheld from a cultural impact assessment, but it is important that the document identify the impact a project would have on the burials. At times an informant may provide information only on the condition that it remain in confidence. The wishes of the informant should be respected.

Primary source materials reviewed and analyzed may include, as appropriate: Mahele, land court, census and tax records, including testimonies; vital statistics records; family histories and genealogies; previously published or recorded ethnographic interviews and oral histories; community studies, old maps and photographs; and other archival documents, including correspondence, newspaper or almanac articles, and visitor journals. Secondary source materials such as historical, sociological, and anthropological texts, manuscripts, and similar materials, published and unpublished, should also be consulted. Other materials which should be examined include prior land use proposals, decisions, and rulings which pertain to the study area.

III. CULTURAL IMP ACT ASSESSMENT CONTENTS

In addition to the content requirements for environmental assessments and environmental impact statements, which are set out in HAR §§ 11-200-10 and 16 through 18, the portion of the assessment concerning cultural impacts should address, but not necessarily be limited to, the following matters:

1. A discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints or limitations which might have affected the quality of the information obtained.

2. A description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken.

3. Ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained.

4. Biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area.

5. A discussion concerning historical and cultural source materials consulted, the institutions and repositories searched, and the level of effort undertaken. This discussion should include, if appropriate, the particular perspective of the authors, any opposing views, and any other relevant constraints, limitations or biases.

6. A discussion concerning the cultural resources, practices and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site.

7. A discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project.

8. An explanation of confidential information that has been withheld from public disclosure in the assessment.

9. A discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs.

10. An analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place.

11. A bibliography of references, and attached records of interviews which were allowed to be disclosed.

The inclusion of this information will help make environmental assessments and environmental impact statements complete and meet the requirements of Chapter 343, HRS. If you have any questions, please call us at 586-4185.

APPENDIX B

Transcripts of Oral Interviews completed for
TCP and CIA Study of `Iao Flood Control Project

(to be inserted)

Duke Sevilla
September 11, 2003

I met with Duke at his family home on Kaae Place, Wailuku. We spent nearly 2 hours together and he took me to visit the fresh water spring in back of family house. The spring is huge, with a drop off from the upper ledge of approximately 40 feet. There's bananas, coconuts and betel palm growing inside – all planted by Duke's father or himself. Some of the stone walls still remain…portions of them. See photos.

According to Duke, Paul Winter owns much of the land from Waihee to Waiehu, along this coastal portion. There have been problems with his and his partners (Giovanni and Robin Williams or Northshore LLC) intentions to develop along this shoreline. Burials, near Duke's home on the oceanside, is one of the problems. Duke said the archaeologists have been out to look at the burials but did not cover them properly. He also knows of the heiau…walls have been pointed out by Uncle Charlie (Duke will take me on a visit if I want to go see the site). This is the same heiau mentioned by Inez Ashdown.

Duke's father bought this property. He did not come into as a kuleana. He recalls swimming in the water spring and showed me many pictures he took of his nieces and nephews playing in it. There are points within the spring that are possibly up to 10 feet depth but most was shallow. Some of the photos show the taro growing on the sides/edges of the spring. He says sometimes in the winter, there is a trickle of water but when there's heavy rainfall. Otherwise, its been fairly dry since the channelization. Prior to the channel placement, the water was bubbling…it would run like Iao Stream. "when I was in grade school, I was like paradise".

His dad had taro, and grew Ong Choi and watercress. He placed a submersible pump with canvas hoses that took water from the spring up to the vegetable patches. I asked why his father didn't try to stop or caution the constructors of the channel, and he's father commented "what can one man do"?

Duke recalls the old kupuna who could come down to fill up their jugs with water from the spring. They were from places outside of Wailuku. They called the pond "Waiola". This was in the 70s and 80s. there is also a legend of the Mo'o associated with the pond, and the heiau (the ones along the stream I think). He said he asked the kupuna if they knew the name of the spring because it was supposed to be a secret, but they themselves didn't know. He doesn't think its Wailoa.

He also used to walk along the "ili ili" (small pebbled) lined trails along the sand dunes, makai of his house. The construction by people such as Robin Williams has destroyed most of these trails areas. He said that he was more afraid of the coastal areas than of the spirits in the spring. He's father told him to be respectful of the spirits in the spring…and he witnessed several eerie events. But he never feared them. He also said that he's uncle once saw a menehune walk into one of the walls of the spring.

There also was a mullet pond on the Kekona's property right below (oceanside) of the spring. Uncle Kekona filled up the pond once the water started to dry up. It was sad to see and Duke tried to stop him but Kekona went ahead and filled up the pond.

Also, there was a big pond that formed from the stream, in front (below) Sac & Save. This is where the kids would go to swim. Like Rose Duey, Duke recalls when they would drive over through the stream bed to get to the other side. This is before the bridge was placed. The bottom of the stream bed was lined with pebbles. Rose remembers people washing their cars as they passed through the area. When the water got too high, they'd have to go use the Market Street Bridge.

Two houses down, he pointed out a house that has had a reputation for evil spirits lingering. It was once occupied by the Kong family. The wife murdered her husband by chopping his body into small pieces, and throwing them around. Afterwards, the Cruz's bought the property and they were all thought to be a bit insane. Now the house seems to be at peace but it is built on burials. The problems are associated with the idea the spirits are unhappy.

Duke suggested that I talk with Charlie Duarte who worked for IGE Construction until he retired. Ige Construction did a lot of the work in this area…they were big. Charlie worked on the diversion of water in the Happy Valley area. Duke noticed the soils and found an artifact (rock charcoal/incense holder) near where the present Youth Center is. He asked Charlie and Charlie said that the materials they removed from the Happy Valley area for the diversion, was dumped in the gulch by the Youth Center. Duke figures there's more artifacts that got dumped off.

Oliver Dukelow, who now lives in Kakakuloa, used to live in Hawaiian Homelands along Iao Stream. He was kicked out because he refused to pay the taxes on water to the County. Everyone is DHHL lands is supposed to have free water…Oliver argued over why he should have to pay taxes. He was fined by the County and then finally forced off.

Joe Duarte Jr.
(son of Joe Duarte, grandson of Feliciano Duarte; born and raised on Iao Valley Road)

Joe recalls that the stream was water for irrigation all the way down to the ocean. He remembers that his grandfather had o'opu traps set out in the river/stream. He also remembers that the kuleana water went to the taro patches that his grandfather owned. Manual (uncle) Duarte's place had taro patches and coffee. Joe's grandfather used to lease the lands from Wailuku Sugar Company and had coffee farms all the way down to Mokehau. He also had a hog farm and dairy, just before WWII. It was the lower portions that were leased from Wailuku Sugar.

Eddie Rogers exchanged lands for his grandfather's leased lands, and raised cattle in the Mokehau area.

Below his house is the Ornellas' place. They've been here a long time (good to talk to). The Apanas are new; they bought the lands more recently (they sell flowers).

I asked what he's opinion was of the channeling. He said that the cementing was alright. He thinks because of the channelization, the Mokehau area homes are protected now. "water and rains no more like the old days". But Joe feels the homes needed and still need protection.

Kanji Wakamatsu
Wakamatsu Fish Store, Wailuku, August 28, 2003

Kanji is approximately 84 years old. He grew up in the plantation here in Wailuku. He worked on the plantation for 75 cents a day. Back then, they hired kids at the age of 15. When he worked 26 days straight, he'd get a little more than $26.00. 'used to get dollar half day' for the straight workdays, while in high school.

He never sold *o`opu* nor *hi`iwai,* but picked both as a kid. You eat the inside of the *hi`iwai*. You find them when you turn over a rock. He used to go fishing in the early 1930s. We used to catch *o`opu* and catfish. Where the irrigation ditch is…the HC&S irrigation ditch. We used to sell to the Chinese families. They were large size. The *hi`iwai* were big enough to use as whistles.

He served in Guam in 1946; he stayed 6 months and became good friends with the Chamorros. His brother in law was on Tinian. He was not in the 442nd; he was drafted.

Kanji is getting ready to take his 82 year old wife to the Mayo Clinic for some procedure (didn't say what). He's fish store will close down after his generation since his son doesn't want to carry on. In fact, he son has left him (his words).

Kanji's quite the fresh little man…a very nice reminder of the old times.

Margaret Duarte
550 Iao Valley Road. Wife of Manual Duarte
(original residents of lot leased by Feliciano Duarte)

Margaret is 88 years old; she has lived at this residence for the past 68 years. Her husband, Manual is 93 and has Alzheimer's; he was born and raised on this family land. She donated the one picture of her in-laws standing in front of the dairy/barn area to the Bailey House Museum.

Margaret recalls that there were plenty of 'oopu' in the stream. 'it's a sweet water fish, catfish. Has opai, but in the mountains, in the waterfalls, ponds where Hawaiians used to go to gather food. I should call Rebecca Minn (and Ralph Minn); she is the daughter of John Mahi, neice of James Mahi. Margaret recalls James going up to pick food. "uncles would go up stream to pick up his food – opai, oopu and taro. I remember that. But they're all gone". Rebecca lives in the Papokalo Hawaiian Homestead area. Also contact the Ornellas family who live below me.

Margaret discussed that they "had kuleana water right in our lands but when Duey's bought in, they covered it [water]. They graded for houses, planted trees right over our kuleana water. When we talked to the plantation, they say we have to go down to the river; we'd have to get an intake. They 'destroyed' the water. Water is supposed to come to our land…it runs a few feet from our house. But the water is lower. We had a lot of taro patches, whatever [water] we didn't use, went back to the river".

"[its] Wailuku River…history says Wailuku River…not stream. When it gets full of water, let me tell you, it looks just like a river".

"we haven't seen water in our river for a very long time".

There are trees up (towards the Duey's) from her house, in the stream. There's oak, kukui, etc. "That's gonna make a lot of damage. We've seen lots of rocks, rolling and everything…like back-up, things flood up. We don't have any more pigs, we don't have any more cows".

We stopped our hogs; killed our last one last Sunday. I don't want any more animals. It's a good thing we live on a agricutlural lot but I'm calling the agricutlure division to let them know that I don't have any more hogs. The Duey's owning above us complain so much about the smell, flies, etc. I've removed the hogs but won't remove the pens…I'm 88 years old. I can no longer go out there and do that.

The land Margaret lives on is the same one that her father-in-law lived on. He had a 100 year lease from Wailuku Sugar Company. Before the lease expired, they were telling us to clean up the land (before the Duey's came in and bought it). This used to be the Duarte family lands but no more since the Duey's have bought most of the land above them.

She recalls that the river was just one channel before the big flood. "the Big Flood (maybe 1987) took half of our land. Used to be one river against the mountain. [she remembers when it was just one]. [it] split in two". This was the same flood where 2 cars went down under Wailuku Bridge.

APPENDIX C

Questionnaire for Oral History Studies for the Determination of Traditional Cultural Properties and Cultural Impact Assessment for the 'Iao Flood Control Project, Maui Island, Hawaii

Name: _____ **Contact #** (optional): _____

Place of Residence: _____

1. Do you live near 'Iao Stream? Yes_____ No_____
   Adjacent to levee _____ Nearby _____

2. How much time have your spent around the stream area?_____

3. Do you use 'Iao Stream for recreational and/or subsistence purposes?
   If yes, describe activity_____

4. Do you know of any traditional uses of 'Iao Stream?_____

   a.. Are you familiar with any of the traditional sites/features along the stream and/or within the flood plains area?
   If yes, list here (provide complete description)
   _____
   _____

5. Have you witnessed any changes to the stream over the years (e.g., stream flow, erosion, floods, etc.)?
   If yes, describe the change_____
   _____

6. Do you feel flood control efforts are necessary for 'Iao Stream? Yes_____ No_____
   Have you observed any of the activities:_____

7. Are you familiar with the proposal to repair erosion along the stream? Yes_____ No_____
   If yes, is there one particular proposed alignment you favor others? (List by #)
   Why_____
   Which other alternative alignment would want to see?_____

   a. Will one or any of these alternatives impact your use of the stream?
   If YES, then how?_____

8. Do you think that any of the proposed flood control measures will affect traditional sites/features along the stream?

8. Do you think that any of the proposed flood control measures will affect traditional sites/features along the stream?
   If YES, then
   how?_____

9. In general, how would you characterize the effect(s) of the proposed flood control measures for `Iao Stream?

   a. Positive: _____
   a. Negative:_____
   b. None foreseen:_____
   c. Unable to form opinion:_____

10. Do you have any concerns/issues about the proposed flood control measures?

    _____
    _____

1. Do you have any suggestions/observations of what the Corps of Engineers can do to help the community better understand their proposal(s) for `Iao Stream?

   _____
   _____

2. Is there anything else you would like to add or say?

   _____
   _____

APPENDIX D

List of Individuals Interviewed and/or Contacted for Oral History Studies for the Identification of TCPs in the `Iao Flood Control Project, Maui Island, Hawaii

1. Charles Keau
2. Sam Ka`a`ai
3. Ned Purdy, Division of Forestry
4. Skippy Hau, area resident and employee of Department of Land and Natural Resources
5. John Duey
6. Rose Duey
7. Bob Hobdy, Division of Forestry
8. Ed Lindsey
9. Duke Sevilla, area resident
10. Kaimu Willstein, Office of Hawaiian Affairs
11. Melissa Kykendall, State Historic Preservation Office, Maui
12. Leona Ryder, `Iao Valley School
13. Manual and Margaret Duarte
14. Manual Duarte Jr.
15. Joe Duarte (Manual's nephew)
16. Charlie Duarte
17. Takamiya Family
18. Kamita family
19. Honda family
20. Kanji Wakamatsu (Wakamatsu Fish Market)
21. Gordon Cockett
22. Winifred Cockett
23. Tom Cerizo
24. Alan K. Bernaldo
25. Ken and Beverly Kurokawa
26. Greg Apa
27. Emmett Rodrigues

Appendix L:

EDR Radius Map Report

Iao Stream
Iao Stream
Wailuku, HI 96793

Inquiry Number: 3914751.2s
April 16, 2014

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

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Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

IAO STREAM
WAILUKU, HI 96793

COORDINATES

Latitude (North):	20.8962000 - 20° 53' 46.32''
Longitude (West):	156.4993000 - 156° 29' 57.48''
Universal Tranverse Mercator:	Zone 4
UTM X (Meters):	760140.1
UTM Y (Meters):	2312549.0
Elevation:	161 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	20156-H4 KAHAKULOA, HI
Most Recent Revision:	Not reported
West Map:	20156-H5 NAPILI, HI
Most Recent Revision:	Not reported

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL ---------- National Priority List
Proposed NPL ---------- Proposed National Priority List Sites

EXECUTIVE SUMMARY

NPL LIENS ---- Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ---- National Priority List Deletions

Federal CERCLIS list

CERCLIS ---- Comprehensive Environmental Response, Compensation, and Liability Information System
FEDERAL FACILITY ---- Federal Facility Site Information listing

Federal RCRA CORRACTS facilities list

CORRACTS ---- Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF ---- RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG ---- RCRA - Large Quantity Generators

Federal institutional controls / engineering controls registries

US ENG CONTROLS ---- Engineering Controls Sites List
US INST CONTROL ---- Sites with Institutional Controls
LUCIS ---- Land Use Control Information System

Federal ERNS list

ERNS ---- Emergency Response Notification System

State and tribal landfill and/or solid waste disposal site lists

SWF/LF ---- Permitted Landfills in the State of Hawaii

State and tribal leaking storage tank lists

INDIAN LUST ---- Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

UST ---- Underground Storage Tank Database
INDIAN UST ---- Underground Storage Tanks on Indian Land
FEMA UST ---- Underground Storage Tank Listing

State and tribal institutional control / engineering control registries

ENG CONTROLS ---- Engineering Control Sites

State and tribal voluntary cleanup sites

VCP ---- Voluntary Response Program Sites
INDIAN VCP ---- Voluntary Cleanup Priority Listing

EXECUTIVE SUMMARY

State and tribal Brownfields sites

BROWNFIELDS ---------- Brownfields Sites

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS ---------- A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9 ---------- Torres Martinez Reservation Illegal Dump Site Locations
ODI ---------- Open Dump Inventory
INDIAN ODI ---------- Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL ---------- Clandestine Drug Labs
CDL ---------- Clandestine Drug Lab Listing
US HIST CDL ---------- National Clandestine Laboratory Register

Local Land Records

LIENS 2 ---------- CERCLA Lien Information

Records of Emergency Release Reports

HMIRS ---------- Hazardous Materials Information Reporting System
SPILLS ---------- Release Notifications
SPILLS 90 ---------- SPILLS 90 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR ---------- RCRA - Non Generators
DOT OPS ---------- Incident and Accident Data
DOD ---------- Department of Defense Sites
FUDS ---------- Formerly Used Defense Sites
CONSENT ---------- Superfund (CERCLA) Consent Decrees
ROD ---------- Records Of Decision
UMTRA ---------- Uranium Mill Tailings Sites
US MINES ---------- Mines Master Index File
TRIS ---------- Toxic Chemical Release Inventory System
TSCA ---------- Toxic Substances Control Act
FTTS ---------- FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS ---------- FIFRA/TSCA Tracking System Administrative Case Listing
SSTS ---------- Section 7 Tracking Systems
ICIS ---------- Integrated Compliance Information System
PADS ---------- PCB Activity Database System
MLTS ---------- Material Licensing Tracking System
RADINFO ---------- Radiation Information Database
FINDS ---------- Facility Index System/Facility Registry System

RAATS RCRA Administrative Action Tracking System
RMP Risk Management Plans
UIC Underground Injection Wells Listing
DRYCLEANERS Permitted Drycleaner Facility Listing
AIRS List of Permitted Facilities
INDIAN RESERV Indian Reservations
SCRD DRYCLEANERS State Coalition for Remediation of Drycleaners Listing
LEAD SMELTERS Lead Smelter Sites
2020 COR ACTION 2020 Corrective Action Program List
US AIRS Aerometric Information Retrieval System Facility Subsystem
PRP Potentially Responsible Parties
Financial Assurance Financial Assurance Information Listing
US FIN ASSUR Financial Assurance Information
PCB TRANSFORMER PCB Transformer Registration Database
COAL ASH EPA Coal Combustion Residues Surface Impoundments List
COAL ASH DOE Steam-Electric Plant Operation Data
EPA WATCH LIST EPA WATCH LIST

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP EDR Proprietary Manufactured Gas Plants

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LF Recovered Government Archive Solid Waste Facilities List
RGA HWS Recovered Government Archive State Hazardous Waste Facilities List
RGA LUST Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Federal CERCLIS NFRAP site List

CERC-NFRAP: Archived sites are sites that have been removed and archived from the inventory of CERCLIS

sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

A review of the CERC-NFRAP list, as provided by EDR, and dated 10/25/2013 has revealed that there is 1 CERC-NFRAP site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
KUKUI GROVE HOLDER	*46 TINGS DR*	*SSE 1/4 - 1/2 (0.476 mi.)*	*C14*	*21*

Federal RCRA generators list

RCRA-SQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

A review of the RCRA-SQG list, as provided by EDR, and dated 03/11/2014 has revealed that there is 1 RCRA-SQG site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
MAUI S QUALITY DRY CLEANING	*210 IMI KALA ST*	*S 1/8 - 1/4 (0.213 mi.)*	*A4*	*10*

RCRA-CESQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

A review of the RCRA-CESQG list, as provided by EDR, and dated 03/11/2014 has revealed that there is 1 RCRA-CESQG site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
BROWNING FERRIS IND	*280 IMI KALA ST*	*W 0 - 1/8 (0.101 mi.)*	*3*	*9*

State- and tribal - equivalent CERCLIS

SHWS: The State Hazardous Waste Sites records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. The data come from the Department of Health.

A review of the SHWS list, as provided by EDR, and dated 01/04/2014 has revealed that there are 12

SHWS sites within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
WAILUKU SUGAR COMPANY PESTICID	*250 IMI KALA ST*	*SW 0 - 1/8 (0.075 mi.)*	*1*	*7*
GOMES CONSTRUCTION & REPAIRS I	*1790 MILL ST*	*SSW 1/4 - 1/2 (0.297 mi.)*	*8*	*13*
MECO TRANSFORMER 3358	*1540 E MAIN ST*	*SE 1/4 - 1/2 (0.362 mi.)*	*B10*	*17*
WAILUKU SUGAR AGRICULTURAL DEP	*2015 HOLOWAI PL*	*SW 1/4 - 1/2 (0.449 mi.)*	*12*	*19*
MAUI SANDTORCHES	*46 TING DR*	*SSE 1/4 - 1/2 (0.476 mi.)*	*C13*	*20*
REX TIRE & SUPPLY, DIESEL	*1728 KAAHUMANU AVE*	*SSE 1/2 - 1 (0.572 mi.)*	*15*	*23*
2102 VINEYARD ST.	*2102 VINEYARD ST*	*SSW 1/2 - 1 (0.572 mi.)*	*16*	*24*
ROBERT JOSLIN	*2026 MAIN ST*	*SSW 1/2 - 1 (0.610 mi.)*	*17*	*25*
MAIN STREET PROMENADE PROJECT	*2058 MAIN ST*	*SSW 1/2 - 1 (0.629 mi.)*	*D18*	*30*
ALVIN'S UPTOWN CHEVRON SERVICE	*2085 WEST MAIN ST*	*SSW 1/2 - 1 (0.648 mi.)*	*D19*	*31*
ORGANIZATIONAL MAINTENANCE SHO	*260 S MARKET ST*	*S 1/2 - 1 (0.799 mi.)*	*20*	*32*

Lower Elevation	Address	Direction / Distance	Map ID	Page
WAIALE ASH PILE	*MAHALANI ST*	*ESE 1/2 - 1 (0.958 mi.)*	*21*	*33*

State and tribal leaking storage tank lists

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the Department of Health's Active Leaking Underground Storage Tank Log Listing.

A review of the LUST list, as provided by EDR, and dated 12/04/2013 has revealed that there are 2 LUST sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
HALE MAKUA NURSING HOME - WAIL	*1540 LOWER MAIN ST*	*SE 1/4 - 1/2 (0.362 mi.)*	*B9*	*16*
Facility Status: Site Cleanup Completed (NFA)				
OGAWA SERVICE STATION	*327 N MARKET ST*	*SW 1/4 - 1/2 (0.415 mi.)*	*11*	*18*
Facility Status: Site Cleanup Completed (NFA)				

State and tribal institutional control / engineering control registries

Voluntary Remediation Program and Brownfields sites with institutional controls in place.

A review of the INST CONTROL list, as provided by EDR, and dated 01/04/2014 has revealed that there is 1 INST CONTROL site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
WAILUKU SUGAR AGRICULTURAL DEP	*2015 HOLOWAI PL*	*SW 1/4 - 1/2 (0.449 mi.)*	*12*	*19*

EXECUTIVE SUMMARY

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR US Hist Auto Stat: EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

A review of the EDR US Hist Auto Stat list, as provided by EDR, has revealed that there are 3 EDR US Hist Auto Stat sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
Not reported	395 NEKI PL	WNW 0 - 1/8 (0.101 mi.)	2	8
Not reported	1720 WILI PA LOOP	S 1/8 - 1/4 (0.231 mi.)	6	12
Not reported	1726 MILL ST	SSE 1/8 - 1/4 (0.237 mi.)	7	13

EDR US Hist Cleaners: EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

A review of the EDR US Hist Cleaners list, as provided by EDR, has revealed that there is 1 EDR US Hist Cleaners site within approximately 0.25 miles of the target property.

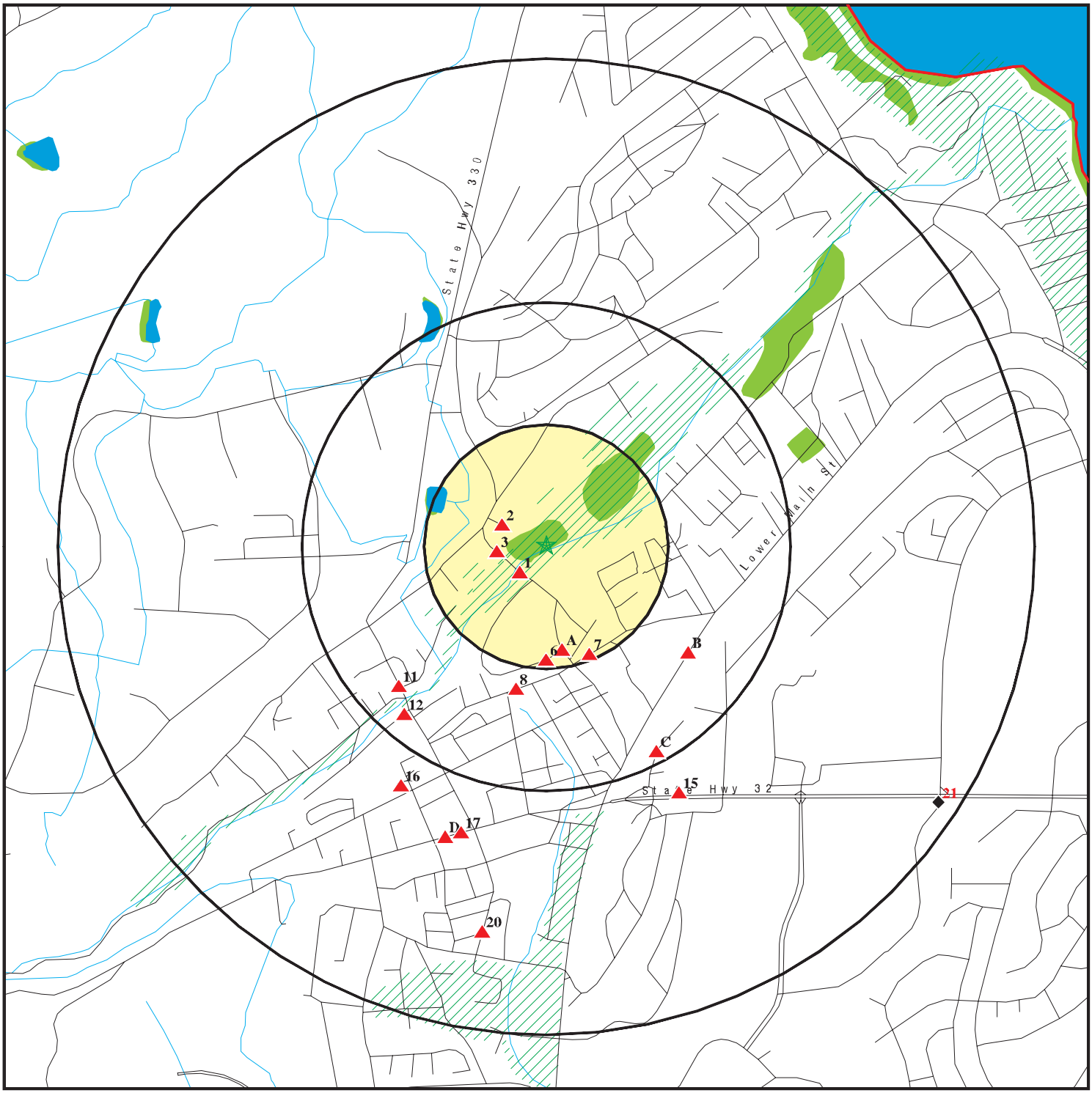
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
Not reported	210 IMI KALA ST	S 1/8 - 1/4 (0.213 mi.)	A5	12

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 20 records.

Site Name	Database(s)
LOT F4 KANE STREET	SHWS, ENG CONTROLS, INST CONTROL
KALAMAULA LANDFILL	SHWS, ENG CONTROLS
MECO STATION-CLASS TRANSFORMER NO.	SHWS, SPILLS
MECO PAD-MOUNT TRANSFORMER NO. 137	SHWS
VECTOR CONTROL BRANCH, MAUI	SHWS, RGA HWS
HOBRON AVE AREA (KAHULUI)	SHWS, RGA HWS
FONG CONSTRUCTION	SHWS, RGA HWS
A&B DUMP SITE	SHWS, RGA HWS
WAIKAPU DUMP-MAUI COUNTY DUMP	SHWS, RGA HWS
PAIA SUGAR MILL	SHWS, RGA HWS
MECO POLE-MOUNT TRANSFORMER NO. 88	SHWS
Y HATA- MAUI	SHWS, SPILLS
WAIKAPU DUMP-MAUI COUNTY DUMP	CERC-NFRAP
MAUI BLOCKS	UST
VACANT LAND TMK NO (2) 3-8-7:101	RCRA NonGen / NLR
IAO VALLEY STATE PARK - LCC	FINDS
WAILUKU AG DIVERSION OF IAO STREAM	FINDS
IAO MIDDLE SCHOOL	FINDS
IAO STREAM	FINDS
WAIEHU BEACH ROAD, REHABILITATION	FINDS

OVERVIEW MAP - 3914751.2s



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- County Boundary
- Oil & Gas pipelines from USGS
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Iao Stream ADDRESS: Iao Stream Wailuku HI 96793 LAT/LONG: 20.8962 / 156.4993	CLIENT: Environet CONTACT: Taylor Chock INQUIRY #: 3914751.2s DATE: April 16, 2014 7:29 pm

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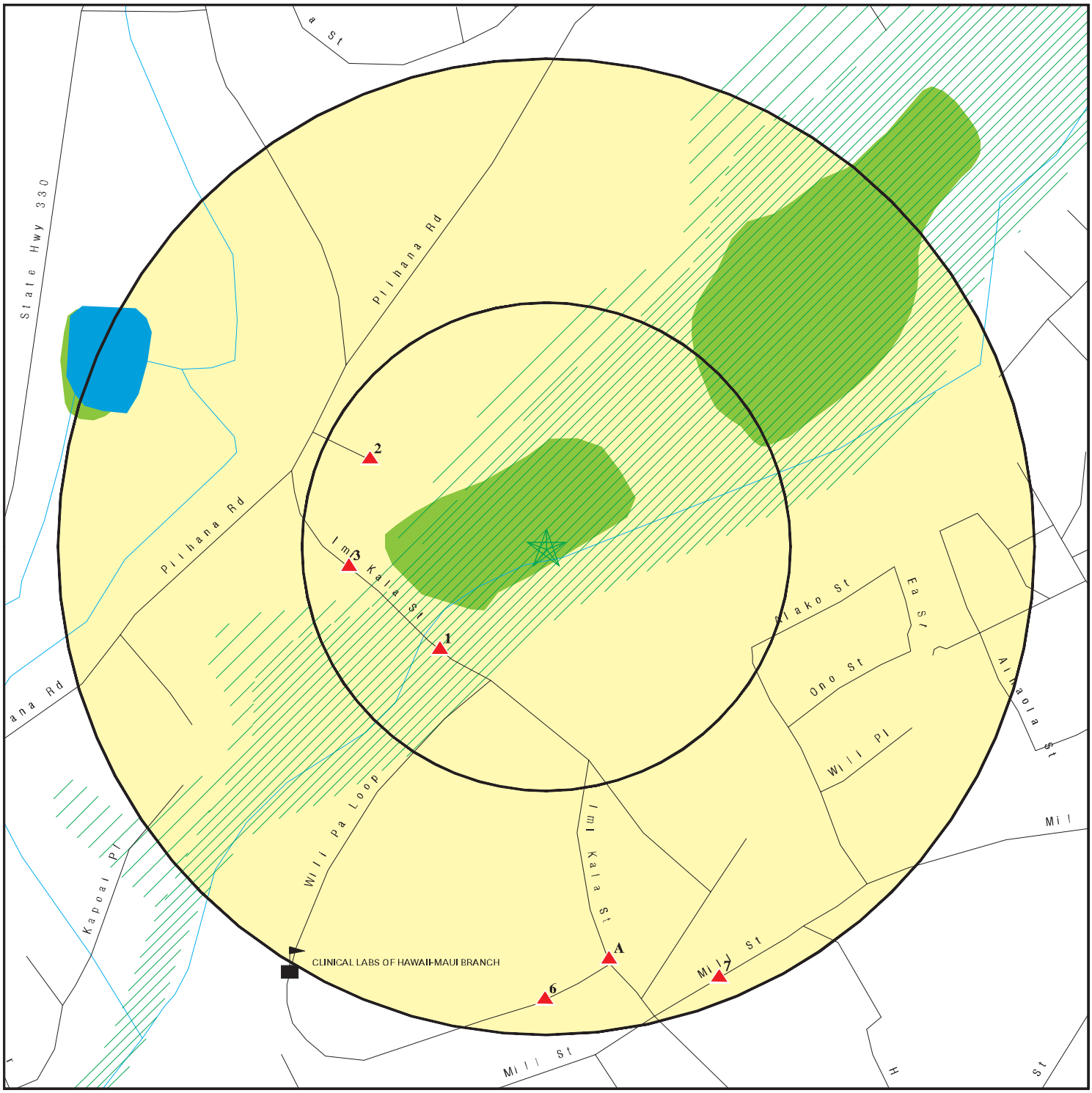
DETAIL MAP - 3914751.2s



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Oil & Gas pipelines from USGS
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory

0 1/16 1/8 1/4 Miles

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Iao Stream ADDRESS: Iao Stream Wailuku HI 96793 LAT/LONG: 20.8962 / 156.4993	CLIENT: Environet CONTACT: Taylor Chock INQUIRY #: 3914751.2s DATE: April 16, 2014 7:29 pm

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MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
CERCLIS	0.500		0	0	0	NR	NR	0
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP	0.500		0	0	1	NR	NR	1
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	1	NR	NR	NR	1
RCRA-CESQG	0.250		1	0	NR	NR	NR	1
Federal institutional controls / engineering controls registries								
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
LUCIS	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.000		1	0	4	7	NR	12
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		0	0	2	NR	NR	2
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
UST	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
INDIAN UST	0.250		0	0	NR	NR	NR	0
FEMA UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
ENG CONTROLS	0.500		0	0	0	NR	NR	0
INST CONTROL	0.500		0	0	1	NR	NR	1
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL	TP		NR	NR	NR	NR	NR	0
CDL	TP		NR	NR	NR	NR	NR	0
US HIST CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
DOD	1.000		0	0	0	0	NR	0
FUDS	1.000		0	0	0	0	NR	0
CONSENT	1.000		0	0	0	0	NR	0
ROD	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
TSCA	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
AIRS	TP		NR	NR	NR	NR	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR US Hist Auto Stat	0.250		1	2	NR	NR	NR	3
EDR US Hist Cleaners	0.250		0	1	NR	NR	NR	1
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA HWS	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

1
SW
< 1/8
0.075 mi.
396 ft.

Relative:
Higher

Actual:
164 ft.

WAILUKU SUGAR COMPANY PESTICIDE MIXING AREA
250 IMI KALA ST
WAILUKU, HI 96793

SHWS **S110061652**
RGA HWS **N/A**

SHWS:

Organization:	Not reported
Supplemental Location:	Not reported
Island:	Maui
Environmental Interest:	Maui Disposal
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	HEER
Program:	State
Project Manager:	Cal Miyahara
Hazard Priority:	NFA
Potential Hazards And Controls:	No Hazard
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Not reported
SDAR Environmental Interest Name:	Maui Disposal
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	HEER
Progran Name:	State
Potential Hazard And Controls:	No Hazard
Priority:	NFA
Assessment:	Response Necessary
Response:	Response Complete
Nature of Contamination:	Found: TPH-o exceeds residential use levels in surface soils.
Nature of Residual Contamination:	Two of four DUs had minimal concentrations (563 and 767 mg/kg) of Petroleum Hydrocarbon as motor oil exceeding residential use EALs of 500 mg/kg for gross contamination. However, there were no signs of soil staining or petroleum odor.
Use Restrictions:	No Hazard Present For Unrestricted Residential Use
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	No Further Action Letter - Unrestricted Residential Use
Document Date:	07/21/2011
Document Number:	2011-412-CMM
Document Subject:	Removal Action Report, Maui Disposal - Wailuku Post Office Former Parking Lot, 250 Imi Kala St, Wail
Project Manager:	Cal Miyahara
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814
Organization:	Not reported
Supplemental Location:	Not reported
Island:	Maui
Environmental Interest:	Wailuku Sugar Company Pesticide Mixing Area
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	HEER
Program:	Site Discovery
Project Manager:	Cal Miyahara
Hazard Priority:	NFA
Potential Hazards And Controls:	No Hazard

WAILUKU SUGAR COMPANY PESTICIDE MIXING AREA (Continued) **S110061652**

Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Not reported
SDAR Environmental Interest Name:	Wailuku Sugar Company Pesticide Mixing Area
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	HEER
Progran Name:	Site Discovery
Potential Hazard And Controls:	No Hazard
Priority:	NFA
Assessment:	Response Necessary
Response:	Response Complete
Nature of Contamination:	Presumed: possible arsenic, organochlorine release in vicinity of former PMA
Nature of Residual Contamination:	Soils do not pose a threat to human health or the environment based on three factors: the low concentrations relative to our unrestricted action levels, the small area impacted and the presence of clean soils above and below the impacted soils.
Use Restrictions:	No Hazard Present For Unrestricted Residential Use
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	No Further Action Letter - Unrestricted Residential Use
Document Date:	03/06/2013
Document Number:	2013-128-CMM
Document Subject:	No Further Action Determination for Pesticides and Metals Contamination at the Wailuku Sugar Company
Project Manager:	Cal Miyahara
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

RGA HWS:

2012	MAUI DISPOSAL	250 IMI KALA ST
2012	WAILUKU SUGAR COMPANY PESTICIDE MIXING AREA	250 IMI KALA ST
2009	MAUI DISPOSAL	250 IMI KALA ST

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2 **EDR US Hist Auto Stat** **1015465504**
WNW **395 NEKI PL** **N/A**
< 1/8 **WAILUKU, HI 96793**
0.101 mi.
534 ft.

Relative:
Higher

Actual:
183 ft.

EDR Historical Auto Stations:

Name:	BIG AL S AUTO SERVICE
Year:	2001
Address:	395 NEKI PL

3
West
< 1/8
0.101 mi.
535 ft.

BROWNING FERRIS IND
280 IMI KALA ST
WAILUKU, HI 96793

RCRA-CESQG
FINDS

1004688734
HI0000146969

Relative:
Higher

Actual:
174 ft.

RCRA-CESQG:

Date form received by agency:	02/11/1994
Facility name:	BROWNING FERRIS IND
Facility address:	280 IMI KALA ST WAILUKU, HI 96793
EPA ID:	HI0000146969
Mailing address:	IMI KALA ST WAILUKU, HI 96793
Contact:	KIRK DUNCAN
Contact address:	280 IMI KALA ST WAILUKU, HI 96793
Contact country:	US
Contact telephone:	(808) 242-7999
Contact email:	Not reported
EPA Region:	09
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:

Owner/operator name:	BROWNING FERRIS IND OF HAWAII INC
Owner/operator address:	207 PUUHALE RD HONOLULU, HI 96819
Owner/operator country:	Not reported
Owner/operator telephone:	(808) 833-9969
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No
Used oil fuel burner:	No

BROWNING FERRIS IND (Continued) **1004688734**

Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Violation Status: No violations found

FINDS:

Registry ID: 110005721889

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

STATE MASTER

A4 **MAUI S QUALITY DRY CLEANING** **RCRA-SQG** **1000860456**
South **210 IMI KALA ST** **FINDS** **HI0000076869**
1/8-1/4 **WAILUKU, HI**
0.213 mi.
1123 ft. **Site 1 of 2 in cluster A**

Relative:
Higher

Actual:
193 ft.

RCRA-SQG:
Date form received by agency: 12/06/1993
Facility name: MAUI S QUALITY DRY CLEANING
Facility address: 210 IMI KALA ST
WAILUKU, HI 96793
EPA ID: HI0000076869
Mailing address: IMI KALA ST
WAILUKU, HI 96793
Contact: JAMIE LANIAS
Contact address: 210 IMI KALA ST
WAILUKU, HI 96793
Contact country: US
Contact telephone: (808) 244-1945
Contact email: Not reported
EPA Region: 09
Land type: Private
Classification: Small Small Quantity Generator
Description: Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:
Owner/operator name: LLOYD EUGENE WIENS
Owner/operator address: 41 KUPUNA ST
KIHEI, HI 96753
Owner/operator country: Not reported

MAUI S QUALITY DRY CLEANING (Continued) **1000860456**

Owner/operator telephone: (808) 879-3603
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Violation Status: No violations found

Evaluation Action Summary:
Evaluation date: 01/23/2007
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 12/18/2003
Evaluation: FOLLOW-UP INSPECTION
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

FINDS:

Registry ID: 110005721781

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

STATE MASTER

A5
South
1/8-1/4
0.213 mi.
1123 ft.

Site 2 of 2 in cluster A

EDR US Hist Cleaners **1015016621**
N/A

210 IMI KALA ST
WAILUKU, HI 96793

Relative:
Higher

Actual:
193 ft.

EDR Historical Cleaners:

Name:	MAUIS QUALITY DRY CLEANING & LAUNDRY
Year:	1999
Address:	210 IMI KALA ST
Name:	MAUIS QLTY DRY CLNNG & LNDRY
Year:	2001
Address:	210 IMI KALA ST
Name:	MAUIS QUALITY DRY CLEANING
Year:	2001
Address:	210 IMI KALA ST
Name:	MAUIS QLTY DRY CLNNG & LNDRY
Year:	2002
Address:	210 IMI KALA ST
Name:	MAUIS QLTY DRY CLNNG & LNDRY
Year:	2003
Address:	210 IMI KALA ST
Name:	MAUIS QLTY DRY CLNNG & LNDRY
Year:	2004
Address:	210 IMI KALA ST

6
South
1/8-1/4
0.231 mi.
1219 ft.

EDR US Hist Auto Stat **1015269450**
N/A

1720 WILI PA LOOP
WAILUKU, HI 96793

Relative:
Higher

Actual:
197 ft.

EDR Historical Auto Stations:

Name:	AUTO TECH
Year:	2007
Address:	1720 WILI PA LOOP
Name:	AUTO TECH
Year:	2009
Address:	1720 WILI PA LOOP
Name:	AUTOTECH MAUI INC
Year:	2010
Address:	1720 WILI PA LOOP
Name:	AUTOTECH MAUI INC
Year:	2011
Address:	1720 WILI PA LOOP
Name:	AUTOTECH MAUI INC
Year:	2012
Address:	1720 WILI PA LOOP

7
SSE
1/8-1/4
0.237 mi.
1250 ft.

Relative:
Higher

Actual:
196 ft.

1726 MILL ST
WAILUKU, HI 96793

EDR US Hist Auto Stat **1015270281**
N/A

EDR Historical Auto Stations:

Name:	MAUI AUTOMOTIVE CTR
Year:	2001
Address:	1726 MILL ST
Name:	MAUI AUTOMOTIVE CTR
Year:	2003
Address:	1726 MILL ST
Name:	WAILUKU AUTOMOTIVE
Year:	2009
Address:	1726 MILL ST
Name:	WAILUKU AUTOMOTIVE
Year:	2010
Address:	1726 MILL ST

8
SSW
1/4-1/2
0.297 mi.
1569 ft.

Relative:
Higher

Actual:
210 ft.

GOMES CONSTRUCTION & REPAIRS INC
1790 MILL ST
WAILUKU, HI

RCRA NonGen / NLR **1000220754**
FINDS **HID982027682**
SHWS
UST
RGA HWS
Financial Assurance

RCRA NonGen / NLR:

Date form received by agency:	08/24/1987
Facility name:	GOMES CONST & REPAIRS INC
Facility address:	1790 MILL ST WAILUKU, HI 96793
EPA ID:	HID982027682
Contact:	ENVIRONMENTAL MANAGER
Contact address:	1790 MILL ST WAILUKU MILL, HI 96793
Contact country:	US
Contact telephone:	(808) 244-4083
Contact email:	Not reported
EPA Region:	09
Land type:	Other land type
Classification:	Non-Generator
Description:	Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name:	GOMES CONST JACK GOMES
Owner/operator address:	NOT REQUIRED NOT REQUIRED, ME 99999
Owner/operator country:	Not reported
Owner/operator telephone:	(415) 555-1212
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported
Owner/operator name:	NOT REQUIRED

GOMES CONSTRUCTION & REPAIRS INC (Continued) **1000220754**

Owner/operator address: NOT REQUIRED
NOT REQUIRED, ME 99999
Owner/operator country: Not reported
Owner/operator telephone: (415) 555-1212
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Violation Status: No violations found

Evaluation Action Summary:
Evaluation date: 01/17/1996
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 05/19/1992
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

FINDS:

Registry ID: 110006399940

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

STATE MASTER

GOMES CONSTRUCTION & REPAIRS INC (Continued) **1000220754**

SHWS:

Organization:	Not reported
Supplemental Location:	Not reported
Island:	Maui
Environmental Interest:	Gomes Construction - 1790 Mill Street, Wailuku, Maui
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	HEER
Program:	State
Project Manager:	Clarence Callahan
Hazard Priority:	NFA
Potential Hazards And Controls:	No Hazard
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Not reported
SDAR Environmental Interest Name:	Gomes Construction - 1790 Mill Street, Wailuku, Maui
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	HEER
Progran Name:	State
Potential Hazard And Controls:	No Hazard
Priority:	NFA
Assessment:	Assessment Ongoing
Response:	Response Complete
Nature of Contamination:	Not reported
Nature of Residual Contamination:	Petroleum contaminated soil
Use Restrictions:	No Hazard Present For Unrestricted Residential Use
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	No Further Action - Type Undetermined
Document Date:	08/24/2005
Document Number:	Not reported
Document Subject:	Not reported
Project Manager:	Clarence Callahan
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

UST:

Facility ID:	9-500384
Owner:	GOMES CONSTRUCTION & REPAIRS INC
Owner Address:	1790 MILL
Owndер City,St,Zip:	Wailuku, 96793 96793
Tank ID:	R-1
Date Installed:	04/10/1968
Tank Status:	**Permanently Out of Use**
Date Closed:	02/01/1994
Tank Capacity:	550
Substance:	Gasoline

RGA HWS:

2012	1790 MILL STREET	1790 MILL ST
2009	1790 MILL STREET	1790 MILL ST
2008	1790 MILL STREET	1790 MILL ST
2006	1790 MILL STREET	1790 MILL ST

GOMES CONSTRUCTION & REPAIRS INC (Continued) **1000220754**

2005 1790 MILL STREET 1790 MILL ST

HI Financial Assurance:
Alt Facility ID: 9-500384
Tank Id: R-1
Tank Status: Permanently Out of Use
FRTYPE: Self Insured
Expiration Date: Not reported

B9 **HALE MAKUA NURSING HOME - WAILUK** **LUST U003222260**
SE **1540 LOWER MAIN ST** **UST N/A**
1/4-1/2 **WAILUKU, HI 96793** **RGA LUST**
0.362 mi.
1912 ft. **Site 1 of 2 in cluster B**

Relative:
Higher

Actual:
185 ft.

LUST:
Facility ID: 9-502621
Facility Status: Site Cleanup Completed (NFA)
Facility Status Date: 10/20/1997
Release ID: 930098
Project Officer: Jose Ruiz

UST:
Facility ID: 9-502621
Owner: HALE MAKUA
Owner Address: 472 KAULANA ST
Owndder City,St,Zip: Wailuku, 96793 96793

Tank ID: R-1
Date Installed: 01/01/1966
Tank Status: **Permanently Out of Use**
Date Closed: 11/06/1992
Tank Capacity: 1000
Substance: Diesel

Tank ID: R-2
Date Installed: 01/01/1966
Tank Status: **Permanently Out of Use**
Date Closed: 11/06/1992
Tank Capacity: 500
Substance: Diesel

Tank ID: R-3
Date Installed: 01/01/1966
Tank Status: **Permanently Out of Use**
Date Closed: 11/06/1992
Tank Capacity: 500
Substance: Diesel

Tank ID: R-4
Date Installed: 01/01/1967
Tank Status: **Permanently Out of Use**
Date Closed: 11/06/1992
Tank Capacity: 500
Substance: Diesel

HALE MAKUA NURSING HOME - WAILUK (Continued) **U003222260**

RGA LUST:

2012	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2011	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2010	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2009	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2008	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2007	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2006	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2005	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2004	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2003	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2002	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2001	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
2000	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
1999	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
1998	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
1997	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST
1995	HALE MAKUA NURSING HOME - WAILUK	1540 LOWER MAIN ST

B10 **MECO TRANSFORMER 3358** **SHWS S110061657**
SE **1540 E MAIN ST** **SPILLS N/A**
1/4-1/2 **WAILUKU, HI 96793** **RGA HWS**
0.362 mi.
1912 ft. **Site 2 of 2 in cluster B**

Relative:
Higher

Actual:
185 ft.

SHWS:

Organization:	Not reported
Supplemental Location:	Hale Makua
Island:	Maui
Environmental Interest:	MECO Transformer 3358 Self Implementing PCB Cleanup
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	HEER
Program:	State
Project Manager:	Paul Chong
Hazard Priority:	NFA
Potential Hazards And Controls:	No Hazard
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Hale Makua
SDAR Environmental Interest Name:	MECO Transformer 3358 Self Implementing PCB Cleanup
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	HEER
Progran Name:	State
Potential Hazard And Controls:	No Hazard
Priority:	NFA
Assessment:	Response Necessary
Response:	Self Implementing TSCA Cleanup
Nature of Contamination:	Found: PCBs in soil.
Nature of Residual Contamination:	Confirmation samples were collected beneath the excavated area and all samples were below HDOH environmental action levels for unrestricted use.
Use Restrictions:	No Hazard Present For Unrestricted Residential Use
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported

MECO TRANSFORMER 3358 (Continued) **S110061657**

Site Closure Type:	No Further Action Letter - Unrestricted Residential Use
Document Date:	01/27/2011
Document Number:	2011-043-PC
Document Subject:	Pad Mount Transformer 3358 PCB Release
Project Manager:	Paul Chong
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

HI SPILLS:

Island:	Maui
Supplemental Loc. Text:	Hale Makua
Case Number:	20080714-1258
HID Number:	Not reported
Facility Registry Id:	Not reported
Lead and Program:	HEER EP&R
ER:	None
Units:	MECO Pad-Mount Transformer no. 3358
Substances:	Oil Lubricating
Less Or Greater Than:	Not reported
Numerical Quantity:	3
Units:	Gallons
Activity Type:	Response
Activity Lead:	Liz Galvez
Assignment End Date:	Not reported
Result:	Not reported
File Under:	Maui Electric Co., Inc.

RGA HWS:

2012	MECO TRANSFORMER 3358	1540 E MAIN ST
2009	MECO TRANSFORMER 3358	1540 E MAIN ST

11
SW
1/4-1/2
0.415 mi.
2191 ft.

OGAWA SERVICE STATION **LUST U003222184**
327 N MARKET ST **UST N/A**
WAILUKU, HI 96793 **RGA LUST**

Relative:
Higher

Actual:
240 ft.

LUST:

Facility ID:	9-500398
Facility Status:	Site Cleanup Completed (NFA)
Facility Status Date:	08/19/1996
Release ID:	960046
Project Officer:	Jose Ruiz

UST:

Facility ID:	9-500398
Owner:	MASASHI OGAWA
Owner Address:	327 N MARKET ST
Owner City,St,Zip:	Wailuku, 96793 96793
Tank ID:	R-001
Date Installed:	07/27/1956
Tank Status:	**Permanently Out of Use**
Date Closed:	03/04/1995
Tank Capacity:	1000
Substance:	Gasoline

OGAWA SERVICE STATION (Continued) **U003222184**

Tank ID: R-002
Date Installed: 07/27/1956
Tank Status: Permanently Out of Use
Date Closed: 03/04/1996
Tank Capacity: 1000
Substance: Gasoline

Tank ID: R-003
Date Installed: 07/27/1977
Tank Status: Permanently Out of Use
Date Closed: 03/04/1996
Tank Capacity: 5000
Substance: Gasoline

RGA LUST:

2012	OGAWA SERVICE STATION	327 N MARKET ST
2011	OGAWA SERVICE STATION	327 N MARKET ST
2010	OGAWA SERVICE STATION	327 N MARKET ST
2009	OGAWA SERVICE STATION	327 N MARKET ST
2008	OGAWA SERVICE STATION	327 N MARKET ST
2007	OGAWA SERVICE STATION	327 N MARKET ST
2006	OGAWA SERVICE STATION	327 N MARKET ST
2005	OGAWA SERVICE STATION	327 N MARKET ST
2004	OGAWA SERVICE STATION	327 N MARKET ST
2003	OGAWA SERVICE STATION	327 N MARKET ST
2002	OGAWA SERVICE STATION	327 N MARKET ST
2001	OGAWA SERVICE STATION	327 N MARKET ST
2000	OGAWA SERVICE STATION	327 N MARKET ST
1999	OGAWA SERVICE STATION	327 N MARKET ST
1998	OGAWA SERVICE STATION	327 N MARKET ST
1997	OGAWA SERVICE STATION	327 N MARKET ST

12
SW
1/4-1/2
0.449 mi.
2371 ft.

WAILUKU SUGAR AGRICULTURAL DEPARTMENT PESTICIDE MIXING **SHWS** **S113230524**
2015 HOLOWAI PL **INST CONTROL** **N/A**
WAILUKU, HI 96793

Relative: Higher

Actual: 250 ft.

SHWS:

Organization:	Not reported
Supplemental Location:	Kahekili Terrace
Island:	Maui
Environmental Interest:	Wailuku Sugar Agricultural Department Pesticide Mixing
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	HEER
Program:	Site Discovery
Project Manager:	Unassigned
Hazard Priority:	Medium
Potential Hazards And Controls:	Hazard Managed With Controls
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Kahekili Terrace
SDAR Environmental Interest Name:	Wailuku Sugar Agricultural Department Pesticide Mixing
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	HEER

WAILUKU SUGAR AGRICULTURAL DEPARTMENT PESTICIDE MIXING (Continued) **S113230524**

Progran Name:	Site Discovery
Potential Hazard And Controls:	Hazard Managed With Controls
Priority:	Medium
Assessment:	Assessment Ongoing
Response:	Not reported
Nature of Contamination:	Found: Arsenic, lead and dioxin in soil.
Nature of Residual Contamination:	Not reported
Use Restrictions:	Controls Required to Manage Contamination
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Government - Hawaii Dept. of Health Letter Issued
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	Not reported
Document Date:	Not reported
Document Number:	Not reported
Document Subject:	Not reported
Project Manager:	Unassigned
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

INST CONTROL:

Potential hazards and controls:	Hazard Managed With Controls
Supplemental Location:	Kahekili Terrace
Zip Suffix:	Not reported
Island:	Maui
Institutional Control:	Government - Hawaii Dept. of Health Letter Issued

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C13 **MAUI SANDTORCHES** **SHWS** **S106819015**
SSE **46 TING DR** **RGA HWS** **N/A**
1/4-1/2 **WAILUKU, HI 96793**
0.476 mi.
2511 ft. **Site 1 of 2 in cluster C**

Relative:
Higher

Actual:
243 ft.

SHWS:

Organization:	Not reported
Supplemental Location:	Not reported
Island:	Maui
Environmental Interest:	Maui Sandtorches
HID Number:	HID077670842
Facility Registry Identifier:	110005723217
Lead Agency:	Not reported
Program:	State
Project Manager:	Unassigned
Hazard Priority:	NFA
Potential Hazards And Controls:	Hazard Undetermined
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Not reported
SDAR Environmental Interest Name:	Maui Sandtorches
HID Number:	HID077670842
Facility Registry Identifier:	110005723217
Lead Agency:	Not reported
Progran Name:	State
Potential Hazard And Controls:	Hazard Undetermined
Priority:	NFA
Assessment:	Response Necessary
Response:	Response Complete
Nature of Contamination:	Not reported

MAUI SANDTORCHES (Continued) **S106819015**

Nature of Residual Contamination:	Not reported
Use Restrictions:	Undetermined
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	No Further Action - Type Undetermined
Document Date:	04/15/1996
Document Number:	Not reported
Document Subject:	Not reported
Project Manager:	Unassigned
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

RGA HWS:

2012	MAUI SANDTORCHES	46 TING DR
2009	MAUI SANDTORCHES	46 TING DR
2008	MAUI SANDTORCHES	46 TING DR
2006	MAUI SANDTORCHES	46 TING DR
2005	MAUI SANDTORCHES	46 TING DR

C14 **KUKUI GROVE HOLDER** **CERC-NFRAP** **1000245007**
SSE **46 TINGS DR** **RCRA NonGen / NLR** **HID077670842**
1/4-1/2 **WAILUKU, HI** **FINDS**
0.476 mi.
2514 ft. **Site 2 of 2 in cluster C**

Relative:
Higher

Actual:
243 ft.

CERC-NFRAP:

Site ID:	0902848
Federal Facility:	Not a Federal Facility
NPL Status:	Not on the NPL
Non NPL Status:	NFRAP-Site does not qualify for the NPL based on existing information

CERCLIS-NFRAP Site Contact Details:

Contact Sequence ID:	13037389.00000
Person ID:	9000059.00000

CERCLIS-NFRAP Assessment History:

Action:	DISCOVERY
Date Started:	/ /
Date Completed:	07/01/80
Priority Level:	Not reported
Action:	ARCHIVE SITE
Date Started:	/ /
Date Completed:	09/01/84
Priority Level:	Not reported
Action:	PRELIMINARY ASSESSMENT
Date Started:	08/01/84
Date Completed:	09/01/84
Priority Level:	NFRAP-Site does not qualify for the NPL based on existing information

RCRA NonGen / NLR:

Date form received by agency:	07/30/1980
Facility name:	MAUI SANDTORCHES
Facility address:	46 TINGS DR WAILUKU, HI 96793

KUKUI GROVE HOLDER (Continued) **1000245007**

EPA ID:	HID077670842
Mailing address:	46 TINGS DRIVE WAILUKU MAUI, HI 96793
Contact:	ENVIRONMENTAL MANAGER
Contact address:	46 TINGS DR WAILUKU, HI 96793
Contact country:	US
Contact telephone:	(808) 244-7541
Contact email:	Not reported
EPA Region:	09
Classification:	Non-Generator
Description:	Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name:	JACQUELINE CARLIN
Owner/operator address:	NOT REQUIRED NOT REQUIRED, ME 99999
Owner/operator country:	Not reported
Owner/operator telephone:	(415) 555-1212
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Owner/operator name:	NOT REQUIRED
Owner/operator address:	NOT REQUIRED NOT REQUIRED, ME 99999
Owner/operator country:	Not reported
Owner/operator telephone:	(415) 555-1212
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No
Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No

Violation Status: No violations found

FINDS:

Registry ID: 110005723217

KUKUI GROVE HOLDER (Continued) **1000245007**

Environmental Interest/Information System

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

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15 **REX TIRE & SUPPLY, DIESEL** **SHWS S106820230**
SSE **1728 KAAHUMANU AVE** **RGA HWS N/A**
1/2-1 **KAHULUI, HI 96732**
0.572 mi.
3019 ft.

Relative:
Higher

Actual:
212 ft.

SHWS:

Organization:	Not reported
Supplemental Location:	Not reported
Island:	Maui
Environmental Interest:	Rex Tire Diesel
HID Number:	Not reported
Facility Registry Identifier:	110013778386
Lead Agency:	HEER
Program:	State
Project Manager:	Eric Sadoyama
Hazard Priority:	NFA
Potential Hazards And Controls:	No Hazard
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Not reported
SDAR Environmental Interest Name:	Rex Tire Diesel
HID Number:	Not reported
Facility Registry Identifier:	110013778386
Lead Agency:	HEER
Progran Name:	State
Potential Hazard And Controls:	No Hazard
Priority:	NFA
Assessment:	Response Necessary
Response:	Response Complete
Nature of Contamination:	Found: Diesel fuel in soil
Nature of Residual Contamination:	Diesel fuel
Use Restrictions:	No Hazard Present for Unrestricted Residential Use
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	No Further Action Letter - Unrestricted Residential Use
Document Date:	03/14/2006
Document Number:	2006-149-ES
Document Subject:	No further action determination for 1991 diesel release from heating oil UST
Project Manager:	Eric Sadoyama
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

RGA HWS:

2012	REX TIRE & SUPPLY, DIESEL	1728 KAAHUMANU AVE
2009	REX TIRE & SUPPLY, DIESEL	1728 KAAHUMANU AVE

REX TIRE & SUPPLY, DIESEL (Continued) **S106820230**

2008	REX TIRE & SUPPLY, DIESEL	1728 KAAHUMANU AVE
2006	REX TIRE & SUPPLY, DIESEL	1728 KAAHUMANU AVE
2005	REX TIRE & SUPPLY, DIESEL	1728 KAAHUMANU AVE

16
SSW
1/2-1
0.572 mi.
3021 ft.

2102 VINEYARD ST.
2102 VINEYARD ST
WAILUKU, HI 96793

SHWS **U003222271**
UST **N/A**
Financial Assurance
RGA HWS

Relative:
Higher

Actual:
299 ft.

SHWS:

Organization:	Not reported
Supplemental Location:	Not reported
Island:	Maui
Environmental Interest:	Vineyard Street Tank Closure
HID Number:	Not reported
Facility Registry Identifier:	110013766656
Lead Agency:	HEER
Program:	State
Project Manager:	Paul Chong
Hazard Priority:	NFA
Potential Hazards And Controls:	No Hazard
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Not reported
SDAR Environmental Interest Name:	Vineyard Street Tank Closure
HID Number:	Not reported
Facility Registry Identifier:	110013766656
Lead Agency:	HEER
Progran Name:	State
Potential Hazard And Controls:	No Hazard
Priority:	NFA
Assessment:	Response Necessary
Response:	Response Complete
Nature of Contamination:	Not reported
Nature of Residual Contamination:	Petroleum in soil
Use Restrictions:	No Hazard Present For Unrestricted Residential Use
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	No Further Action Letter - Unrestricted Residential Use
Document Date:	04/01/2011
Document Number:	2011-196-PC
Document Subject:	No Further Action Determination for Removal of Underground Fuel Tank located at 2102 Vineyard St dat
Project Manager:	Paul Chong
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

UST:

Facility ID:	9-503115
Owner:	RALPH KATO
Owner Address:	1063 LOWER MAIN ST
Owndер City,St,Zip:	Wailuku, 96793 96793
Tank ID:	R-1
Date Installed:	Not reported
Tank Status:	**Permanently Out of Use**

2102 VINEYARD ST. (Continued) **U003222271**

Date Closed: 10/05/1995
Tank Capacity: 550
Substance: Diesel

HI Financial Assurance:
Alt Facility ID: 9-503115
Tank Id: R-1
Tank Status: Permanently Out of Use
FRTYPE: Insurance
Expiration Date: Not reported

RGA HWS:

2012	MAUI VINEYARD INN, UST CLOSURE	2102 VINEYARD ST
2009	MAUI VINEYARD INN, UST CLOSURE	2102 VINEYARD ST
2008	MAUI VINEYARD INN, UST CLOSURE	2102 VINEYARD ST
2006	MAUI VINEYARD INN, UST CLOSURE	2102 VINEYARD ST
2005	MAUI VINEYARD INN, UST CLOSURE	2102 VINEYARD ST
2000	2102 VINEYARD ST	

17
SSW
1/2-1
0.610 mi.
3222 ft.

Relative:
Higher

Actual:
282 ft.

ROBERT JOSLIN
2026 MAIN ST
WAILUKU, HI 96793

RCRA-CESQG **1000601460**
SHWS **HID984466896**
LUST
UST
SPILLS
RGA LUST
RGA HWS

RCRA-CESQG:
Date form received by agency: 04/27/2001
Facility name: ROBERT JOSLIN
Facility address: 2026 MAIN ST
WAILUKU, HI 96793
EPA ID: HID984466896
Contact: ROBERT JOSLIN
Contact address: 2026 MAIN ST
WAILUKU, HI 96793
Contact country: US
Contact telephone: (808) 244-3980
Contact email: Not reported
EPA Region: 09
Land type: Private
Classification: Conditionally Exempt Small Quantity Generator
Description: Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

ROBERT JOSLIN (Continued) **1000601460**

Owner/Operator Summary:
- Owner/operator name: ROBERT JOSLIN
- Owner/operator address: 2026 MAIN ST
  WAILUKU, HI 96793
- Owner/operator country: Not reported
- Owner/operator telephone: (808) 244-3980
- Legal status: Private
- Owner/Operator Type: Owner
- Owner/Op start date: Not reported
- Owner/Op end date: Not reported

Handler Activities Summary:
- U.S. importer of hazardous waste: No
- Mixed waste (haz. and radioactive): No
- Recycler of hazardous waste: No
- Transporter of hazardous waste: No
- Treater, storer or disposer of HW: No
- Underground injection activity: No
- On-site burner exemption: No
- Furnace exemption: No
- Used oil fuel burner: No
- Used oil processor: No
- User oil refiner: No
- Used oil fuel marketer to burner: No
- Used oil Specification marketer: No
- Used oil transfer facility: No
- Used oil transporter: No

Hazardous Waste Summary:
- Waste code: D000
- Waste name: Not Defined

- Waste code: D001
- Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

- Waste code: D008
- Waste name: LEAD

- Waste code: D018
- Waste name: BENZENE

- Violation Status: No violations found

Evaluation Action Summary:
- Evaluation date: 01/19/1996
- Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
- Area of violation: Not reported
- Date achieved compliance: Not reported
- Evaluation lead agency: State

ROBERT JOSLIN (Continued) **1000601460**

SHWS:

Organization:	Not reported
Supplemental Location:	Not reported
Island:	Maui
Environmental Interest:	Valley Isle Motors Leaking UST
HID Number:	Not reported
Facility Registry Identifier:	110005727516
Lead Agency:	SHWB
Program:	State
Project Manager:	Melody Calisay
Hazard Priority:	NFA
Potential Hazards And Controls:	No Hazard
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Not reported
SDAR Environmental Interest Name:	Valley Isle Motors Leaking UST
HID Number:	Not reported
Facility Registry Identifier:	110005727516
Lead Agency:	SHWB
Progran Name:	State
Potential Hazard And Controls:	No Hazard
Priority:	NFA
Assessment:	Response Necessary
Response:	Response Complete
Nature of Contamination:	Found: Petroleum in soil
Nature of Residual Contamination:	None
Use Restrictions:	No Hazard Present for Unrestricted Residential Use
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	No Further Action Letter - Unrestricted Residential Use
Document Date:	05/15/2003
Document Number:	Not reported
Document Subject:	Former Valley Isle Motors
Project Manager:	Melody Calisay
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

LUST:

Facility ID:	9-501588
Facility Status:	Site Cleanup Completed (NFA)
Facility Status Date:	05/15/2003
Release ID:	900024
Project Officer:	Shunsheng Fu

Facility ID:	9-501588
Facility Status:	Site Cleanup Completed (NFA)
Facility Status Date:	05/15/2003
Release ID:	010004
Project Officer:	Shunsheng Fu

UST:

Facility ID:	9-501588
Owner:	VALLEY ISLE MOTORS, LTD.
Owner Address:	2026 MAIN St
Ownder City,St,Zip:	Wailuku, 96793 96793

ROBERT JOSLIN (Continued) **1000601460**

Tank ID: R-1
Date Installed: 04/22/1966
Tank Status: **Permanently Out of Use**
Date Closed: 05/10/1990
Tank Capacity: 1000
Substance: Used Oil

Tank ID: R-2
Date Installed: 04/22/1966
Tank Status: **Permanently Out of Use**
Date Closed: 05/10/1990
Tank Capacity: 1000
Substance: Used Oil

Tank ID: R-3
Date Installed: Not reported
Tank Status: **Permanently Out of Use**
Date Closed: 05/10/1990
Tank Capacity: 1000
Substance: Used Oil

Tank ID: R-4
Date Installed: Not reported
Tank Status: **Permanently Out of Use**
Date Closed: 01/01/1990
Tank Capacity: 1000
Substance: Gasoline

Tank ID: R-7
Date Installed: Not reported
Tank Status: **Permanently Out of Use**
Date Closed: 10/01/2000
Tank Capacity: 300
Substance: Used Oil

Tank ID: R-8
Date Installed: Not reported
Tank Status: **Permanently Out of Use**
Date Closed: 01/01/1990
Tank Capacity: 300
Substance: Kerosene

Tank ID: r-5
Date Installed: Not reported
Tank Status: **Permanently Out of Use**
Date Closed: 01/01/1990
Tank Capacity: 1000
Substance: Gasoline

Tank ID: r-6

ROBERT JOSLIN (Continued) **1000601460**

Date Installed: Not reported
Tank Status: **Permanently Out of Use**
Date Closed: 01/01/1990
Tank Capacity: 1000
Substance: Gasoline

HI SPILLS:
Island: Maui
Supplemental Loc. Text: Not reported
Case Number: 19990804-1500
HID Number: Not reported
Facility Registry Id: 110005727516
Lead and Program: HEER EP&R
ER: No
Units: Valley Isle Motors LUST
Substances: Oil
Less Or Greater Than: Not reported
Numerical Quantity: Not reported
Units: Not reported
Activity Type: Response
Activity Lead: Bill Perry
Assignment End Date: Not reported
Result: Refer to ISST
File Under: Valley Isle Motors

Island: Maui
Supplemental Loc. Text: Not reported
Case Number: 19990805-1343
HID Number: Not reported
Facility Registry Id: 110005727516
Lead and Program: HEER EP&R
ER: No
Units: Former Valley Isle Motors LUST
Substances: Not reported
Less Or Greater Than: Not reported
Numerical Quantity: Not reported
Units: Not reported
Activity Type: Response
Activity Lead: Terry Corpus
Assignment End Date: Not reported
Result: Refer to ISST
File Under: Valley Isle Motors

RGA LUST:

2012	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
2011	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
2010	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
2009	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
2008	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
2007	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
2006	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
2005	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
2004	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
2003	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
2002	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
2001	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST

ROBERT JOSLIN (Continued) **1000601460**

2000	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
1999	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
1998	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST
1997	VALLEY ISLE MOTORS, LTD.	2026 MAIN ST

RGA HWS:

2012	VALLEY ISLE MOTORS LUST	2026 MAIN ST
2009	VALLEY ISLE MOTORS LUST	2026 MAIN ST
2008	VALLEY ISLE MOTORS LUST	2026 MAIN ST
2006	VALLEY ISLE MOTORS LUST	2026 MAIN ST
2005	VALLEY ISLE MOTORS LUST	2026 MAIN ST

D18 **MAIN STREET PROMENADE PROJECT (DEMOLITION PHASE 1B)** **SHWS** **S106818881**
SSW **2058 MAIN ST** **RGA HWS** **N/A**
1/2-1 **WAILUKU, HI**
0.629 mi.
3320 ft. **Site 1 of 2 in cluster D**

Relative: Higher

Actual: 290 ft.

SHWS:

Organization:	Not reported
Supplemental Location:	Not reported
Island:	Maui
Environmental Interest:	Main Street Promenade Project (Demolition Phase 1B)
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	Not reported
Program:	State
Project Manager:	Mike Cripps
Hazard Priority:	NFA
Potential Hazards And Controls:	Hazard Undetermined
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Not reported
SDAR Environmental Interest Name:	Main Street Promenade Project (Demolition Phase 1B)
HID Number:	Not reported
Facility Registry Identifier:	Not reported
Lead Agency:	Not reported
Progran Name:	State
Potential Hazard And Controls:	Hazard Undetermined
Priority:	NFA
Assessment:	Assessment Ongoing
Response:	Not reported
Nature of Contamination:	Not reported
Nature of Residual Contamination:	Not reported
Use Restrictions:	Undetermined
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	No Further Action - Type Undetermined
Document Date:	09/01/2000
Document Number:	Not reported
Document Subject:	Not reported
Project Manager:	Mike Cripps
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

RGA HWS:

2012	MAIN STREET PROMENADE PROJECT (DEMOLITION PHASE 1B)	2058 MAIN ST

MAIN STREET PROMENADE PROJECT (DEMOLITION PHASE 1B) (Continued) **S106818881**

2009 MAIN STREET PROMENADE PROJECT (DEMOLITION PHASE 1B) 2058 MAIN ST
2008 MAIN STREET PROMENADE PROJECT (DEMOLITION PHASE 1B) 2058 MAIN ST
2006 MAIN STREET PROMENADE PROJECT (DEMOLITION PHASE 1B) 2058 MAIN ST
2005 MAIN STREET PROMENADE PROJECT (DEMOLITION PHASE 1B) 2058 MAIN ST

D19 **ALVIN'S UPTOWN CHEVRON SERVICE STATION** **SHWS** **S107022542**
SSW **2085 WEST MAIN ST** **RGA HWS** **N/A**
1/2-1 **WAILUKU, HI 96793**
0.648 mi.
3421 ft. **Site 2 of 2 in cluster D**

Relative: Higher

Actual: 297 ft.

SHWS:

Organization:	Not reported
Supplemental Location:	Not reported
Island:	Maui
Environmental Interest:	Hydraulic Hoist and Sand-and-Grease Trap Removal
HID Number:	Not reported
Facility Registry Identifier:	110006399922
Lead Agency:	HEER
Program:	State
Project Manager:	Diane England
Hazard Priority:	NFA
Potential Hazards And Controls:	Hazard Undetermined
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Not reported
SDAR Environmental Interest Name:	Hydraulic Hoist and Sand-and-Grease Trap Removal
HID Number:	Not reported
Facility Registry Identifier:	110006399922
Lead Agency:	HEER
Progran Name:	State
Potential Hazard And Controls:	Hazard Undetermined
Priority:	NFA
Assessment:	Response Necessary
Response:	Response Complete
Nature of Contamination:	Not reported
Nature of Residual Contamination:	Petroleum impacted soil
Use Restrictions:	Undetermined
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	No Further Action Letter - Unrestricted Residential Use
Document Date:	04/28/2005
Document Number:	2005-185-DE
Document Subject:	No Further Action Determination for Release No. 20031119-0831
Project Manager:	Diane England
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

RGA HWS:

2012 ALVIN'S UPTOWN CHEVRON SERVICE STATION 2085 WEST MAIN ST
2009 ALVIN'S UPTOWN CHEVRON SERVICE STATION 2085 WEST MAIN ST
2008 ALVIN'S UPTOWN CHEVRON SERVICE STATION 2085 WEST MAIN ST
2006 ALVIN'S UPTOWN CHEVRON SERVICE STATION 2085 WEST MAIN ST

ALVIN'S UPTOWN CHEVRON SERVICE STATION (Continued) **S107022542**

2005 ALVIN'S UPTOWN CHEVRON SERVICE STATION 2085 WEST MAIN ST

20
South
1/2-1
0.799 mi.
4217 ft.

ORGANIZATIONAL MAINTENANCE SHOP #3 (OMS #3) **SHWS** **1006818976**
260 S MARKET ST **RGA HWS** **N/A**
WAILUKU, HI 96793

Relative:
Higher

Actual:
257 ft.

SHWS:

Organization:	Not reported
Supplemental Location:	Not reported
Island:	Maui
Environmental Interest:	Organizational Maintenance Shop #3 (OMS #3)
HID Number:	Not reported
Facility Registry Identifier:	110013767352
Lead Agency:	Not reported
Program:	Hawaii Air National Guard
Project Manager:	Unassigned
Hazard Priority:	Low
Potential Hazards And Controls:	Hazard Undetermined
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Not reported
SDAR Environmental Interest Name:	Organizational Maintenance Shop #3 (OMS #3)
HID Number:	Not reported
Facility Registry Identifier:	110013767352
Lead Agency:	Not reported
Progran Name:	Hawaii Air National Guard
Potential Hazard And Controls:	Hazard Undetermined
Priority:	Low
Assessment:	Assessment Ongoing
Response:	Not reported
Nature of Contamination:	Not reported
Nature of Residual Contamination:	Not reported
Use Restrictions:	Undetermined
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	Not reported
Document Date:	Not reported
Document Number:	Not reported
Document Subject:	Not reported
Project Manager:	Unassigned
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

RGA HWS:

2012	ORGANIZATIONAL MAINTENANCE SHOP #3 (OMS #3)	260 S MARKET ST
2009	ORGANIZATIONAL MAINTENANCE SHOP #3 (OMS #3)	260 S MARKET ST
2008	ORGANIZATIONAL MAINTENANCE SHOP #3 (OMS #3)	260 S MARKET ST
2006	ORGANIZATIONAL MAINTENANCE SHOP #3 (OMS #3)	260 S MARKET ST
2005	ORGANIZATIONAL MAINTENANCE SHOP #3 (OMS #3)	260 S MARKET ST

21
ESE
1/2-1
0.958 mi.
5060 ft.

WAIALE ASH PILE
MAHALANI ST
WAILUKU, HI 96793

SHWS **1006819707**
RGA HWS **N/A**

Relative:
Lower

Actual:
80 ft.

SHWS:

Organization:	Not reported
Supplemental Location:	Not reported
Island:	Maui
Environmental Interest:	Waiale Ash Pile
HID Number:	Not reported
Facility Registry Identifier:	110013775575
Lead Agency:	HEER
Program:	State
Project Manager:	Anna Fernandez
Hazard Priority:	Low
Potential Hazards And Controls:	Hazard Present
Organization:	Not reported
Island:	Maui
Supplemental Location Text:	Not reported
SDAR Environmental Interest Name:	Waiale Ash Pile
HID Number:	Not reported
Facility Registry Identifier:	110013775575
Lead Agency:	HEER
Progran Name:	State
Potential Hazard And Controls:	Hazard Present
Priority:	Low
Assessment:	Response Necessary
Response:	Response Ongoing
Nature of Contamination:	Presumed: TPH, metals, pesticides, heterogenous mixture associated with landfills in soil
Nature of Residual Contamination:	Not reported
Use Restrictions:	Controls Required to Manage Contamination
Engineering Control:	Not reported
Description of Restrictions:	Not reported
Institutional Control:	Not reported
Within Designated Areawide Contamination:	Not reported
Site Closure Type:	Not reported
Document Date:	Not reported
Document Number:	Not reported
Document Subject:	Not reported
Project Manager:	Anna Fernandez
Contact Information:	(808) 586-4249 919 Ala Moana Blvd, Honolulu, HI 96814

RGA HWS:

2012	WAIALE ASH PILE	MAHALANI ST
2009	WAIALE ASH PILE	MAHALANI ST
2008	WAIALE ASH PILE	MAHALANI ST
2006	WAIALE ASH PILE	MAHALANI ST
2005	WAIALE ASH PILE	MAHALANI ST

Count: 20 records. ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
KAHULUI	1003879111	WAIKAPU DUMP-MAUI COUNTY DUMP	CENTRAL MAUI	96732	CERC-NFRAP
KAHULUI	S113230501	MECO STATION-CLASS TRANSFORMER NO.	DAIRY RD SE CORNER OF HANA HWY	96732	SHWS, SPILLS
KAHULUI	S113230485	MECO PAD-MOUNT TRANSFORMER NO. 137	DAIRY RD & HANA HWY	96732	SHWS
KAHULUI	S106820852	VECTOR CONTROL BRANCH, MAUI	54 HIGH ST, 641 MUA ST, KAHALE	96793	SHWS, RGA HWS
KAHULUI	1006820577	HOBRON AVE AREA (KAHULUI)	HOBRON AVE	96732	SHWS, RGA HWS
KAHULUI	S106817098	FONG CONSTRUCTION	HUKILIKI ST	96732	SHWS, RGA HWS
KAHULUI	S113230471	LOT F4 KANE STREET	KANE ST	96732	SHWS, ENG CONTROLS, INST CONT
KAHULUI	1006820345	A&B DUMP SITE	W PAPA AVE	96732	SHWS, RGA HWS
KAHULUI	1006819647	WAIKAPU DUMP-MAUI COUNTY DUMP	WAIKAPU RD	96732	SHWS, RGA HWS
KAUNAKAKAI	S108859913	KALAMAULA LANDFILL	HOAWA RD	96793	SHWS, ENG CONTROLS
PAIA	S106819555	PAIA SUGAR MILL	BALDWIN AVE	96732	SHWS, RGA HWS
WAIKAPU	1008194955	VACANT LAND TMK NO (2) 3-8-7:101	KUIHELANI HWY NEAR WAIKO RD	96793	RCRA NonGen / NLR
WAILUKU	1012152162	IAO VALLEY STATE PARK - LCC	900 IAO VALLEY ROAD		FINDS
WAILUKU	1009332782	WAILUKU AG DIVERSION OF IAO STREAM	KEPANIWAI PARK		FINDS
WAILUKU	1015914219	IAO MIDDLE SCHOOL	260 SOUTH MARTKET STREET		FINDS
WAILUKU	S113230499	MECO POLE-MOUNT TRANSFORMER NO. 88	POLE E-1-16 AT WAIHEE VALLE RD	96793	SHWS
WAILUKU	1014884259	IAO STREAM	UNK		FINDS
WAILUKU	S108008644	Y HATA- MAUI	200 WAIEHU BEACH RD & KAHULU B	96793	SHWS, SPILLS
WAILUKU	1015940186	WAIEHU BEACH ROAD, REHABILITATION	WAIEHU BEACH ROAD		FINDS
WAILUKU	U001236653	MAUI BLOCKS	WAIKAPU-OFF HONOAPIILANI HWY	96793	UST

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 78

Source: EPA
Telephone: N/A
Last EDR Contact: 04/08/2014
Next Scheduled EDR Contact: 07/21/2014
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 78

Source: EPA
Telephone: N/A
Last EDR Contact: 04/08/2014
Next Scheduled EDR Contact: 07/21/2014
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 78

Source: EPA
Telephone: N/A
Last EDR Contact: 04/08/2014
Next Scheduled EDR Contact: 07/21/2014
Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 94

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 02/28/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 05/31/2013
Date Data Arrived at EDR: 07/08/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 151

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 04/11/2014
Next Scheduled EDR Contact: 07/21/2014
Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 94

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 02/28/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 03/13/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 03/13/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 03/13/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 03/13/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 03/13/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Varies

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 12/17/2013
Date Data Arrived at EDR: 01/14/2014
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 03/10/2014
Next Scheduled EDR Contact: 06/23/2014
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 12/17/2013
Date Data Arrived at EDR: 01/14/2014
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 14

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 03/10/2014
Next Scheduled EDR Contact: 06/23/2014
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 11/20/2013
Date Data Arrived at EDR: 11/21/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 95

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 02/14/2014
Next Scheduled EDR Contact: 06/02/2014
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/30/2013
Date Data Arrived at EDR: 10/01/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 66

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 04/04/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

SHWS: Sites List

Facilities, sites or areas in which the Office of Hazard Evaluation and Emergency Response has an interest, has investigated or may investigate under HRS 128D (includes CERCLIS sites).

Date of Government Version: 01/04/2014
Date Data Arrived at EDR: 02/26/2014
Date Made Active in Reports: 03/07/2014
Number of Days to Update: 9

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 02/26/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Semi-Annually

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Permitted Landfills in the State of Hawaii

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 09/17/2012
Date Data Arrived at EDR: 04/03/2013
Date Made Active in Reports: 05/10/2013
Number of Days to Update: 37

Source: Department of Health
Telephone: 808-586-4245
Last EDR Contact: 04/04/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Varies

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tank Database

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 12/04/2013
Date Data Arrived at EDR: 12/05/2013
Date Made Active in Reports: 12/10/2013
Number of Days to Update: 5

Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 03/17/2014
Next Scheduled EDR Contact: 06/16/2014
Data Release Frequency: Semi-Annually

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 08/27/2013
Date Data Arrived at EDR: 08/27/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 66

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 09/12/2011
Date Data Arrived at EDR: 09/13/2011
Date Made Active in Reports: 11/11/2011
Number of Days to Update: 59

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 02/21/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 03/01/2013
Date Data Arrived at EDR: 03/01/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 42

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/07/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 29

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 08/27/2012
Date Data Arrived at EDR: 08/28/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 49
Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 02/13/2014
Date Data Arrived at EDR: 02/14/2014
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 10
Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 05/01/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 184
Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 01/30/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 11/21/2013
Date Data Arrived at EDR: 11/26/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 90
Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Semi-Annually

State and tribal registered storage tank lists

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 12/04/2013
Date Data Arrived at EDR: 12/05/2013
Date Made Active in Reports: 12/10/2013
Number of Days to Update: 5
Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 03/17/2014
Next Scheduled EDR Contact: 06/16/2014
Data Release Frequency: Semi-Annually

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 05/01/2013
Date Made Active in Reports: 01/27/2014
Number of Days to Update: 271
Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 01/30/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 11/21/2013
Date Data Arrived at EDR: 11/26/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 90

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 02/13/2014
Date Data Arrived at EDR: 02/14/2014
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 10

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 01/29/2014
Date Data Arrived at EDR: 01/29/2014
Date Made Active in Reports: 03/12/2014
Number of Days to Update: 42

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 02/28/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 43

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 07/29/2013
Date Data Arrived at EDR: 08/01/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 92

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 07/29/2013
Date Data Arrived at EDR: 07/30/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 129

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 02/05/2013
Date Data Arrived at EDR: 02/06/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 65

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Quarterly

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 04/15/2014
Next Scheduled EDR Contact: 07/28/2014
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

ENG CONTROLS: Engineering Control Sites

A listing of sites with engineering controls in place.

Date of Government Version: 01/04/2014
Date Data Arrived at EDR: 02/26/2014
Date Made Active in Reports: 03/07/2014
Number of Days to Update: 9

Source: Department of Health
Telephone: 404-586-4249
Last EDR Contact: 02/26/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Varies

INST CONTROL: Sites with Institutional Controls

Voluntary Remediation Program and Brownfields sites with institutional controls in place.

Date of Government Version: 01/04/2014
Date Data Arrived at EDR: 02/26/2014
Date Made Active in Reports: 03/07/2014
Number of Days to Update: 9

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 02/26/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 09/17/2013
Date Data Arrived at EDR: 10/01/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 66

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 04/01/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

VCP: Voluntary Response Program Sites
Sites participating in the Voluntary Response Program. The purpose of the VRP is to streamline the cleanup process in a way that will encourage prospective developers, lenders, and purchasers to voluntarily cleanup properties.

Date of Government Version: 01/04/2014
Date Data Arrived at EDR: 02/26/2014
Date Made Active in Reports: 03/07/2014
Number of Days to Update: 9
Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 02/26/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Sites
With certain legal exclusions and additions, the term 'brownfield site' means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

Date of Government Version: 01/04/2014
Date Data Arrived at EDR: 02/26/2014
Date Made Active in Reports: 03/07/2014
Number of Days to Update: 9
Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 02/26/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites
Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 03/20/2014
Date Data Arrived at EDR: 03/20/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 20
Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 03/20/2014
Next Scheduled EDR Contact: 07/07/2014
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137
Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: No Update Planned

ODI: Open Dump Inventory
An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39
Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52
Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 11/04/2013
Next Scheduled EDR Contact: 02/17/2014
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 12/04/2013
Date Data Arrived at EDR: 12/10/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 65
Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/04/2014
Next Scheduled EDR Contact: 06/16/2014
Data Release Frequency: Quarterly

CDL: Clandestine Drug Lab Listing
A listing of clandestine drug lab site locations.

Date of Government Version: 08/04/2010
Date Data Arrived at EDR: 09/10/2010
Date Made Active in Reports: 10/22/2010
Number of Days to Update: 42
Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 03/03/2014
Next Scheduled EDR Contact: 06/16/2014
Data Release Frequency: Varies

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131
Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/04/2014
Next Scheduled EDR Contact: 06/16/2014
Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information
A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/06/2013
Date Data Arrived at EDR: 04/25/2013
Date Made Active in Reports: 05/10/2013
Number of Days to Update: 15
Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 01/03/2014
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 52

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 04/01/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Annually

SPILLS: Release Notifications

Releases of hazardous substances to the environment reported to the Office of Hazard Evaluation and Emergency Response since 1988.

Date of Government Version: 01/04/2014
Date Data Arrived at EDR: 02/26/2014
Date Made Active in Reports: 03/10/2014
Number of Days to Update: 12

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 02/26/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Varies

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 03/10/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 02/11/2013
Number of Days to Update: 39

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 03/13/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 02/06/2014
Next Scheduled EDR Contact: 05/19/2014
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 01/15/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 03/13/2013
Number of Days to Update: 15

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 03/10/2014
Next Scheduled EDR Contact: 06/23/2014
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 01/24/2014
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 31

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 03/27/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 11/25/2013
Date Data Arrived at EDR: 12/12/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 74

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 03/11/2014
Next Scheduled EDR Contact: 06/23/2014
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 10/07/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 146

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 02/25/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Varies

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/01/2013
Date Data Arrived at EDR: 09/05/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 28

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 03/05/2014
Next Scheduled EDR Contact: 06/16/2014
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/31/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 44

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 02/26/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 09/29/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 64

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 03/28/2014
Next Scheduled EDR Contact: 07/07/2014
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 02/24/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 02/24/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40
Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77
Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 01/28/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 07/20/2011
Date Data Arrived at EDR: 11/10/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 61
Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 10/09/2014
Next Scheduled EDR Contact: 07/21/2014
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 06/01/2013
Date Data Arrived at EDR: 07/17/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 107
Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 01/28/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/22/2013
Date Data Arrived at EDR: 08/02/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 91
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 03/10/2014
Next Scheduled EDR Contact: 06/23/2014
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 01/09/2014
Date Data Arrived at EDR: 01/10/2014
Date Made Active in Reports: 03/12/2014
Number of Days to Update: 61
Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 04/09/2014
Next Scheduled EDR Contact: 07/21/2014
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 11/18/2013
Date Data Arrived at EDR: 02/27/2014
Date Made Active in Reports: 03/12/2014
Number of Days to Update: 13

Source: EPA
Telephone: (415) 947-8000
Last EDR Contact: 03/14/2014
Next Scheduled EDR Contact: 06/23/2014
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 11/01/2013
Date Data Arrived at EDR: 12/12/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 04/19/2013
Number of Days to Update: 52

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 02/28/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Biennially

UIC: Underground Injection Wells Listing

A listing of underground injection well locations.

Date of Government Version: 02/07/2013
Date Data Arrived at EDR: 02/12/2013
Date Made Active in Reports: 04/09/2013
Number of Days to Update: 56

Source: Department of Health
Telephone: 808-586-4258
Last EDR Contact: 03/03/2014
Next Scheduled EDR Contact: 06/16/2014
Data Release Frequency: Varies

DRYCLEANERS: Permitted Drycleaner Facility Listing
A listing of permitted drycleaner facilities in the state.

Date of Government Version: 01/01/2014
Date Data Arrived at EDR: 02/21/2014
Date Made Active in Reports: 03/07/2014
Number of Days to Update: 14
Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 04/07/2014
Next Scheduled EDR Contact: 07/21/2014
Data Release Frequency: Varies

AIRS: List of Permitted Facilities
A listing of permitted facilities in the state.

Date of Government Version: 01/01/2014
Date Data Arrived at EDR: 02/21/2014
Date Made Active in Reports: 03/07/2014
Number of Days to Update: 14
Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 04/07/2014
Next Scheduled EDR Contact: 07/21/2014
Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34
Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 01/15/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing
The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54
Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 01/20/2014
Next Scheduled EDR Contact: 05/05/2014
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites
A listing of former lead smelter site locations.

Date of Government Version: 01/29/2013
Date Data Arrived at EDR: 02/14/2013
Date Made Active in Reports: 02/27/2013
Number of Days to Update: 13
Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 04/04/2014
Next Scheduled EDR Contact: 07/21/2014
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites
A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36
Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 11/11/2011
Date Data Arrived at EDR: 05/18/2012
Date Made Active in Reports: 05/25/2012
Number of Days to Update: 7

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 02/14/2014
Next Scheduled EDR Contact: 05/26/2014
Data Release Frequency: Varies

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 04/15/2013
Date Data Arrived at EDR: 07/03/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 72

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 04/04/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Quarterly

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 01/15/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: N/A

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/23/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 30

Source: EPA
Telephone: 202-564-5962
Last EDR Contact: 03/31/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 10/23/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 30

Source: EPA
Telephone: 202-564-5962
Last EDR Contact: 03/31/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Annually

Financial Assurance: Financial Assurance Information Listing

A listing of financial assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 01/23/2014
Date Data Arrived at EDR: 01/24/2014
Date Made Active in Reports: 03/07/2014
Number of Days to Update: 42

Source: Department of Health
Telephone: 808-586-4226
Last EDR Contact: 03/17/2014
Next Scheduled EDR Contact: 06/30/2014
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 02/25/2014
Date Data Arrived at EDR: 02/27/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 41

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 02/14/2014
Next Scheduled EDR Contact: 06/02/2014
Data Release Frequency: Quarterly

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 01/30/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 08/17/2010
Date Data Arrived at EDR: 01/03/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 77

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 03/11/2014
Next Scheduled EDR Contact: 06/23/2014
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 01/13/2014
Next Scheduled EDR Contact: 04/28/2014
Data Release Frequency: Varies

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 06/30/2013
Date Data Arrived at EDR: 08/13/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 31

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 02/10/2014
Next Scheduled EDR Contact: 05/26/2014
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR US Hist Auto Stat: EDR Exclusive Historic Gas Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Cleaners: EDR Exclusive Historic Dry Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Auto Stat: EDR Proprietary Historic Gas Stations - Cole

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: N/A
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Cleaners: EDR Proprietary Historic Dry Cleaners - Cole

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: N/A
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Health in Hawaii.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/17/2014
Number of Days to Update: 200

Source: Department of Health
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Health in Hawaii.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/08/2014
Number of Days to Update: 191

Source: Department of Health
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Health in Hawaii.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/03/2014
Number of Days to Update: 186

Source: Department of Health
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

STREET AND ADDRESS INFORMATION

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GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

IAO STREAM
IAO STREAM
WAILUKU, HI 96793

TARGET PROPERTY COORDINATES

Latitude (North):	20.8962 - 20° 53' 46.32''
Longitude (West):	156.4993 - 156° 29' 57.48''
Universal Tranverse Mercator:	Zone 4
UTM X (Meters):	760140.1
UTM Y (Meters):	2312549.0
Elevation:	161 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	20156-H4 KAHAKULOA, HI
Most Recent Revision:	Not reported
West Map:	20156-H5 NAPILI, HI
Most Recent Revision:	Not reported

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

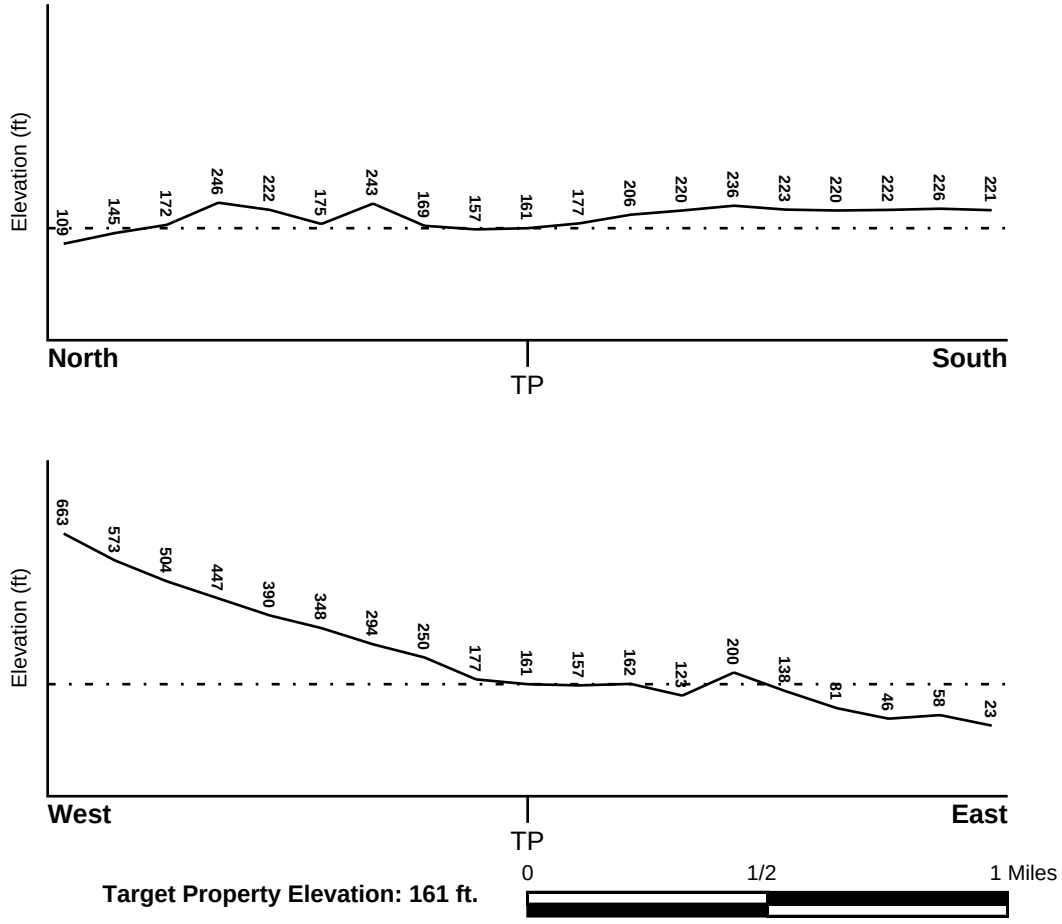
TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General ENE

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
MAUI, HI	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 1500030190D - FEMA Q3 Flood data

Additional Panels in search area: 1500030170B - FEMA Q3 Flood data

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
NOT AVAILABLE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

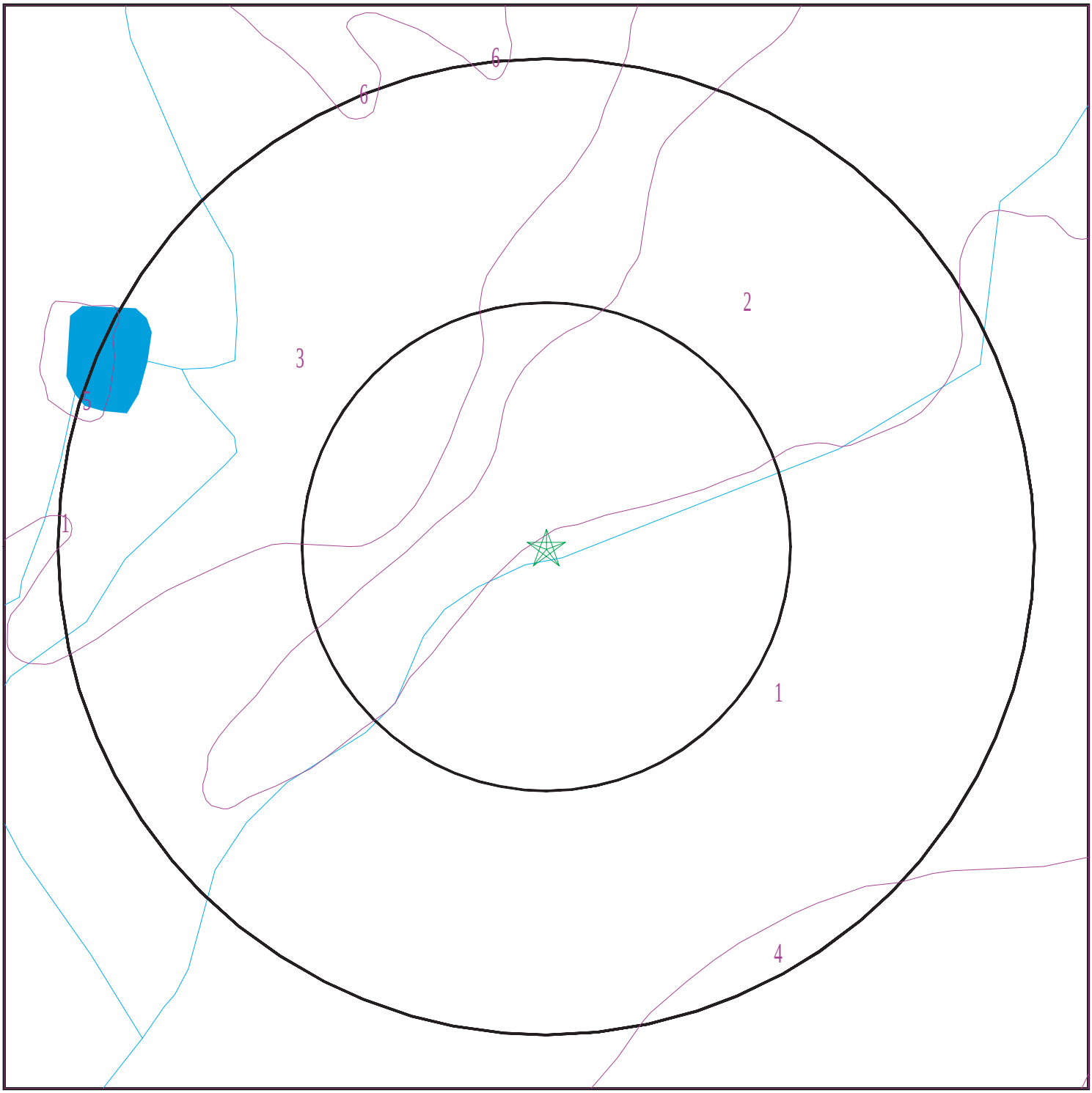
Era: -
System: -
Series: -
Code: N/A *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: -

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 3914751.2s



Target Property
SSURGO Soil
Water

0 1/16 1/8 1/4 Miles

N

SITE NAME:	Iao Stream	CLIENT:	Environet
ADDRESS:	Iao Stream Wailuku HI 96793	CONTACT:	Taylor Chock
LAT/LONG:	20.8962 / 156.4993	INQUIRY #:	3914751.2s
		DATE:	April 16, 2014 7:30 pm

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GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Iao

Soil Surface Texture: cobbly silty clay

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	14 inches	cobbly silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 14.11 Min: 1.41	Max: 7.3 Min: 6.6
2	14 inches	48 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 4.23 Min: 1.41	Max: 7.3 Min: 6.6
3	48 inches	59 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 14.11 Min: 1.41	Max: 7.3 Min: 6.6

Soil Map ID: 2

Soil Component Name: Pulehu

Soil Surface Texture: cobbly clay loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	20 inches	cobbly clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4.23	Max: 7.3 Min: 6.6
2	20 inches	59 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 14.11	Max: 7.8 Min: 6.6

Soil Map ID: 3

Soil Component Name: Iao

Soil Surface Texture: clay

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	14 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14.11 Min: 1.41	Max: 7.3 Min: 6.6
2	14 inches	48 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 4.23 Min: 1.41	Max: 7.3 Min: 6.6
3	48 inches	59 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14.11 Min: 1.41	Max: 7.3 Min: 6.6

Soil Map ID: 4

Soil Component Name: Wailuku

Soil Surface Texture: silty clay

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	11 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 1.41	Max: 6.5 Min: 5.6
2	11 inches	59 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 4.23 Min: 0.42	Max: 6.5 Min: 5.6

Soil Map ID: 5

Soil Component Name: Water > 40 acres

Soil Surface Texture: silty clay

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class:
Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Not Reported

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

No Layer Information available.

Soil Map ID: 6

Soil Component Name: Puuone

Soil Surface Texture: sand

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Somewhat excessively drained

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	20 inches	sand	Granular materials (35 pct. or less passing No. 200), Fine Sand.	COARSE-GRAINED SOILS, Sands, Clean Sands, Poorly graded sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 42.34	Max: 8.4 Min: 7.9
2	20 inches	40 inches	cemented material	Granular materials (35 pct. or less passing No. 200), Fine Sand.	COARSE-GRAINED SOILS, Sands, Clean Sands, Poorly graded sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14.11 Min: 4.23	Max: 8.5 Min: 8

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A1	USGS40000269171	0 - 1/8 Mile SE

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A2	USGS40000269170	0 - 1/8 Mile SSE
B5	USGS40000269164	1/2 - 1 Mile ESE
C8	USGS40000269173	1/2 - 1 Mile West
D11	USGS40000269158	1/2 - 1 Mile SE
D13	USGS40000269157	1/2 - 1 Mile SE
14	USGS40000269162	1/2 - 1 Mile ESE
E15	USGS40000269184	1/2 - 1 Mile WNW
D16	USGS40000269156	1/2 - 1 Mile SE
F18	USGS40000269159	1/2 - 1 Mile WSW
G24	USGS40000269188	1/2 - 1 Mile NW
H25	USGS40000269160	1/2 - 1 Mile WSW
G29	USGS40000269190	1/2 - 1 Mile NW
I30	USGS40000269145	1/2 - 1 Mile ESE
J31	USGS40000269154	1/2 - 1 Mile WSW
J35	USGS40000269152	1/2 - 1 Mile WSW
J36	USGS40000269149	1/2 - 1 Mile SW

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

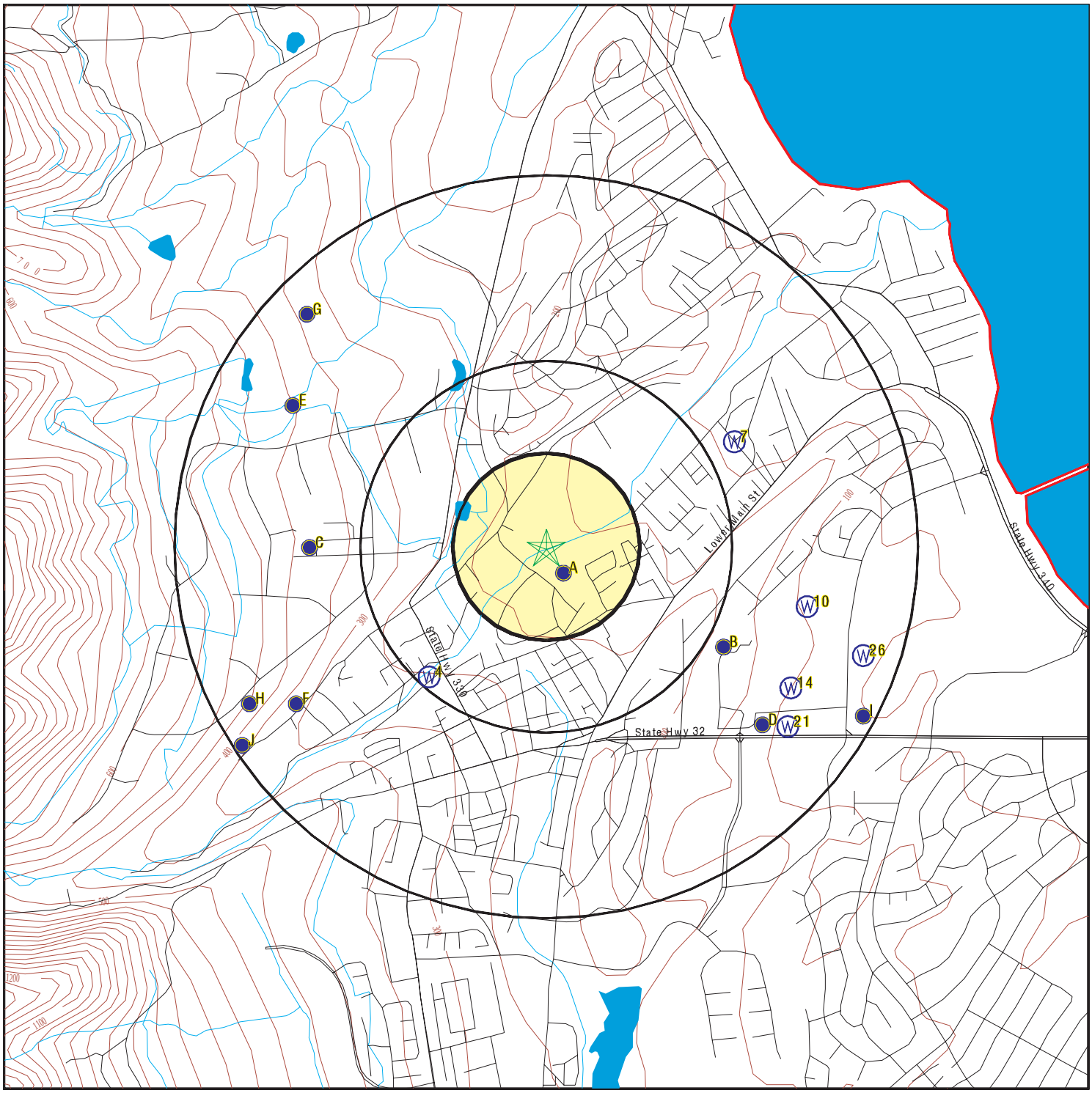
MAP ID	WELL ID	LOCATION FROM TP
G23	HI0000212	1/2 - 1 Mile NW

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A3	HI8000000001574	0 - 1/8 Mile SSE
4	HI8000000001562	1/4 - 1/2 Mile SW
B6	HI8000000001568	1/2 - 1 Mile ESE
7	HI8000000001589	1/2 - 1 Mile ENE
C9	HI8000000001575	1/2 - 1 Mile West
10	HI8000000001573	1/2 - 1 Mile ESE
D12	HI8000000001552	1/2 - 1 Mile SE
D17	HI8000000001554	1/2 - 1 Mile SE
E19	HI8000000001594	1/2 - 1 Mile WNW
F20	HI8000000001559	1/2 - 1 Mile WSW
21	HI8000000001555	1/2 - 1 Mile SE
G22	HI8000000001603	1/2 - 1 Mile NW
26	HI8000000001565	1/2 - 1 Mile ESE
H27	HI8000000001558	1/2 - 1 Mile WSW
G28	HI8000000001606	1/2 - 1 Mile NW
J32	HI8000000001545	1/2 - 1 Mile SW
J33	HI8000000001548	1/2 - 1 Mile WSW
I34	HI8000000001556	1/2 - 1 Mile ESE

PHYSICAL SETTING SOURCE MAP - 3914751.2s



County Boundary
Major Roads
Contour Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

Groundwater Flow Direction
GI Indeterminate Groundwater Flow at Location
GV Groundwater Flow Varies at Location

SITE NAME: Iao Stream ADDRESS: Iao Stream Wailuku HI 96793 LAT/LONG: 20.8962 / 156.4993	CLIENT: Environet CONTACT: Taylor Chock INQUIRY #: 3914751.2s DATE: April 16, 2014 7:30 pm

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GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

A1
SE **FED USGS** **USGS40000269171**
0 - 1/8 Mile
Higher

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205355156300501		
Monloc name:	6-5330-04 Wailuku Well at Wailuku, Maui, HI		
Monloc type:	Well		
Monloc desc:	Former well name Maui T-113		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8954018
Longitude:	-156.498567	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Unknown		
Horiz coord refsys:	NAD83	Vert measure val:	180
Vert measure units:	feet	Vertacc measure val:	1
Vert accmeasure units:	feet		
Vertcollection method:	Reported		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	705
Welldepth units:	ft	Wellholedepth:	705
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 0

A2
SSE **FED USGS** **USGS40000269170**
0 - 1/8 Mile
Higher

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205354156300501		
Monloc name:	6-5330-04 Test Hole T-113, Wailuku Mill, Maui, HI		
Monloc type:	Well: Test hole not completed as a well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8951241
Longitude:	-156.498567	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	180
Vert measure units:	feet	Vertacc measure val:	10
Vert accmeasure units:	feet		
Vertcollection method:	Unknown		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		

Aquifer type:	Not Reported		
Construction date:	1945	Welldepth:	705
Welldepth units:	ft	Wellholedepth:	705
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 0

A3
SSE
0 - 1/8 Mile
Higher

HI WELLS **HI8000000001574**

Objectid:	3450	Wid:	6-5330-004
Island:	Maui	Well name:	Wailuku Mill TH
Old name:	Not Reported		
Yr drilled:	1945		
Driller:	MULLIN		
Quad map:	5		
Long83dd:	-156.498611		
Lat83dd:	20.895		
Gps:	0	Utm:	-1
Owner user:	Wailuku Sugar	Old number:	113-TH
Well type:	ROT	Casing dia:	1
Ground el:	180		
Well depth:	705		
Solid case:	663	Perf case:	705
Use:	OBS - Observation	Use year:	Not Reported
Init head:	16.4	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	22		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	0		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	TW		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	-525
Bot solid:	-483	Bot perf:	-525
Spec capac:	Not Reported		
Pump mgd:	0		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	(2) 3-4-020:084
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	01-JAN-45
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001574

4
SW
1/4 - 1/2 Mile
Higher

HI WELLS **HI8000000001562**

Objectid:	3448	Wid:	6-5330-002
Island:	Maui	Well name:	Iao Tunnel (Puako)
Old name:	Not Reported		
Yr drilled:	1900		
Driller:	Not Reported		
Quad map:	5		
Long83dd:	-156.504167		
Lat83dd:	20.891111		
Gps:	0	Utm:	-1
Owner user:	Hawaiian Commercial & Sugar Co (HC&S)	Owner:	10-TU
Well type:	TUN	Casing dia:	Not Reported
Ground el:	240		
Well depth:	0		
Solid case:	Not Reported	Perf case:	Not Reported
Use:	IRR - Irrigation (non-domestic, non-agriculture)	Use year:	Not Reported
Init head:	240	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	0		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	0		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	RA		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	Not Reported
Bot solid:	Not Reported	Bot perf:	Not Reported
Spec capac:	Not Reported		
Pump mgd:	0		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	(2) 3-4-033:000
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	02-JAN-00
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001562

B5
ESE **FED USGS** **USGS40000269164**
1/2 - 1 Mile
Higher

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205344156294101		
Monloc name:	6-5329.06 -17		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8923465
Longitude:	-156.4919007	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	180.00
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		

Aquifer type:	Not Reported		
Construction date:	19690101	Welldepth:	122
Welldepth units:	ft	Wellholedepth:	122
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 0

B6
ESE **HI WELLS** **HI8000000001568**
1/2 - 1 Mile
Higher

Objectid:	3442	Wid:	6-5329-017
Island:	Maui	Well name:	Wailuku Arm
Old name:	Not Reported		
Yr drilled:	1969		
Driller:	ROSCOE MOSS		
Quad map:	5		
Long83dd:	-156.491944444		
Lat83dd:	20.8922222222		
Gps:	0	Utm:	-1
Owner user:	U S Army	Old number:	Not Reported
Well type:	PER	Casing dia:	8
Ground el:	180		
Well depth:	122		
Solid case:	102	Perf case:	Not Reported
Use:	UNU - Unused	Use year:	Not Reported
Init head:	Not Reported	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	0		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	0		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	Not Reported		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	58
Bot solid:	78	Bot perf:	Not Reported
Spec capac:	Not Reported		
Pump mgd:	0		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	Not Reported
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	04-APR-69
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001568

7
ENE **HI WELLS** **HI8000000001589**
1/2 - 1 Mile
Lower

Objectid:	3528	Wid:	6-5429-002
Island:	Maui	Well name:	Papohaku Park
Old name:	Not Reported		
Yr drilled:	1991		
Driller:	ROSCOE MOSS		
Quad map:	5		
Long83dd:	-156.491472		
Lat83dd:	20.900306		
Gps:	0	Utm:	-1
Owner user:	Maui Parks & Recreation	Old number:	Not Reported
Well type:	PER	Casing dia:	8
Ground el:	85		
Well depth:	140		
Solid case:	80	Perf case:	110
Use:	IRR - Parks	Use year:	Not Reported
Init head:	24.71	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	60		
Test date:	6/4/1991	Test gpm:	150
Test ddown:	0.5	Test chlor:	60
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	150		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	RA		
Pump yr:	1991		
Draft yr:	Not Reported	Bot hole:	-55
Bot solid:	5	Bot perf:	-25
Spec capac:	300		
Pump mgd:	.21		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	(2) 3-4-030:015
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	07-JUN-91
Pir:	7/7/1991	Surveyor:	Not Reported
T:	140	Site id:	HI8000000001589

C8
West
1/2 - 1 Mile
Higher

FED USGS **USGS40000269173**

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205358156304301		
Monloc name:	6-5330-12 Puuohala TH-C, Maui, HI		
Monloc type:	Well: Test hole not completed as a well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8962353
Longitude:	-156.5091223	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	397.66
Vert measure units:	feet	Vertacc measure val:	.01
Vert accmeasure units:	feet		
Vertcollection method:	Level or other surveying method		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		

Aquifer type:	Not Reported		
Construction date:	19750813	Welldepth:	610
Welldepth units:	ft	Wellholedepth:	610
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1975-08-12	14.40	

C9
West
1/2 - 1 Mile
Higher

HI WELLS **HI8000000001575**

Objectid:	3458	Wid:	6-5330-012
Island:	Maui	Well name:	Puuohala TH-C
Old name:	Not Reported		
Yr drilled:	1975		
Driller:	CONTINENTAL		
Quad map:	5		
Long83dd:	-156.509166667		
Lat83dd:	20.8961111111		
Gps:	0	Utm:	-1
Owner user:	Wailuku Sugar	Old number:	Not Reported
Well type:	Not Reported	Casing dia:	1
Ground el:	398		
Well depth:	610		
Solid case:	400	Perf case:	610
Use:	UNU - Unused	Use year:	Not Reported
Init head:	16.7	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	0		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	0		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	TW		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	-212
Bot solid:	-2	Bot perf:	-212
Spec capac:	Not Reported		
Pump mgd:	0		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	Not Reported
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	12-AUG-75
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001575

10
ESE
1/2 - 1 Mile
Lower

HI WELLS **HI8000000001573**

Objectid:	3439	Wid:	6-5329-014
Island:	Maui	Well name:	War Memorial Footbal
Old name:	Not Reported		
Yr drilled:	1970		
Driller:	OCEAN VIEW		
Quad map:	5		
Long83dd:	-156.488444		
Lat83dd:	20.893861		
Gps:	0	Utm:	-1
Owner user:	Maui Parks & Recreation	Old number:	17-1
Well type:	ROT	Casing dia:	Not Reported
Ground el:	120		
Well depth:	128		
Solid case:	106	Perf case:	Not Reported
Use:	IRR - Parks	Use year:	Not Reported
Init head:	Not Reported	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	285		
Test date:	Not Reported	Test gpm:	300
Test ddown:	Not Reported	Test chlor:	74
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	300		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	THO		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	-8
Bot solid:	14	Bot perf:	Not Reported
Spec capac:	Not Reported		
Pump mgd:	.288		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	(2) 3-8-007:055
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	01-JAN-70
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001573

D11
SE
1/2 - 1 Mile
Lower

FED USGS **USGS40000269158**

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205333156293701		
Monloc name:	6-5329-06 T105		
Monloc type:	Well: Test hole not completed as a well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8892913
Longitude:	-156.4907896	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	120.00
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		

Aquifer type:	Not Reported		
Construction date:	19390101	Welldepth:	131
Welldepth units:	ft	Wellholedepth:	131
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 0

D12
SE
1/2 - 1 Mile
Lower

HI WELLS **HI8000000001552**

Objectid:	3431	Wid:	6-5329-006
Island:	Maui	Well name:	Baldwin High TH
Old name:	Not Reported		
Yr drilled:	1939		
Driller:	JM HEIZER		
Quad map:	5		
Long83dd:	-156.490833333		
Lat83dd:	20.8891666667		
Gps:	0	Utm:	-1
Owner user:	Maui County	Old number:	105-TH
Well type:	ROT	Casing dia:	1
Ground el:	120		
Well depth:	131		
Solid case:	131	Perf case:	Not Reported
Use:	UNU - Unused	Use year:	Not Reported
Init head:	5.9	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	152		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	0		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	THO		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	-11
Bot solid:	-11	Bot perf:	Not Reported
Spec capac:	Not Reported		
Pump mgd:	0		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	Not Reported
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	01-JAN-39
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001552

D13
SE
1/2 - 1 Mile
Lower

FED USGS **USGS40000269157**

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205333156293601		
Monloc name:	6-5329-05 W19B		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8892913
Longitude:	-156.4905118	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	120.00
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19630101	Welldepth:	Not Reported
Welldepth units:	Not Reported	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

14
ESE **FED USGS** **USGS40000269162**
1/2 - 1 Mile
Lower

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205338156293101		
Monloc name:	6-5329-14 W17-1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.89068
Longitude:	-156.489123	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	120.00
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19700101	Welldepth:	128
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

E15
WNW
1/2 - 1 Mile
Higher | **FED USGS** | **USGS40000269184**

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205419156304401		
Monloc name:	6-5430-03 TH-E Waiehu, Maui, HI		
Monloc type:	Well: Test hole not completed as a well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.9020682
Longitude:	-156.5094	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	415.0
Vert measure units:	feet	Vertacc measure val:	.5
Vert accmeasure units:	feet		
Vertcollection method:	Level or other surveying method		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Hawaii volcanic-rock aquifers		
Formation type:	Wailuku Volcanic Series, Lava Flows		
Aquifer type:	Not Reported		
Construction date:	19760204	Welldepth:	580
Welldepth units:	ft	Wellholedepth:	580
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 176

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
2004-08-18		9.88	2004-07-12		10.55
2004-05-13		11.22	2004-04-02		11.15
2004-02-10		10.72	2004-01-07		9.58
2003-11-13		8.89	2003-10-02		8.86
2003-08-19		10.31			
2003-07-10		10.71			
Note: Other conditions existed that would affect the measured water level.					
2003-05-14		10.81			
Note: Other conditions existed that would affect the measured water level.					
2003-03-31		11.66			
Note: Other conditions existed that would affect the measured water level.					
2003-02-11		11.79			
Note: Other conditions existed that would affect the measured water level.					
2003-01-07		11.08			
Note: Other conditions existed that would affect the measured water level.					
2002-11-18		10.72			
Note: Other conditions existed that would affect the measured water level.					
2002-10-01		9.53			
Note: Other conditions existed that would affect the measured water level.					
2002-08-20		9.70			
Note: Other conditions existed that would affect the measured water level.					
2002-07-02		10.82			
Note: Other conditions existed that would affect the measured water level.					
2002-05-14		12.10			
Note: Other conditions existed that would affect the measured water level.					

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
2002-04-02		11.96			
Note: Other conditions existed that would affect the measured water level.					
2002-02-21		12.27			
Note: Other conditions existed that would affect the measured water level.					
2002-01-08		11.55			
Note: Other conditions existed that would affect the measured water level.					
2001-12-04		10.50			
Note: Other conditions existed that would affect the measured water level.					
2001-10-16		9.43	2001-08-21		9.22
2001-07-03		9.75	2001-05-15		10.08
2001-04-03		10.47	2001-03-08		10.87
2001-01-09		11.30	2000-12-07		11.10
2000-10-03		10.29	2000-08-24		9.98
2000-07-06		10.15	2000-05-16		11.03
2000-04-04		11.12	2000-02-16		11.71
2000-01-04		10.84	1999-11-19		9.52
1999-10-01		9.08	1999-08-24		9.27
1999-07-01		10.32	1999-05-18		11.35
1999-03-30		12.55	1999-03-09		12.97
1999-01-05		12.88	1998-12-01		12.34
1998-09-29		11.79	1998-08-24		11.64
1998-07-02		12.14	1998-05-26		11.99
1998-04-02		12.40	1998-02-24		12.64
1998-01-05		13.05	1997-11-25		12.53
1997-10-01		11.34	1997-08-25		10.47
1997-08-06		9.97	1997-06-30		10.19
1997-05-27		10.80	1997-04-01		11.63
1997-02-24		11.35	1997-01-03		11.55
1996-11-25		11.27	1996-10-01		9.65
1996-08-26		9.96	1996-07-01		10.80
1996-05-29		11.70	1996-04-02		12.82
1996-02-12		13.34	1996-01-03		12.46
1995-11-21		11.54	1995-10-04		11.04
1995-08-07		11.50	1995-07-06		12.04
1995-05-12		13.97	1995-01-11		12.94
1994-10-05		12.11	1994-08-10		12.15
1994-06-17		13.10	1994-04-28		14.29
1994-03-17		14.60	1994-01-19		14.27
1993-12-01		14.06	1993-11-08		13.74
1993-08-23		13.23	1993-06-18		13.63
1993-04-29		14.38	1993-03-29		14.71
1993-01-26		15.47	1992-12-21		15.02
1992-11-05		14.71	1992-09-08		14.24
1992-07-22		14.47	1992-06-03		15.58
1992-04-24		15.72	1992-03-12		15.52
1992-01-22		16.61	1991-12-05		16.07
1991-10-17		15.47	1991-10-01		15.25
1991-09-04		14.4	1991-06-27		14.47
1991-05-23		15.45	1991-04-11		16.65
1991-03-04		16.95	1991-01-23		16.9
1990-11-28		16.38	1990-10-24		16.39
1990-08-22		16.86	1990-07-23		16.02
1990-05-29		18.31	1990-04-17		18.38
1990-03-07		19.51	1990-01-18		19.91
1989-11-27		19.86	1989-10-24		19.62

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1989-09-21		18.85	1989-08-11		18.43
1989-07-18		18.3	1989-05-04		18.23
1989-03-03		19.38	1989-01-17		19.25
1988-12-01		18.22	1988-10-11		17.76
1988-09-13		17.93	1988-07-20		18.18
1988-05-18		18.73	1988-04-18		18.77
1988-02-23		19.04	1988-01-11		18.55
1987-11-23		17.58	1987-10-15		17.12
1987-08-17		16.75	1987-07-14		16.8
1987-05-20		17.16	1987-04-13		16.65
1987-02-25		17.28	1987-01-13		16.95
1986-11-21		16.06	1986-10-09		15.6
1986-08-22		15.06	1986-07-08		15.04
1986-05-16		15.19	1986-04-22		15.38
1986-02-28		15.76	1986-01-16		15.87
1985-11-29		15.67	1985-10-11		14.67
1985-09-16		14.88	1985-08-28		14.86
1985-07-05		15.09	1985-05-15		15.54
1985-03-29		16.07	1985-02-12		16.21
1985-01-03		16.08	1984-11-01		15.65
1984-10-18		15.77	1984-08-14		16.02
1984-07-03		16.43	1984-05-22		17.09
1984-04-09		17.46	1984-03-01		17.83
1983-12-06		18.16	1983-10-19		18.13
1983-08-24		18.24	1983-07-13		18.77
1983-06-15		19.35	1983-05-25		19.55
1983-04-14		20.35	1983-03-02		21.22
1983-01-18		22.03	1982-12-02		21.85
1982-11-02		21.37	1982-10-14		20.84
1982-08-06		19.57			

D16
SE
1/2 - 1 Mile
Lower

FED USGS **USGS40000269156**

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205333156293301		
Monloc name:	6-5329-04 W19A		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8892913
Longitude:	-156.4896785	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	80.00
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		

Aquifer type:	Not Reported		
Construction date:	19630101	Welldepth:	110
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

D17
SE
1/2 - 1 Mile
Lower

HI WELLS **HI8000000001554**

Objectid:	3429	Wid:	6-5329-004
Island:	Maui	Well name:	Maui Stadium Well
Old name:	Not Reported		
Yr drilled:	1971		
Driller:	PAUL SMITH		
Quad map:	5		
Long83dd:	-156.489722		
Lat83dd:	20.889167		
Gps:	0	Utm:	-1
Owner user:	Maui Parks & Recreation	Old number:	Not Reported
Well type:	ROT	Casing dia:	8
Ground el:	80		
Well depth:	110		
Solid case:	Not Reported	Perf case:	Not Reported
Use:	UNU - Unused	Use year:	Not Reported
Init head:	Not Reported	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	0		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	250		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	THO		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	-30
Bot solid:	Not Reported	Bot perf:	Not Reported
Spec capac:	Not Reported		
Pump mgd:	.36		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	(2) 3-8-007:055
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	30-DEC-99
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001554

F18
WSW
1/2 - 1 Mile
Higher

FED USGS **USGS40000269159**

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205336156304501		
Monloc name:	6-5330-06 Mokuhau Test Hole Ex-1, Maui, HI		
Monloc type:	Well: Test hole not completed as a well		
Monloc desc:	alternate well name 15C		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8901248
Longitude:	-156.5096778	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	309.6
Vert measure units:	feet	Vertacc measure val:	.1
Vert accmeasure units:	feet		
Vertcollection method:	Reported		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19500803	Welldepth:	431
Welldepth units:	ft	Wellholedepth:	431
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 0

E19
WNW
1/2 - 1 Mile
Higher

HI WELLS **HI8000000001594**

Objectid:	3532	Wid:	6-5430-003
Island:	Maui	Well name:	Waiehu TH-E
Old name:	Not Reported		
Yr drilled:	1976		
Driller:	CONTINENTAL		
Quad map:	5		
Long83dd:	-156.510277778		
Lat83dd:	20.9013888889		
Gps:	-1	Utm:	0
Owner user:	Wailuku Agribusiness Co., Inc.	Old number:	Not Reported
Well type:	Not Reported	Casing dia:	3
Ground el:	415		
Well depth:	580		
Solid case:	Not Reported	Perf case:	Not Reported
Use:	OBS - Observation	Use year:	Not Reported
Init head:	14.4	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	0		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	0		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	TW		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	-165
Bot solid:	Not Reported	Bot perf:	Not Reported
Spec capac:	Not Reported		
Pump mgd:	0		

Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	(2) 3-3-002:001
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	01-JAN-76
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001594

F20
WSW
1/2 - 1 Mile
Higher

HI WELLS **HI8000000001559**

Objectid:	3452	Wid:	6-5330-006
Island:	Maui	Well name:	Mokuhau TH 1
Old name:	Not Reported		
Yr drilled:	1950		
Driller:	E MAUI IRRIG		
Quad map:	5		
Long83dd:	-156.509722		
Lat83dd:	20.89		
Gps:	0	Utm:	-1
Owner user:	Maui DWS	Old number:	15-C TH
Well type:	ROT	Casing dia:	1
Ground el:	310		
Well depth:	431		
Solid case:	391	Perf case:	431
Use:	OBS - Observation	Use year:	Not Reported
Init head:	27.3	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	280		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	0		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	TW		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	-121
Bot solid:	-81	Bot perf:	-121
Spec capac:	Not Reported		
Pump mgd:	0		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	(2) 3-4-035:023
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	01-JAN-50
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001559

21
SE
1/2 - 1 Mile
Lower

HI WELLS **HI8000000001555**

Objectid:	3430	Wid:	6-5329-005
Island:	Maui	Well name:	Baldwin High School
Old name:	Not Reported		
Yr drilled:	1971		
Driller:	Not Reported		
Quad map:	5		
Long83dd:	-156.48925		
Lat83dd:	20.889167		
Gps:	0	Utm:	-1
Owner user:	Maui Parks & Recreation	Old number:	19-B
Well type:	Not Reported	Casing dia:	Not Reported
Ground el:	120		
Well depth:	0		
Solid case:	Not Reported	Perf case:	Not Reported
Use:	IRR - Schools	Use year:	Not Reported
Init head:	Not Reported	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	0		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	280		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	THO		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	Not Reported
Bot solid:	Not Reported	Bot perf:	Not Reported
Spec capac:	Not Reported		
Pump mgd:	0		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	(2) 3-8-007:055
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	30-DEC-99
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001555

G22
NW
1/2 - 1 Mile
Higher

HI WELLS **HI8000000001603**

Objectid:	3530	Wid:	6-5430-001
Island:	Maui	Well name:	Waiehu Heights 1
Old name:	514		
Yr drilled:	1975		
Driller:	WAT RES INTL		
Quad map:	5		
Long83dd:	-156.508889		
Lat83dd:	20.905278		
Gps:	-1	Utm:	0
Owner user:	Maui DWS	Old number:	Not Reported
Well type:	ROT	Casing dia:	14
Ground el:	337		
Well depth:	675		
Solid case:	337	Perf case:	367
Use:	MUN - County	Use year:	Not Reported
Init head:	18	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	52		
Test date:	4/21/1975	Test gpm:	1300
Test ddown:	6.5	Test chlor:	51

Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	700		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	TW		
Pump yr:	2007		
Draft yr:	Not Reported	Bot hole:	-338
Bot solid:	0	Bot perf:	-30
Spec capac:	200		
Pump mgd:	1.008		
Draft mgd:	Not Reported	Pump elev:	-22
Pump depth:	359	Tmk:	(2) 3-3-002:028
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	01-MAY-75
Pir:	10/16/2007	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001603

G23
NW
1/2 - 1 Mile
Higher

FRDS PWS **HI0000212**

PWS ID: HI0000212
Date Initiated: Not Reported Date Deactivated: Not Reported
PWS Name: DWS WAILUKU
WAILUKU, MAUI, HI 96793

Addressee / Facility: System Owner/Responsible Party
MR. DAVID CRADDOCK, DIRECTOR
DEPARTMENT OF WATER SUPPLY
P.O. BOX 1109
WAILUKU, HI 96793

Addressee / Facility: Laboratory
MS. CARI CERIZO
DEPARTMENT OF WATER SUPPLY
614 PALAPALA DRIVE
KAHULUI, MAUI, HI 96732

Facility Latitude:	20 53 12.0000	Facility Longitude:	156 32 14.0000
Facility Latitude:	20 53 29.0000	Facility Longitude:	156 30 55.0000
Facility Latitude:	20 54 40.0000	Facility Longitude:	156 31 1.0000
Facility Latitude:	20 54 40.0000	Facility Longitude:	156 31 2.0000
Facility Latitude:	20 54 44.0000	Facility Longitude:	156 31 4.0000
Facility Latitude:	20 54 32.0000	Facility Longitude:	156 30 44.0000
Facility Latitude:	20 54 30.0000	Facility Longitude:	156 30 44.0000
Facility Latitude:	20 53 9.0000	Facility Longitude:	156 32 30.0000
Facility Latitude:	20 53 30.0000	Facility Longitude:	156 30 54.0000
City Served:	WAILUKU		
Treatment Class:	Treated	Population:	41691

Violations information not reported.

ENFORCEMENT INFORMATION:

Truedate:	03/31/2009	Pwsid:	HI0000212
Pwsname:	WAILUKU		
Retpopsrvd:	52200	Pwstypecod:	C
Vioid:	10101	Contaminant:	COLIFORM (TCR)
Viol. Type:	MCL, Monthly (TCR)		
Complperbe:	10/1/2000 0:00:00		
Complperen:	10/31/2000 0:00:00	Enfdate:	10/16/2000 0:00:00
Enf action:	State Violation/Reminder Notice		
Violmeasur:	Not Reported		

Truedate:	03/31/2009	Pwsid:	HI0000212
Pwsname:	WAILUKU		
Retpopsrvd:	52200	Pwstypecod:	C
Violid:	10101	Contaminant:	COLIFORM (TCR)
Viol. Type:	MCL, Monthly (TCR)		
Complperbe:	10/1/2000 0:00:00		
Complperen:	10/31/2000 0:00:00	Enfdate:	10/16/2000 0:00:00
Enf action:	State Public Notif Requested		
Violmeasur:	Not Reported		

Truedate:	03/31/2009	Pwsid:	HI0000212
Pwsname:	WAILUKU		
Retpopsrvd:	52200	Pwstypecod:	C
Violid:	10101	Contaminant:	COLIFORM (TCR)
Viol. Type:	MCL, Monthly (TCR)		
Complperbe:	10/1/2000 0:00:00		
Complperen:	10/31/2000 0:00:00	Enfdate:	10/19/2000 0:00:00
Enf action:	State Public Notif Issued		
Violmeasur:	Not Reported		

Truedate:	03/31/2009	Pwsid:	HI0000212
Pwsname:	WAILUKU		
Retpopsrvd:	52200	Pwstypecod:	C
Violid:	10201	Contaminant:	COLIFORM (TCR)
Viol. Type:	MCL, Acute (TCR)		
Complperbe:	10/1/2000 0:00:00		
Complperen:	10/31/2000 0:00:00	Enfdate:	10/16/2000 0:00:00
Enf action:	State Violation/Reminder Notice		
Violmeasur:	Not Reported		

Truedate:	03/31/2009	Pwsid:	HI0000212
Pwsname:	WAILUKU		
Retpopsrvd:	52200	Pwstypecod:	C
Violid:	10201	Contaminant:	COLIFORM (TCR)
Viol. Type:	MCL, Acute (TCR)		
Complperbe:	10/1/2000 0:00:00		
Complperen:	10/31/2000 0:00:00	Enfdate:	10/16/2000 0:00:00
Enf action:	State Public Notif Requested		
Violmeasur:	Not Reported		

Truedate:	03/31/2009	Pwsid:	HI0000212
Pwsname:	WAILUKU		
Retpopsrvd:	52200	Pwstypecod:	C
Violid:	10201	Contaminant:	COLIFORM (TCR)
Viol. Type:	MCL, Acute (TCR)		
Complperbe:	10/1/2000 0:00:00		
Complperen:	10/31/2000 0:00:00	Enfdate:	10/19/2000 0:00:00
Enf action:	State Public Notif Issued		
Violmeasur:	Not Reported		

System Name:	WAILUKU		
Violation Type:	MCL, Monthly (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/01/00 - 10/31/00		
Violation ID:	10101		
Enforcement Date:	10/16/00	Enf. Action:	State Public Notif Requested

ENFORCEMENT INFORMATION:

System Name:	WAILUKU		
Violation Type:	MCL, Monthly (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/01/00 - 10/31/00		
Violation ID:	10101		
Enforcement Date:	10/16/00	Enf. Action:	State Violation/Reminder Notice
System Name:	WAILUKU		
Violation Type:	MCL, Monthly (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/1/2000 0:00:00 - 10/31/2000 0:00:00		
Violation ID:	10101		
Enforcement Date:	10/19/2000 0:00:00	Enf. Action:	State Public Notif Issued
System Name:	WAILUKU		
Violation Type:	MCL, Monthly (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/1/2000 0:00:00 - 10/31/2000 0:00:00		
Violation ID:	10101		
Enforcement Date:	10/16/2000 0:00:00	Enf. Action:	State Public Notif Requested
System Name:	WAILUKU		
Violation Type:	MCL, Monthly (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/1/2000 0:00:00 - 10/31/2000 0:00:00		
Violation ID:	10101		
Enforcement Date:	10/16/2000 0:00:00	Enf. Action:	State Violation/Reminder Notice
System Name:	WAILUKU		
Violation Type:	MCL, Monthly (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/01/00 - 10/31/00		
Violation ID:	10101		
Enforcement Date:	10/19/00	Enf. Action:	State Public Notif Issued
System Name:	WAILUKU		
Violation Type:	MCL, Acute (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/1/2000 0:00:00 - 10/31/2000 0:00:00		
Violation ID:	10201		
Enforcement Date:	10/16/2000 0:00:00	Enf. Action:	State Public Notif Requested
System Name:	WAILUKU		
Violation Type:	MCL, Acute (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/1/2000 0:00:00 - 10/31/2000 0:00:00		
Violation ID:	10201		
Enforcement Date:	10/16/2000 0:00:00	Enf. Action:	State Violation/Reminder Notice
System Name:	WAILUKU		
Violation Type:	MCL, Acute (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/1/2000 0:00:00 - 10/31/2000 0:00:00		
Violation ID:	10201		
Enforcement Date:	10/19/2000 0:00:00	Enf. Action:	State Public Notif Issued
System Name:	WAILUKU		
Violation Type:	MCL, Acute (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/01/00 - 10/31/00		
Violation ID:	10201		
Enforcement Date:	10/16/00	Enf. Action:	State Public Notif Requested

ENFORCEMENT INFORMATION:

System Name:	WAILUKU		
Violation Type:	MCL, Acute (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/01/00 - 10/31/00		
Violation ID:	10201		
Enforcement Date:	10/16/00	Enf. Action:	State Violation/Reminder Notice
System Name:	WAILUKU		
Violation Type:	MCL, Acute (TCR)		
Contaminant:	COLIFORM (TCR)		
Compliance Period:	10/01/00 - 10/31/00		
Violation ID:	10201		
Enforcement Date:	10/19/00	Enf. Action:	State Public Notif Issued

CONTACT INFORMATION:

Name:	WAILUKU	Population:	52200
Contact:	ENG, JEFFREY	Phone:	808-270-7816
Address:	Department of Water Supply		
Address 2:	200 South High Street		
	WAILUKU, HI 96793		

G24
NW
1/2 - 1 Mile
Higher

FED USGS **USGS40000269188**

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205430156304401		
Monloc name:	6-5430-01 Waiehu Heights 1, Maui, HI		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.9051236
Longitude:	-156.5094	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	337.07
Vert measure units:	feet	Vertacc measure val:	.01
Vert accmeasure units:	feet		
Vertcollection method:	Level or other surveying method		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19750416	Welldepth:	675
Welldepth units:	ft	Wellholedepth:	675
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1975-06-24	319.64	

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

H25
WSW
1/2 - 1 Mile
Higher | **FED USGS** | **USGS40000269160**

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205336156305201		
Monloc name:	6-5330-07 Mokuhau Test Hole Ex-2, Maui, HI		
Monloc type:	Well: Test hole not completed as a well		
Monloc desc:	alternate well name 15D		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8901248
Longitude:	-156.5116222	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	484.23
Vert measure units:	feet	Vertacc measure val:	.01
Vert accmeasure units:	feet		
Vertcollection method:	Reported		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19510514	Welldepth:	585.4
Welldepth units:	ft	Wellholedepth:	585.4
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 0

26
ESE
1/2 - 1 Mile
Lower | **HI WELLS** | **HI8000000001565**

Objectid:	3445	Wid:	6-5329-020
Island:	Maui	Well name:	Maui Cent Park 2
Old name:	Not Reported		
Yr drilled:	1997		
Driller:	WAILANI DRLG		
Quad map:	5		
Long83dd:	-156.486111		
Lat83dd:	20.891944		
Gps:	0	Utm:	-1
Owner user:	Maui Parks & Recreation	Old number:	Not Reported
Well type:	ROT	Casing dia:	10
Ground el:	71		
Well depth:	110		
Solid case:	80	Perf case:	95
Use:	IRR - Parks	Use year:	Not Reported
Init head:	1.9	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	260		
Test date:	12/4/1997	Test gpm:	300
Test ddown:	6.3	Test chlor:	260

Test temp:	23.9	Test unit:	C
Pump gpm:	230		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	THO		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	-39
Bot solid:	-9	Bot perf:	-24
Spec capac:	48		
Pump mgd:	.331		
Draft mgd:	Not Reported	Pump elev:	-12
Pump depth:	83	Tmk:	(2) 3-8-007:001
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	04-DEC-97
Pir:	2/10/1998	Surveyor:	S D DUPONTE
T:	60357	Site id:	HI8000000001565

H27
WSW
1/2 - 1 Mile
Higher

HI WELLS **HI8000000001558**

Objectid:	3453	Wid:	6-5330-007
Island:	Maui	Well name:	Mokuhau TH 2
Old name:	Not Reported		
Yr drilled:	1951		
Driller:	E MAUI IRRIG		
Quad map:	5		
Long83dd:	-156.511667		
Lat83dd:	20.89		
Gps:	0	Utm:	-1
Owner user:	Maui DWS	Old number:	15-D TH
Well type:	ROT	Casing dia:	1
Ground el:	484		
Well depth:	585		
Solid case:	549	Perf case:	570
Use:	OBS - Observation	Use year:	Not Reported
Init head:	23.7	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	0		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	0		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	TW		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	-101
Bot solid:	-65	Bot perf:	-86
Spec capac:	Not Reported		
Pump mgd:	0		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	(2) 3-3-017:066
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	01-JAN-51
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001558

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database | EDR ID Number

G28
NW
1/2 - 1 Mile
Higher

HI WELLS **HI8000000001606**

Objectid:	3531	Wid:	6-5430-002
Island:	Maui	Well name:	Waiehu Heights 2
Old name:	514		
Yr drilled:	1975		
Driller:	WAT RES INTL		
Quad map:	5		
Long83dd:	-156.509167		
Lat83dd:	20.905556		
Gps:	-1	Utm:	0
Owner user:	Maui DWS	Old number:	Not Reported
Well type:	ROT	Casing dia:	14
Ground el:	337		
Well depth:	543		
Solid case:	337	Perf case:	367
Use:	MUN - County	Use year:	Not Reported
Init head:	18	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	20		
Test date:	5/29/1975	Test gpm:	1300
Test ddown:	21	Test chlor:	20
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	1250		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	TW		
Pump yr:	1998		
Draft yr:	Not Reported	Bot hole:	-206
Bot solid:	0	Bot perf:	-30
Spec capac:	62		
Pump mgd:	1.8		
Draft mgd:	Not Reported	Pump elev:	-23
Pump depth:	360	Tmk:	(2) 3-3-002:028
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	18-MAY-75
Pir:	10/26/2011	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001606

G29
NW
1/2 - 1 Mile
Higher

FED USGS **USGS40000269190**

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205432156304401		
Monloc name:	6-5430-02 Waiehu Heights 2, Maui, HI		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.9054013
Longitude:	-156.5094	Sourcemap scale:	24000

Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	337
Vert measure units:	feet	Vertacc measure val:	1
Vert accmeasure units:	feet		
Vertcollection method:	Level or other surveying method		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19750425	Welldepth:	543
Welldepth units:	ft	Wellholedepth:	543
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 0

I30
ESE **FED USGS** **USGS40000269145**
1/2 - 1 Mile
Lower

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205323156291001		
Monloc name:	6-5329-19 Maui Central Park 1, Maui, HI		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8897222
Longitude:	-156.486111	Sourcemap scale:	24000
Horiz Acc measure:	3	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from Digital Map		
Horiz coord refsys:	NAD83	Vert measure val:	60
Vert measure units:	feet	Vertacc measure val:	40
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19971118	Welldepth:	95
Welldepth units:	ft	Wellholedepth:	110
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 0

J31
WSW **FED USGS** **USGS40000269154**
1/2 - 1 Mile
Higher

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205331156305301		
Monloc name:	6-5330-08 W15E		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8887361
Longitude:	-156.5119	Sourcemap scale:	24000

Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	364.00
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19520101	Welldepth:	466
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

J32
SW
1/2 - 1 Mile
Higher

HI WELLS **HI8000000001545**

Objectid:	3457	Wid:	6-5330-011
Island:	Maui	Well name:	Mokuhau 3
Old name:	Not Reported		
Yr drilled:	1967		
Driller:	LAYNE INTL		
Quad map:	5		
Long83dd:	-156.511667		
Lat83dd:	20.888333		
Gps:	-1	Utm:	0
Owner user:	Maui DWS	Old number:	15-F
Well type:	ROT	Casing dia:	18
Ground el:	354		
Well depth:	605		
Solid case:	Not Reported	Perf case:	Not Reported
Use:	MUN - County	Use year:	Not Reported
Init head:	Not Reported	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	30		
Test date:	Not Reported	Test gpm:	4584
Test ddown:	13.4	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	4250		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	TW		
Pump yr:	1997		
Draft yr:	Not Reported	Bot hole:	-251
Bot solid:	Not Reported	Bot perf:	Not Reported
Spec capac:	342		
Pump mgd:	6.12		
Draft mgd:	Not Reported	Pump elev:	-7
Pump depth:	361	Tmk:	(2) 3-3-002:024
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	01-JAN-67
Pir:	10/10/2011	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001545

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

J33
WSW
1/2 - 1 Mile
Higher

HI WELLS **HI8000000001548**

Objectid:	3454	Wid:	6-5330-008
Island:	Maui	Well name:	Mokuhau TH 3
Old name:	Not Reported		
Yr drilled:	1952		
Driller:	E MAUI IRRIG		
Quad map:	5		
Long83dd:	-156.511944		
Lat83dd:	20.888611		
Gps:	0	Utm:	-1
Owner user:	Maui DWS	Old number:	15-E TH
Well type:	ROT	Casing dia:	1
Ground el:	364		
Well depth:	466		
Solid case:	364	Perf case:	Not Reported
Use:	OBS - Observation	Use year:	Not Reported
Init head:	Not Reported	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	0		
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Test unit:	Not Reported
Pump gpm:	0		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	TW		
Pump yr:	0		
Draft yr:	Not Reported	Bot hole:	-102
Bot solid:	0	Bot perf:	Not Reported
Spec capac:	Not Reported		
Pump mgd:	0		
Draft mgd:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Tmk:	(2) 3-3-017:068
Aqui code:	60102		
Latest hd:	Not Reported	Wcr:	01-JAN-52
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Site id:	HI8000000001548

I34
ESE
1/2 - 1 Mile
Lower

HI WELLS **HI8000000001556**

Objectid:	3444	Wid:	6-5329-019
Island:	Maui	Well name:	Maui Cent Park 1
Old name:	Not Reported		
Yr drilled:	1997		
Driller:	WAILANI DRLG		
Quad map:	5		
Long83dd:	-156.486111		
Lat83dd:	20.889444		
Gps:	0	Utm:	-1
Owner user:	Maui Parks & Recreation	Old number:	Not Reported

Well type:	ROT	Casing dia:	10
Ground el:	76		
Well depth:	110		
Solid case:	80	Perf case:	95
Use:	IRR - Parks	Use year:	Not Reported
Init head:	2.5	Init head2:	Not Reported
Init head3:	Not Reported		
Init cl:	240		
Test date:	11/18/1997	Test gpm:	300
Test ddown:	1	Test chlor:	260
Test temp:	23.9	Test unit:	C
Pump gpm:	230		
Draft mgy:	Not Reported	Head feet:	Not Reported
Max chlor:	Not Reported	Min chlor:	Not Reported
Geology:	THO		
Pump yr:	1998		
Draft yr:	Not Reported	Bot hole:	-34
Bot solid:	-4	Bot perf:	-19
Spec capac:	300		
Pump mgd:	.331		
Draft mgd:	Not Reported	Pump elev:	-7
Pump depth:	83	Tmk:	(2) 3-8-007:001
Aqui code:	60301		
Latest hd:	Not Reported	Wcr:	18-NOV-97
Pir:	2/12/1998	Surveyor:	S D DUPONTE
T:	267200	Site id:	HI8000000001556

J35
WSW **FED USGS** **USGS40000269152**
1/2 - 1 Mile
Higher

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205330156305401		
Monloc name:	6-5330-11 Mokuhau Pump 3, Maui, HI		
Monloc type:	Well		
Monloc desc:	former local no. W15F		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8884583
Longitude:	-156.5121778	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	354
Vert measure units:	feet	Vertacc measure val:	1
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19670101	Welldepth:	580
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

J36
SW
1/2 - 1 Mile
Higher | **FED USGS** | **USGS40000269149**

Org. Identifier:	USGS-HI		
Formal name:	USGS Hawaii Water Science Center		
Monloc Identifier:	USGS-205329156305502		
Monloc name:	6-5330-09 Mokuhau Pump 2, Maui, HI		
Monloc type:	Well		
Monloc desc:	former local well no. W15A		
Huc code:	20020000	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	20.8880556
Longitude:	-156.5120278	Sourcemap scale:	24000
Horiz Acc measure:	.5	Horiz Acc measure units:	seconds
Horiz Collection method:	Global positioning system (GPS), uncorrected		
Horiz coord refsys:	NAD83	Vert measure val:	353.2
Vert measure units:	feet	Vertacc measure val:	.1
Vert accmeasure units:	feet		
Vertcollection method:	Level or other surveying method		
Vert coord refsys:	HILOCAL	Countrycode:	US
Aquifername:	Hawaii volcanic-rock aquifers		
Formation type:	Wailuku Volcanic Series, Lava Flows		
Aquifer type:	Not Reported		
Construction date:	19530501	Welldepth:	600
Welldepth units:	ft	Wellholedepth:	600
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 52

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
2004-08-18		6.93			
Note: A nearby site that taps the same aquifer was being pumped.					
2004-07-12		6.28			
Note: A nearby site that taps the same aquifer was being pumped.					
2004-05-13		7.08			
Note: A nearby site that taps the same aquifer was being pumped.					
2004-04-02		9.33			
Note: A nearby site that taps the same aquifer was being pumped.					
2004-02-10		8.69			
Note: A nearby site that taps the same aquifer was being pumped.					
2004-01-05		7.62			
Note: A nearby site that taps the same aquifer was being pumped.					
2003-11-13		8.19			
Note: The site had been pumped recently.					
2003-10-02		6.13			
Note: A nearby site that taps the same aquifer was being pumped.					
2003-08-19		5.60			
Note: A nearby site that taps the same aquifer was being pumped.					
2003-07-10		7.6			
Note: A nearby site that taps the same aquifer was being pumped.					
2003-05-14		7.30			
Note: A nearby site that taps the same aquifer was being pumped.					
2003-03-31		8.32			
Note: A nearby site that taps the same aquifer was being pumped.					

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel
2003-02-11		9.21
Note: Other conditions existed that would affect the measured water level.		
2003-01-07		9.91
Note: Other conditions existed that would affect the measured water level.		
2002-11-19		7.10
Note: Other conditions existed that would affect the measured water level.		
2002-10-01		6.68
Note: A nearby site that taps the same aquifer was being pumped.		
2002-08-20		4.30
Note: A nearby site that taps the same aquifer was being pumped.		
2002-07-02		8.11
Note: A nearby site that taps the same aquifer was being pumped.		
2002-05-14		8.82
Note: A nearby site that taps the same aquifer was being pumped.		
2002-04-02		10.73
2002-02-21		9.50
Note: A nearby site that taps the same aquifer was being pumped.		
2002-01-08		10.61
Note: A nearby site that taps the same aquifer was being pumped.		
2001-12-04		9.84
Note: A nearby site that taps the same aquifer had been pumped recently.		
2001-10-16		6.61
Note: A nearby site that taps the same aquifer was being pumped.		
2001-08-21		5.74
Note: A nearby site that taps the same aquifer was being pumped.		
2001-07-03		4.22
Note: A nearby site that taps the same aquifer was being pumped.		
2001-05-15		7.26
Note: A nearby site that taps the same aquifer was being pumped.		
2001-01-09		7.43
Note: A nearby site that taps the same aquifer was being pumped.		
2000-12-07		7.39
Note: A nearby site that taps the same aquifer was being pumped.		
2000-10-03		6.24
Note: A nearby site that taps the same aquifer was being pumped.		
2000-08-24		6.42
Note: A nearby site that taps the same aquifer was being pumped.		
2000-07-06		6.59
2000-05-16		5.82
Note: A nearby site that taps the same aquifer was being pumped.		
2000-04-04		8.61
2000-02-16		9.31
2000-01-04		7.89
1999-11-22		4.74
1999-10-01		3.97
1999-08-24		3.88
1999-07-30		4.62
1999-07-30		4.69
1999-07-01		4.75
1999-05-18		10.34
1999-03-30		11.50
1999-03-05		12.03
1999-01-05		12.04
1998-12-01		11.16
1998-09-29		9.12
1998-08-11		9.25
1998-06-19		9.53
1998-04-03		9.86
1998-01-07		10.07

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

Federal EPA Radon Zone for MAUI County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 96793

Number of sites tested: 11

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.291 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW^{R} Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Well Index Database
Source: Commission on Water Resource Management
Telephone: 808-587-0214
CWRM maintains a Well Index Database to track specific information pertaining to the construction and installation of production wells in Hawaii

OTHER STATE DATABASE INFORMATION

RADON

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

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