DAVID Y. IGE
Governor

JOSH GREEN
Lt. Governor

FILE COPY

JAMES J. NAKATANI
Executive Director

MAY 2 3 2021

STATE OF HAWAII
AGRIBUSINESS DEVELOPMENT CORPORATION
235 S. Beretania Street, Room 205
Honolulu, HI 96813
Phone: (808) 586-0186 Fax: (808) 586-0189

May 17, 2021

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

Subject: Chapter 343, Hawai'i Revised Statutes (HRS), Chapter 343
Draft Environmental Assessment for the Waiāhole Water System Improvements
'Ewa, Island of O'ahu, Tax Map Keys (TMK): (1) 9-2-001: 020;
(1) 9-2-004: 006 ('Ewa District, O'ahu, Hawai'i)

Dear Mr. Kawaoka:

With this letter, the State of Hawai'i Agribusiness Development Corporation (ADC), hereby transmits the Draft Environmental Assessment (DEA) for the Waiāhole Water System Improvements, 'Ewa, Island of O'ahu, Tax Map Keys (TMK): (1) 9-2-001: 020; (1) 9-2-004: 006, in the 'Ewa District, O'ahu, Hawai'i, for publication in the May 23, 2021 edition of The Environmental Notice.

An unlocked, searchable PDF file of the DEA and a zip file that contains the shapefile of the project location will be uploaded to the OEQC website along with this letter.

If there are any questions, please contact Mr. Ken Nakamoto, Planner of my office by phone at (808) 586-0087 by email at Ken.T.Nakamoto@hawaii.gov, or Mr. Brian Takeda, our consultant from R. M. Towill Corporation, by phone at (808) 842-1133 or by email at briant@rmtowill.com.

Sincerely,

James Nakatani,
Executive Director

Enclosures

cc:
Brian Takeda, R.M. Towill Corporation
Planning & Survey Branch

21-159

From: webmaster@hawaii.gov
To: HI Office of Environmental Quality Control
Subject: New online submission for The Environmental Notice
Date: Monday, May 17, 2021 4:00:40 PM

Action Name

Waiahole Water System Improvements

Type of Document/Determination

Draft environmental assessment and anticipated finding of no significant impact (DEA-AFNSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds

Judicial district

ʻEwa, Oʻahu

Tax Map Key(s) (TMK(s))

(1) 9-2-001: 020; (1) 9-2-004: 006

Action type

Agency

Other required permits and approvals

Commission on Water Resource Management (CWRM), Water Use Permit, Well Construction Permit and Pump Installation Permit; ACOE Section 10; National Pollutant Discharge Elimination System (NPDES) Permit for Construction Stormwater; City and County of Honolulu (CCH) Department of Planning & Permitting (DPP) Grading, Grubbing and Stockpiling Permit

Proposing/determining agency

State of Hawaii Agribusiness Development Corporation

Agency contact name

Ken Nakamoto

Agency contact email (for info about the action)

Ken.T.Nakamoto@hawaii.gov

Email address or URL for receiving comments

Ken.T.Nakamoto@hawaii.gov

Agency contact phone

(808) 586-0087

Agency address

235 South Beretania
Honolulu, Hawaii 96813
United States
Map It

Was this submittal prepared by a consultant?

Yes

Consultant

R.M. Towill Corporation

Consultant contact name

Brian Takeda

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2024 North King Street, Suite 200
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Map It

Action summary

The State of Hawai‘i Agribusiness Development Corporation (ADC) proposes to construct improvements to a portion of the Waiāhole Ditch Irrigation System in Kunia, Central O‘ahu. This action is needed to support diversified agriculture by restoring portions of the Waiāhole Ditch System supplying water to the Kunia/’Ewa region. The existing water system is aging and in disrepair causing loss of water supply and operational efficiency. System losses are caused by increased sedimentation from erosion, water backing up from blockages and spilling out of the ditch, and by leakage from unlined and earthen ditches, and an existing aging reservoir. Planned improvements will correct the loss of water capacity and provide for the long-term preservation of the Waiāhole Water System. Project improvements are not designed to increase capacity of the existing system, but rather to ensure water security, capacity integrity and system efficiency for the long-term future of agriculture on Oahu.

Reasons supporting determination

See Section 8 SIGNIFICANCE CRITERIA EVALUATION.

Attached documents (signed agency letter & EA/EIS)

- Appendices-All-051721.pdf
- Waiahole-Water-System-Improvs-DEA-051721.pdf

Action location map

- Project-Boundary-Shapefile.zip

Authorized individual

Colette M. Sakoda

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

Draft Environmental Assessment
Prepared in Accordance with Hawaii Revised Statutes,
Chapter 343, and Hawaii Administrative Rules, Title 11, Chapter 200

Waiāhole Water System Improvements

District of ʻEwa, Island of Oʻahu, Hawaiʻi

May 2021

Proposing Agency:
State of Hawaiʻi
Agribusiness Development Corporation
235 South Beretania Street, Suite 205
Honolulu, Hawaiʻi 96813

Accepting Authority:
State of Hawaiʻi
Agribusiness Development Corporation
235 South Beretania Street, Suite 205
Honolulu, Hawaiʻi 96813

Draft Environmental Assessment
Prepared in Accordance with Hawai‘i Revised Statutes, Chapter 343, and Hawai‘i Administrative Rules, Title 11, Chapter 200

Waiāhole Water System Improvements

District of ‘Ewa, Island of O‘ahu, Hawai‘i

May 2021

Proposing Agency:
Agribusiness Development Corporation
Honolulu, Hawai‘i 96813

Accepting Authority:
Agribusiness Development Corporation
Honolulu, Hawai‘i 96813

Prepared By:
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawai‘i 96819-3494

Project No. 1-23620-00

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Acronyms and Abbreviations

AC	Asphalt Concrete
ADA	Americans with Disabilities Act
BMPs	Best Management Practices
CAB	Clean Air Branch
CCH	City and County of Honolulu
CFR	Code of Federal Regulations
cm	centimeter
COSCP	Central Oʻahu Sustainable Communities Plan
CWA	Clean Water Act
CWB	Clean Water Branch
CWRM	Commission on Water Resource Management, DLNR
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dBA	Decibels
DBEDT	Department of Business, Economic Development, and Tourism, State of Hawaiʻi
DEA	Draft Environmental Assessment
DLNR	Department of Land and Natural Resources, State of Hawaiʻi
DOFAW	Department of Forestry and Wildlife, State of Hawaiʻi
DOH	Department of Health, State of Hawaiʻi
DPS	Distinct Population Segment
EA	Environmental Assessment
ECP	Erosion Control Plan
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit
FEA	Final Environmental Assessment
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FONSI	Finding of No Significant Impact
ft	Feet
GHG	Green House Gas
GP	General Plan

Acronyms and Abbreviations

HAR	Hawaiʻi Administrative Rules
HDOT	Department of Transportation, State of Hawaiʻi
HRS	Hawaiʻi Revised Statutes
HSTP	Hawaiʻi State Transportation Plan
lf	Linear Feet
MG	million gallons
MP	Master Plan
MSL	Mean Sea Level
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NPDES	National Polluant Discharge Elimination System
OEQC	Office of Environmental Quality Control
POLs	Petroleum, Oils, and Lubricants
PM	Particulate Matter
ppt	parts per thousand
PVC	Polyvinyl Chloride
RHA	Rivers and Harbors Act of 1899
SCS	Soil Conservation Service, U. S. Department of Agriculture
SHPD	State Historic Preservation Division
SHPO	State Historic Preservation Officer
SMA	Special Management Area
SO_2	Sulfur Dioxide
SOEST	School of Ocean and Earth Science and Technology, University of Hawaiʻi
sy	Square Yard
TGC	The Gas Company, LLC, DBA Hawaiʻi Gas
TMDL	Total Maximum Daily Loads
TMK	Tax Map Keys
USACE	U. S. Army Corps of Engineers
USDA	U. S. Department of Agriculture
USFWS	U. S. Fish & Wildlife Service
USGS	U. S. Geological Survey
WQC	Water Quality Certification
WSE	Water Surface Elevation
WWS	Waiāhole Water System

SECTION 1
PROJECT SUMMARY

Project Name:	Waiāhole Water System Improvements, ‘Ewa , Island of O‘ahu,
Agency/Accepting Authority:	State of Hawai‘i Agribusiness Development Corporation 235 South Beretania Street, Suite 205 Honolulu, Hawai‘i 96813
Agent:	R. M. Towill Corporation 2024 North King Street, Suite 200 Honolulu, Hawai‘i 96819 Contact: Brian Takeda, Planning Project Manager
Project Location:	Kunia, ‘Ewa Island of O‘ahu, Hawai‘i
Proposed Action:	Construction of repairs and improvements to existing irrigation facilities
Present Use:	Existing transmission lines and reservoir in Kunia facility
Tax Map Keys (TMKs):	(1) 9-2-001: 020; (1) 9-2-004: 006
Land Area Used:	Approximately 8.23 acres
Flood Zones:	Zone D
State Land Use District:	Agricultural
City and County of Honolulu Zoning:	AG-1 Agricultural Restricted
Land Ownership:	Monsanto Company (Bayer); Hartung Brothers Hawai‘i, LLC
Permits and Approvals That May be Required:	Environmental Assessment (EA) under Hawai‘i Revised Statutes (HRS), Chapter 343; Commission on Water Resource Management (CWRM), Water Use Permit, Well Construction Permit and Pump Installation Permit; ACOE Section 10; National Pollutant Discharge Elimination System (NPDES) Permit for Construction Stormwater; City and County of Honolulu (CCH) Department of Planning & Permitting (DPP) Grading, Grubbing and Stockpiling Permit.
Anticipated Determination	Finding of No Significant Impact (FONSI)

SECTION 2
PROJECT DESCRIPTION

2.1 Introduction and Project Background

The State of Hawaiʻi Agribusiness Development Corporation (ADC) proposes to construct improvements to a portion of the Waiāhole Ditch Irrigation System in Kunia, Central Oʻahu, Hawaiʻi. The applicable portion of the Waiāhole Ditch Irrigation System and name of the subject project is the Waiāhole Water System (WWS) Improvements project. See Figure 2-1, Project Location.

The Waiāhole Ditch Irrigation System was constructed between 1912 and 1916 to irrigate sugar cane fields on the western side of Oʻahu. The system consists of a 26-mile-long transmission system of ditches, tunnels, siphons and reservoir that provides a source of irrigation water to local farmers from the windward side of the island of Oʻahu. Water is collected both as surface water and from tunnels in the Koʻolau Mountains. After collection, the water is transported through tunnels and ditches and stored in reservoirs for approximately 3,000 acres of diversified agriculture and approximately 2,000 acres of pineapple irrigation. In addition, water from the Waiāhole Ditch is increasingly being used to restore water to Windward Oʻahu streams. See Figure 2-2, Waiāhole Ditch System.

The ADC, an agency attached to the Hawaiʻi Department of Agriculture (HDOA), operates and maintains the Waiāhole Ditch Irrigation System, including an existing reservoir within this system. This reservoir, located to the west of Kunia Road, is an unlined, earthen storage basin used to store irrigation water for adjacent farmers which is fed directly by the Waiāhole Ditch. This reservoir has lost holding capacity due to years of sediment accumulation.

According to a State of Hawaiʻi DLNR Commission on Water Resource Management (DLNR CWRM) 2014 report, Central Oahu Non-Potable Water Master Plan Phase 2, the yield capacity of the Waiāhole Ditch is approximately 15 MGD of non-potable irrigation water. The volume of water losses due to long-term damage and disrepair of the Waiāhole Water System (WWS) are not measured but is anticipated to be on the order of over a million gallons daily. One component of the subject project to improve the Kunia portion of the WWS will reduce the volume of water lost and enable the productive return of this water for agricultural irrigation purposes.

Agriculture in Central Oahu has become the primary center of diversified crop farming for local food production. According to the 2015 Statewide Agricultural Land Use Baseline, some of Hawaiʻi's largest diversified farmers operate on 7,300 acres of the central plain. The Waiāhole Ditch System currently manages and provides water to approximately 5,866 acres in the central plain that are in agricultural use. The system is of critical importance not only because of the impact on the production of crops but also because of the economic impact on the community.

Figure 2-1, Project Location

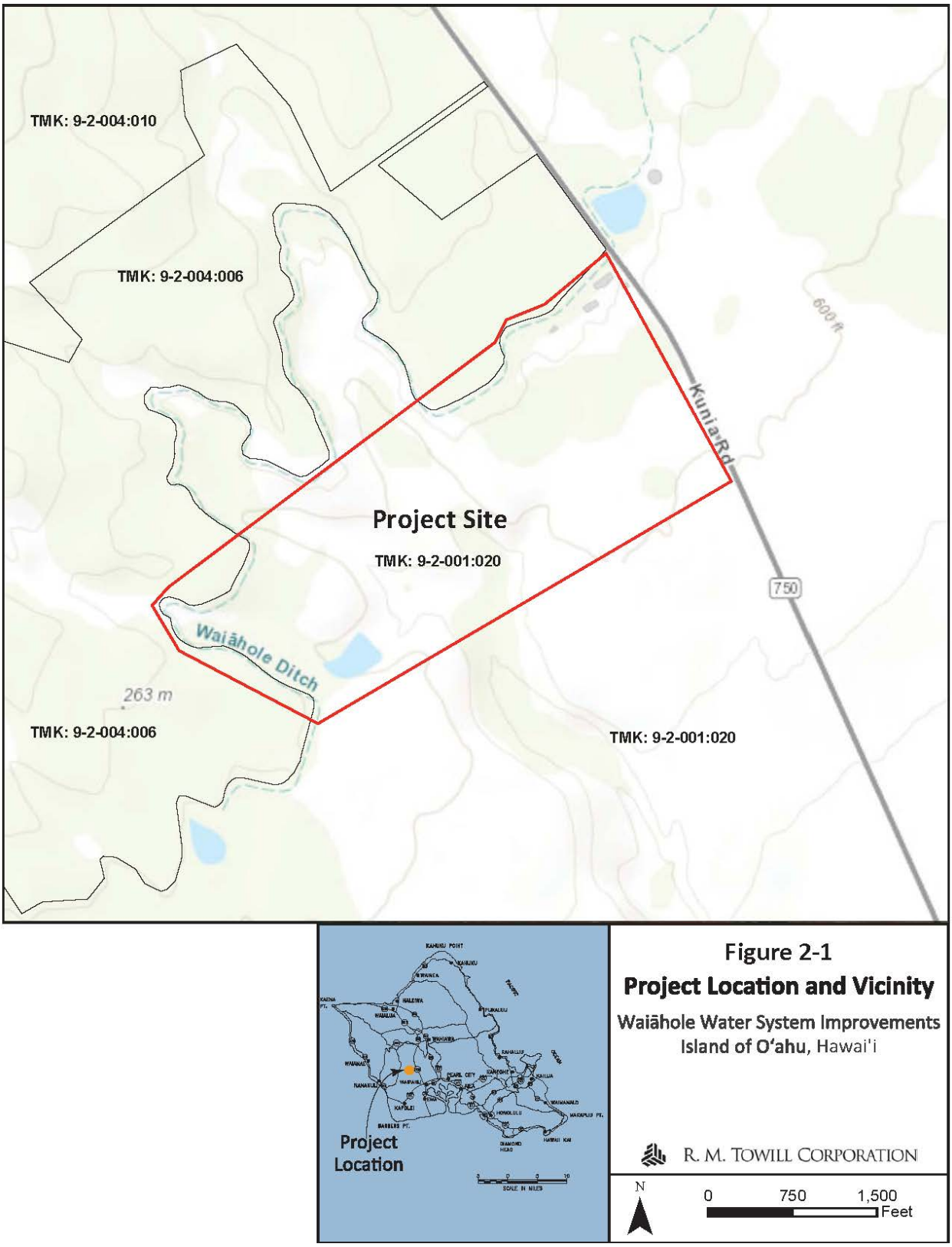
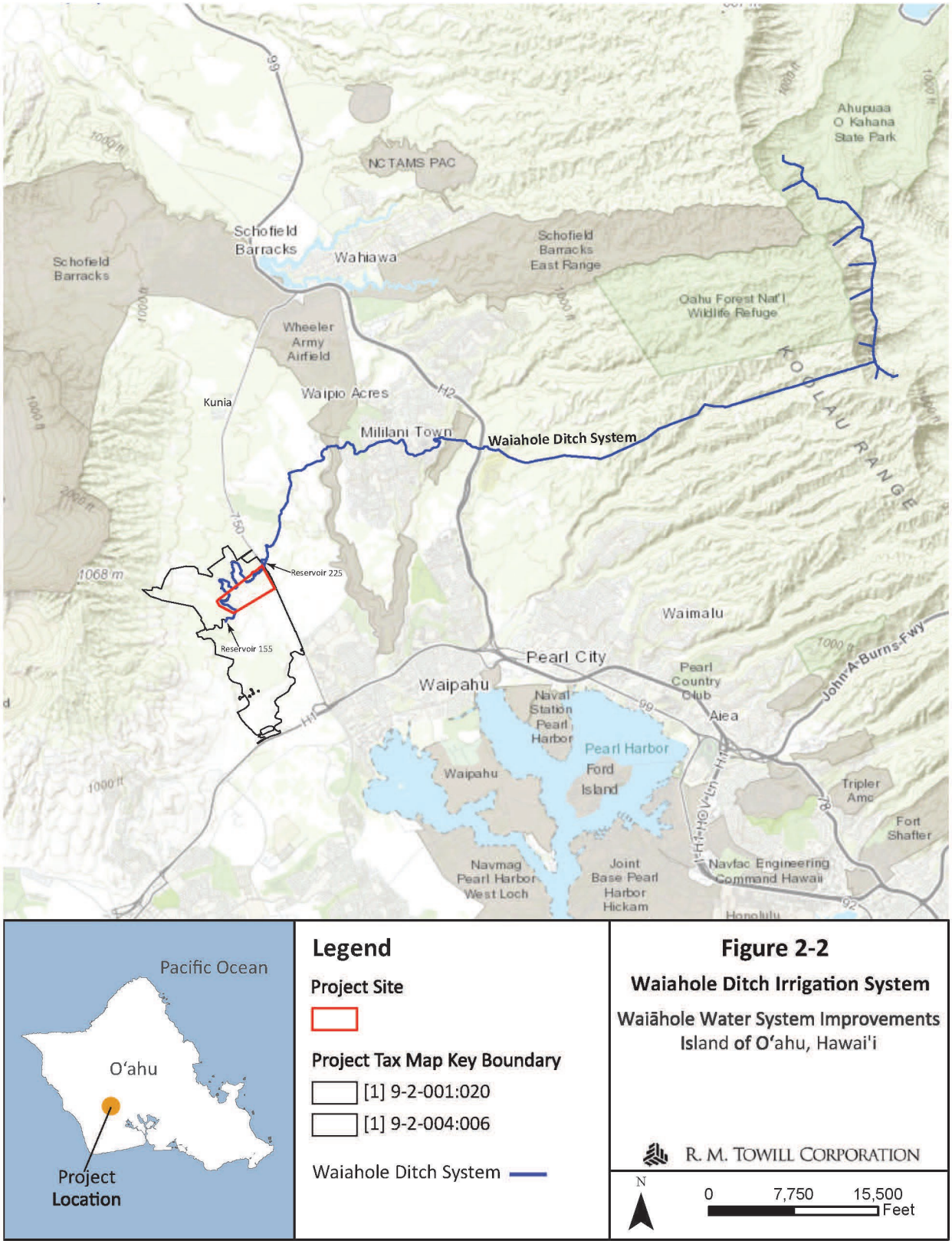


Figure 2-2, Waiāhole Ditch System



According to a 2002 report by the HDOA, there were about 2,000 jobs created by the agribusinesses that the Waiāhole system supports, and the combined value of agriculture production of these businesses was approximately $95 million annually. Currently, the Waiāhole Ditch System provides water to approximately 70 agribusinesses. Disruptions to the delivery of water or prolonged damage to the system would have drastic consequences in the area's ability to continue production at current levels (ADC, July 2016).

Recognizing this, the State of Hawaiʻi ADC seeks to improve the efficiency of the Waiāhole Ditch System built in 1915 to irrigate sugarcane. The system collects groundwater from the windward side of Oahu and transports the water via tunnels to the leeward side of Oahu, where it is conveyed through ditches and siphons by gravity flow. The system supplies irrigation water for agricultural and related purposes between Waipiʻo and Kunia.

Five major components in seven areas of work will be constructed. The five major components include (also described in Section 2.4, Project Description):

- A new ditch diversion and intake piping to divert water to the proposed reservoir or back to the ditch to allow for maintenance of portions of the ditch which are prone to blockage.
- A new earthen reservoir which incorporates the footprint of the existing reservoir which has an accumulation of silt due to deferred maintenance.
- A new water supply well to provide a backup source of irrigation water.
- New interconnecting pipelines and appurtenances/control valves for the System.
- A new piped conduit at an existing hairpin bend in the ditch to correct and reduce damage caused by erosion from areas adjacent to the open ditch.

2.2 Purpose of the Draft Environmental Assessment

This Draft Environmental Assessment (DEA) is prepared pursuant to the requirements of HRS, Chapter 343, Environmental Impact Statement Law; and Hawaiʻi Administrative Rules (HAR), Chapter 11-200.1, Environmental Impact Statement Rules. This DEA is prepared pursuant to an agency action by the ADC with jurisdiction for the Waiāhole Water System Improvements project. The trigger for the preparation of this DEA is the use of State of Hawaiʻi lands and funds for the planning, design, and construction of the proposed project.

The preparation of this DEA will include a request for preliminary or preassessment public comments on relevant issues or concerns that should be addressed in the preparation of the EA documentation including this DEA and anticipated Final EA (FEA)/Finding of No Significant Impact (FONSI) statement. This DEA will provide information to further describe the proposed project, the alternatives considered, the existing environmental conditions of the site, the potential for adverse environmental impacts, and the application of mitigative measures as appropriate to reduce, minimize, or eliminate the potential for significant environmental effects.

2.3 Project Purpose and Need for Action

The proposed project will maintain and repair (provide improvements to) the Waiāhole Water System. This action is needed to support diversified agriculture and restore portions of the Waiāhole Ditch Irrigation System supplying water to the Kunia/'Ewa region of Oʻahu. At the same time, the Waiāhole Water System, under management of the ADC, is aging and in disrepair causing loss of water supply and operational efficiency. System losses are caused by increased sedimentation from erosion, water backing up from blockages and spilling out of the ditch, and by leakage from unlined and earthen ditches, and an existing aging reservoir. Operational efficiency is also degraded since greater maintenance and repair effort is required to maintain the flow of irrigation water, free from excessive build-up of sediments and debris.

The planned improvements will correct the existing loss of water capacity and provide for the long-term preservation of the Waiāhole Water System. Project improvements are not designed to specifically increase capacity of the existing system, but rather to ensure water security, capacity integrity and system efficiency for the long-term future of agriculture on Oʻahu.

The improvements will ensure the capacity to produce crops and address important goals of the Hawaiʻi Fresh Water Initiative in the Blueprint for Action, Water Security for an Uncertain Future, 2016-2018. The Hawaiʻi Fresh Water Council (Council), the authors of the initiative, noted that Hawaiʻi is entering an era of increased uncertainty regarding long-term water security. This includes increased water demand from an increasing population and threats to existing water supplies from sea level rise and ground and surface water contamination. Climate change has also reduced rainfall levels and increased drought and evapotranspiration. Further, rainfall in Hawaiʻi has decreased by 18% between 1978 and 2007, and because of global warming, increased temperatures have resulted in increased evaporation of surface water. The Council emphasizes the three strategies of conservation, recharge, and re-use, to ensure the continued availability of water. A specific goal under the conservation strategy is to improve agricultural water efficiency. It also emphasizes that using storm water runoff and water storage in reservoirs is key to managing drought conditions.

The ADC Water Security Plan also seeks to mitigate the increased need for, and threats to water supply, by helping increase the availability of agricultural water without necessarily increasing water allocation. It also addresses the agricultural water needs of Central Oʻahu by leveraging a public private partnership with a private landowner (ADC 2016).

The ADC notes that the Waiāhole Water System's greatest source of water loss results from operational practices, primarily large volumes of water that bypass Reservoir 155 located at the end of the ditch system that are released into Honouliuli Gulch. It is estimated that 90% of the water loss is from water that bypasses the reservoir. This is not unusual, and it is common in most irrigation systems for operational practices to be the largest source of water loss. Water

conveyance loss throughout the system can also be attributed to several factors including seepage, leakage, ditch blockage, soil attributes, evaporation and transpiration, illegal withdrawal, structure conditions, and climate patterns.

Correcting and improving the efficiency of conveying water through the ditch system, therefore, is in the best interest of farmers and the natural environment. The objectives of the ADC Central Oʻahu Water Security Plan ("Plan") are to reduce water loss, enhance the system's efficiency by increasing storage capacity, and securing a reliable back-up source of water should the Waiāhole Ditch system become temporarily inoperable. The proposed upgrades and improvement to the system, and the use of more effective management practices, provides practical solutions to the specific areas of water loss and inefficiency. By constructing the proposed reservoir, some of the water that would normally bypass the system and flow back to the ocean could be captured and stored for future use. In times of heavy rains, the increased amount of stormwater would be used efficiently and reduce the amount of water that is lost and reduce the amount of water that would need to be released from the siphons in the higher elevations of the system. The additional reservoir would also increase the efficiency of the system by having the water closer to the end users as it currently takes approximately 6 hours for irrigation water to travel from the upper siphons down the system to the farms. According to the ADC, these investments will ensure the system can continue to deliver a reliable source of water for another one hundred years.

Specific proposed improvements, such as the isolation valve on irrigation lines will allow flow from Ditch Connection 1 to bypass the reservoir and flow directly to Ditch Connection 2. This will allow for maintenance of the reservoir while still bypassing the portions of the ditch between Ditch Connections 1 and 2, which have been prone to blockage and are more difficult to access than other portions of the ditch.

Existing Users of the Waiāhole Water System (WWS) - Kunia

The existing major ADC WWS users, including agricultural and non-agricultural users are as follows:

- City and County of Honolulu Waiawa Tree Farm
- Fat Law Farms
- Hartung Brothers, Inc.
- Hawaiʻi Agriculture Research Center
- Larry Jefts Farms, LLC
- Mililani Agricultural Park, LLC
- Mililani Golf Club, LLC
- Mililani Memorial Park and Mortuary
- New Hope Leeward

- Pacific Gateway
- Monsanto (Bayer)
- Pioneer HI-Bred International, Inc.
- Southern Turf Hawaiʻi
- Waiawa Correctional Facility
- Waikele Ag Park (Larry Jefts)
- Waikele Farms Inc. (Larry Jefts)
- Walter Kaluhiokalani
- Darryl Bueno
- Rodney Santiago

Source: ADC 2021

2.4 Project Description

2.4.1 Project Setting and Description

The Kunia reservoir and transmission facilities are part of the Waiāhole Ditch Irrigation System, a gravity irrigation water supply system that moves surface water and groundwater from the windward side of Oʻahu to agricultural areas on the leeward and central parts of Oʻahu. The project area is in western Oʻahu near Waipahu, approximately five miles northwest of Pearl Harbor and approximately 3.5 miles southwest of the area of Waikele on the Schofield Plateau at the base of the Waiʻanae Range.

Proposed improvements to the system are designed to meet the future monthly irrigation water demand of approximately 290,328,000 gallons for the Kunia portion of the Waiāhole Ditch System (2021, ADC).

Five major components in seven areas of work will be constructed. The five major components include:

- A new ditch diversion and intake piping to divert water to the proposed reservoir or back to the ditch to allow for maintenance of portions of the ditch which are prone to blockage.
- A new earthen reservoir which incorporates the footprint of the existing reservoir which has an accumulation of silt due to deferred maintenance.
- A new water supply well to provide a backup source of irrigation water.
- New interconnecting pipelines and appurtenances/control valves for the System.
- A new piped conduit at an existing hairpin bend in the ditch to correct and reduce damage caused by erosion from areas adjacent to the open ditch.

Project implementation is expected to be undertaken in two (2) or possibly more phases of work to complete all project components. Phase 1 will be initiated first and is based on the availability of project funds for construction of the following:

- A new earthen reservoir which incorporates the footprint of an existing smaller reservoir:
  – This will construct a new 15-million-gallon (MG) reservoir
- New interconnecting pipelines and appurtenances/control valves for the WWS:
  – Proposed Ditch Connections No.1 and No. 2
  – Proposed Irrigation Lines B and C

Subsequent phases of the project will be constructed as funds become available for the construction of the new Water Supply (Backup) Irrigation Well; new Irrigation Line A; and repairs at the Hairpin Turn.

SECTION 3 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

3.1 Alternatives Evaluated

3.1.1 No and Delayed Action Alternatives

The No Action Alternative would maintain the existing reservoir and water supply transmission system in its current alignment and dilapidated condition, with no repair or improvement. Damaged portions of the system would continue to leak resulting in the loss of irrigation water on the order of up to one or more million gallons per day (MGD). Because this system is already in poor condition future expectations are that it would continue to degrade and result in further loss of water lost through leaks, impounded or blocked transmission pipes and ditches from erosion, sedimentation and/or disrepair.

The Delayed Action Alternative is similar to the No Action alternative, in that impaired portions of the system would remain in their dilapidated condition for an extended period of time leading to even greater loss of irrigation water and further delay in much needed diversification in agricultural crop growing and cultivation to help Oʻahu and the State overall, achieve food security and self-reliance.

Either alternative fails to meet the purpose and objectives of the proposed action to maintain and repair the Waiāhole Water System, to reduce the loss and waste of irrigation water, and help provide for more efficient use and transmission of water resources from the Waiāhole Ditch Irrigation System. For these reasons, neither the No Action Alternative or Delayed Action Alternative will be further considered as viable project alternatives.

3.1.2 Proposed *Action*

The Proposed Action is to plan, design, and construct the proposed five major water transmission system components in the seven areas of work described and depicted in Sections 2.1, Introduction and Project Background, and 2.4, Project Description, above. This work, including the excavation of the existing embankments, removal of sediment from the interior of an existing reservoir, construction of a backup water well, and construction and repair of irrigation water transmission pipelines and ditches, will be designed in accordance with ADC requirements for the efficient and long-term transmission of irrigation water. This will include a new 15 MG earthen reservoir adjacent to and incorporating an existing reservoir, new ditch diversion and intake, new irrigation lines, new water supply well, and the installation of a conduit to repair damage due to erosion of an existing ditch at a hairpin turn. Overall, the operating capacity of the new reservoir will provide storage of approximately 15 MG of capacity. These proposed improvements to the system are designed to meet the future monthly irrigation water demand of

290,328,000 gallons for the Kunia portion of the Waiāhole Ditch System (2021, ADC). (DLNR Engineering Division correspondence dated 2-1-21).

3.2 Construction Details

Maintenance and repair activities in the seven areas of work are depicted in Figure 3-1, Overview of Major Areas of Work, and summarized as follows:

1. Ditch Connection 1 – New intake for Reservoir near Kunia Road. This area of work is located on the west side of the Kunia Road intersection with the Waiāhole Ditch. A new ditch connection to the Waiāhole Ditch will traverse southwestward toward a proposed new 15-million-gallon (MG) reservoir and include the following:
    a. Construct new shallow manhole over existing plugged 24" culvert connected to existing diversion on Waiāhole Ditch.
    b. Install new trash rack and new 24" cast iron sluice gate at existing diversion.
    c. Unplug existing 24" culvert.
    d. Connect new 30" Irrigation Line "B" to new shallow manhole.
    e. Water surface elevation (WSE) at ditch is approximately 650 feet mean sea level (ft MSL).
2. New 15 MG Reservoir which incorporates the footprint of an existing smaller reservoir. The new reservoir will include (See also Figure 3-2, New 15 MG Reservoir Detail, for additional information):
    a. Water from the Waiāhole Ditch will be diverted into an existing ditch between the reservoir and the Waiāhole Ditch, and then into the existing reservoir for use by agricultural users.
    b. An existing pump will draw water from the existing reservoir and will pump water makai or in a seaward direction from the existing reservoir.
    c. The WSE in the existing reservoir is approximately 646 ft MSL.
    d. Construct new 15 MG reservoir connected to southeast side of existing reservoir.
    e. The crest elevation of the new reservoir will be 648 ft MSL.
    f. Spillway elevation of new reservoir will be 646 ft MSL.
    g. New reservoir will receive water from Ditch Connection 1 through a new Irrigation Line "B-1" through the northeast embankment or through a new Irrigation Line "D" connected to the existing reservoir ditch.
    h. New reservoir can also receive water from new backup irrigation water well through Irrigation Line "C-1" through the northeast embankment.
3. New Irrigation Lines "B" and "C." This area of work is located south and to the east of the new 15 MG Reservoir. The alignments of irrigation lines "B" and "C" are described below and shown in Figure 3-1.

Figure 3-1, Overview of Major Areas of Work

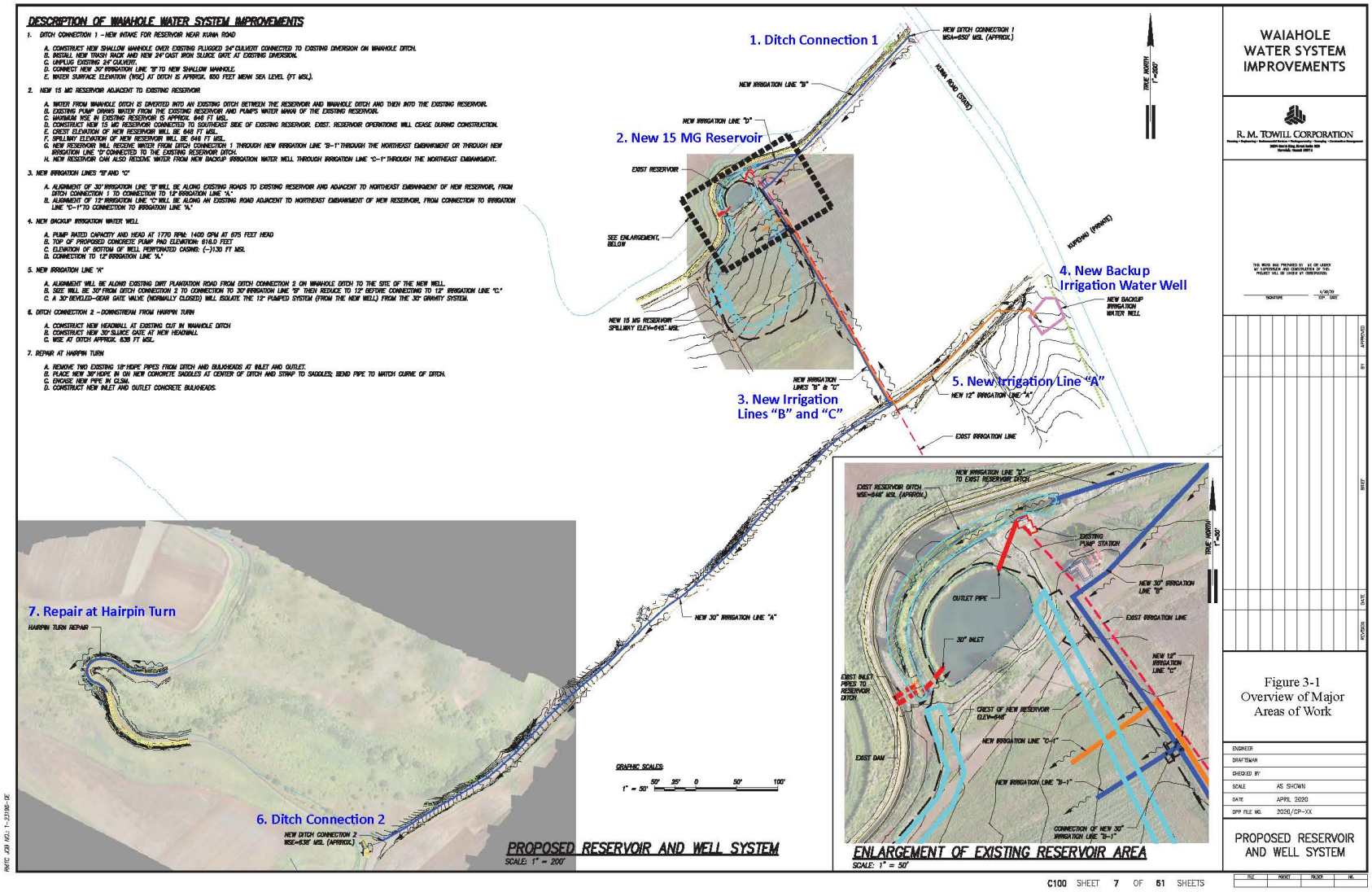
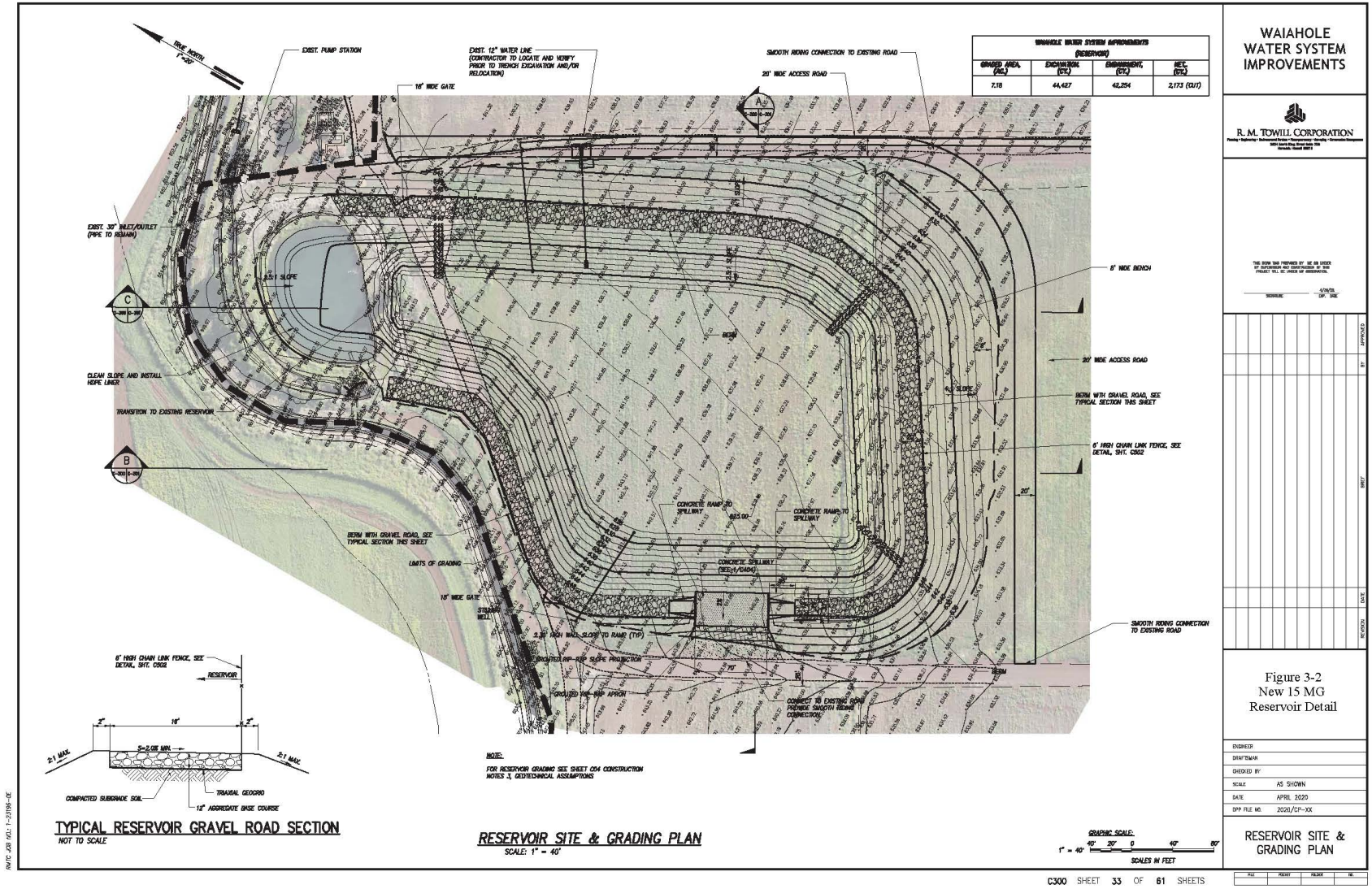


Figure 3-2, New 15 MG Reservoir Detail



   a. Irrigation line "B" originates at Ditch Connection 1. The alignment follows two unpaved roads past the reservoir with a connection to irrigation line "B-1" to the reservoir, and then to a connection with 30" Irrigation Line "A."
   b. Alignment of 30" Irrigation Line "B" will be along existing roads adjacent to northeast embankment of new reservoir, from connection to Irrigation Line "C- 1" to connection to 12" Irrigation Line "A." Note: 12" Irrigation Line "A" is to be constructed in Phase 2.

4. Ditch Connection 2 – Downstream from Hairpin Turn. This connection is near the southwest end of the project and will connect with Irrigation Line "A", as shown in Figure 3-2.
   a. Construct new headwall at existing cut in Waiāhole Ditch.
   b. Construct new 30" sluice gate at new headwall.
   c. WSE at Ditch approximately 638' MSL.

The isolation valve on "B-1" will allow flow from Ditch Connection 1 to bypass the reservoir and flow directly to Ditch Connection 2. This will allow for maintenance of the reservoir while still bypassing the portions of the ditch between Ditch Connections 1 and 2, which have been prone to blockage and are more difficult to access than other portions of the ditch.

Borrow is not likely to be required as preliminary engineering estimates the volume of excavation is greater than the amount of embankment.

Phase 2 of the proposed project consists of the following work to be conducted in the future when funding is available:

5. New Backup Irrigation Water Well. This new backup irrigation well is preliminarily located on the west side of Kunia Road, approximately 100 linear feet south from the intersection of Kunia Road and Kupehau Road. The proposed siting is outside of the Kunia Road and Kupehau Road right-of-way.
   a. Pump Rated Capacity and Head at 1,770 rpm: 1,400 gpm at 675 feet head.
   b. Top of proposed concrete pump pad elevation: 616.0 feet.
   c. Elevation of bottom of well perforated casing: (-)130 ft MSL.
   d. Connection to 12" Irrigation Line "A."
6. New Irrigation Line "A." This new irrigation line will be connected to the New Backup Irrigation Water Well and will follow the general alignment of Kupehau Road southwest as shown in Figure 3-1.
   a. Alignment will be along existing dirt plantation road (Kupehau Road) from Ditch Connection 2 on Waiāhole Ditch to the site of the new well.
   b. Size will be 30" from Ditch Connection 2 to connection to 30" Irrigation Line "B" then reduce to 12" before connecting to 12" Irrigation Line "C."

c. A 30" beveled-gear gate valve (normally closed) will isolate the 12" pumped system (from the new well) from the 30" gravity system.

7. Repair at Hairpin Turn. This is the final repair location near the southwest end of the project site. The existing hairpin turn is heavily eroded which has reduced the efficient movement of irrigation water along the ditch. The existing HPDE irrigation pipes will be replaced and increased in size and will be supported with new inlet and outlet concrete bulkheads.

   a. Remove two existing 18" HDPE pipes from ditch and bulkheads at inlet and outlet.

   b. Place new 36" HDPE on new concrete saddles at center of ditch and strap to saddles; bend pipe to match curve of ditch.

   c. Encase new pipe in CLSM.

   d. Construct new inlet and outlet concrete bulkheads.

Staging Area and Materials Delivery

A staging area will be located adjacent to the reservoir site, approximately 6,000 feet outside the existing building near the Kunia Road boundary. Deliveries of aggregate material will be scheduled to avoid peak hour traffic. Typical work hours will begin with construction personnel arriving on site as early as 6:00 AM and end at about 3:30 PM. Vehicular access will be via Plantation Road from Kunia Road. Trucks will deliver aggregate from the nearby quarry. The staging area would contain contractor's trailers, parking, fencing, and storage of equipment and materials. Security measures will be necessary to protect equipment. Examples of such measures are installation of sensors for overnight security, as well as equipping machines with GPS to avoid theft of equipment and batteries.

Temporary Water Supply

A temporary water supply will be drawn from the ditch for mechanical compaction and dust control activities. A water wagon will be set up for this purpose and will be filled as needed. This usage will be needed at the reservoir site during cut and fill activity for approximately two months. Two water trucks each having an approximately 2,000-gallon capacity are expected to be filled up to six (6) times per day. These trucks would intermittently sprinkle the reservoir construction site as needed for dust control. Only enough water will be spread to suppress the generation of windblown dust, without causing the runoff of silt and sediments downstream of the project site.

Utility Relocation and Coordination

An existing HECo power pole near the reservoir site may require permanent relocation. The power pole capacity is estimated at approximately 12 kilovolts (kV). Coordination for the relocation of the pole, e.g., schedule and relocation site, will be overseen by the ADC, its electrical engineer, and the Contractor.

Surface roads providing personnel, equipment, and imported materials with access to the project area include the Interstate H-1, Interstate H-2, and Kunia Road. All access roadways are paved. Construction of the proposed action would be coordinated with the surrounding local landowners to ensure that access to their parcels is maintained during construction activities.

3.2.1 Construction Scheduling and Cost

Phase 1 of the project will require a construction period of approximately nine (9) months. The Phase 2 duration of construction will be determined following the receipt of appropriations to assess the level of work that can be accomplished. Estimated work hours will be from 7:30 am to 4:00 pm, Monday through Friday. The total construction cost is estimated at approximately $10.1 million (2020, R. M. Towill Corporation).

3.2.2 Other Construction Details

Table 3-1 provides a description of the types of equipment likely to be used during construction of the Proposed Action. Additional equipment may include air compressors to operate tools and other equipment; welding equipment; pumps and piping; communications and safety equipment; and vehicles for delivery and movement of equipment, materials, and personnel.

Table 3-1, Construction Equipment

Equipment	Construction Purpose
Backhoe/Front-end Loader	Soil Manipulation and Drainage Work
Bobcat	Distribution of Fill
Dozer	Soil Manipulation and Earthwork Construction
Scraper	Soil Manipulation and Earthwork Construction
Compactor	Soil Manipulation and Earthwork Construction
Grader	Soil Manipulation and Earthwork Construction
Concrete Truck	Concrete Delivery and Pouring
Haul Truck	Earthwork Construction and Clearing/Grubbing
Hydraulic Crane	Box Culverts Placement
Water Truck	Construction Site and Plantation Road Watering for Dust Control and Irrigation Spraying at Restoration Area

Long Term Maintenance Requirements

Maintenance will be necessary to prevent sediment buildup in the ditches and the reservoir. ADC has a maintenance program to regularly clear the site ditches, reservoir, and proposed new facilities.

3.2.3 Construction-Related Traffic

The construction labor force is estimated to average approximately 10-20 persons per work day over the 9-month construction period.

The ADC utilizes a portion of the project site for the storage of materials for repair and maintenance. The availability of this space has enabled the storage of sufficient materials consisting of piping and appurtenances that can be used for the construction of the project. It is expected that because this material would be used for the project, that this would significantly reduce the need for the delivery using the Kunia Road, and Interstate H-1 and H-2.

The project contractor will also have at their disposal, the use of the following mitigative measures:

- The scheduling of deliveries of other required construction materials and equipment to occur throughout the construction period to avoid peak-periods and minimize daily disruption to area residents. As noted, this is facilitated by a project site that is relatively large with open space for staging and storage of materials/equipment.
- The majority of construction truck traffic would move between the staging area and the project subareas. These routes do not cross any major roads and therefore, would not impact local vehicle traffic. However, materials and equipment would need to be brought to the site from sources within the Honolulu area. These materials are primarily aggregate and delivery of these materials and equipment would use Kunia Road and either Interstate H-1 or Interstate H-2, depending on the type of aggregate.
- The project contractor will evaluate construction materials and equipment that can be pre-assembled prior to transportation to the project site to reduce the total number of truck trips required along the Kunia Road, H-1 or H-2. The majority of these trips are expected to occur during construction mobilization when materials are brought to the reservoir and staging area. The primary materials that would need to be delivered to the site will be pipe cushion and base course (aggregates) for construction.
- All excess materials will remain on-site. Demolition and excavated materials anticipated would be minimal. Any construction debris and waste materials would be disposed of off-site at a permitted and approved waste disposal site such as the PVT Construction and Demolition Debris Landfill. Excess excavated material not reused for embankment will also be transported to an on-site ADC stockpile location.

The contractor's preliminary estimate of truck traffic would be on the order of approximately four to five total daily truck trips along the Kunia Road, Interstate H-1, and/or Interstate H-2 over the period of construction. A total of 220 truckloads of material is expected over the entire construction period.

Long Term Maintenance Requirements

Maintenance activities will be necessary for prevention of sediment buildup in the ditches and the reservoir. ADC has a maintenance program to regularly clear its ditches, reservoir, and proposed new facilities. The project would lessen the long-term burden of maintenance and repairs at this Kunia facility and would not result in substantial changes to current operation and maintenance activities. Other maintenance activities would largely remain unchanged, generally consisting of vegetation maintenance on the downstream slope, clearing of sediment in the interior of the reservoir, and controlling invasive vegetation in the reservoir and ditch. ADC does not anticipate any expansion of existing farm operations and related land use relating to the proposed action. As stated in Section 2.3, the project's purpose and need is to increase water security, capacity integrity and system efficiency of the Waiāhole water system.

3.3 Anticipated Permits and Approvals That May be Required

The anticipated permits and approvals for the Proposed Action are summarized in Table 3-2, below.

Table 3-2, Anticipated Permits and Approvals

Agency	Permit/Review/Approval
Federal	
Army Corps of Engineers	Regulatory Office: Section 404/10 Permit
State	
Department of Land and Natural Resources	State Historic Preservation Division: Consultation for effect determination (Section 106 of the National Historic Preservation Act triggered due to the Section 404/10 Permit by ACOE) Commission on Water Resource Management: Water Use Permit Well Construction Permit Pump Installation Permit
Department of Health	Clean Water Branch: National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Stormwater
Local	
City and County of Honolulu	Department of Planning and Permitting: Construction plan review and approval Erosion control plan review Grading, Grubbing, and Stockpiling Permit

SECTION 4 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section summarizes the existing environmental setting, potential short- and long-term, secondary, and cumulative effects of the proposed project, and mitigation measures. Short-term effects are from construction and infrastructure improvement activities, while long-term effects continue or occur after the project is completed. Although the subject EA document does not require an assessment of impacts according to National Environmental Policy Act (NEPA) requirements, the definition of impacts, according to NEPA, provides guidance toward understanding potential environmental impacts and applicability to this project.

Secondary impacts are generally defined as those induced or caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR §§ 1500-1508). Potential cumulative effects may result from the incremental consequences of an action when added to other past, present, and reasonably foreseeable future actions (40 C.F.R. §1508.7).

4.1 Geology and Soils

4.1.1 Affected Environment

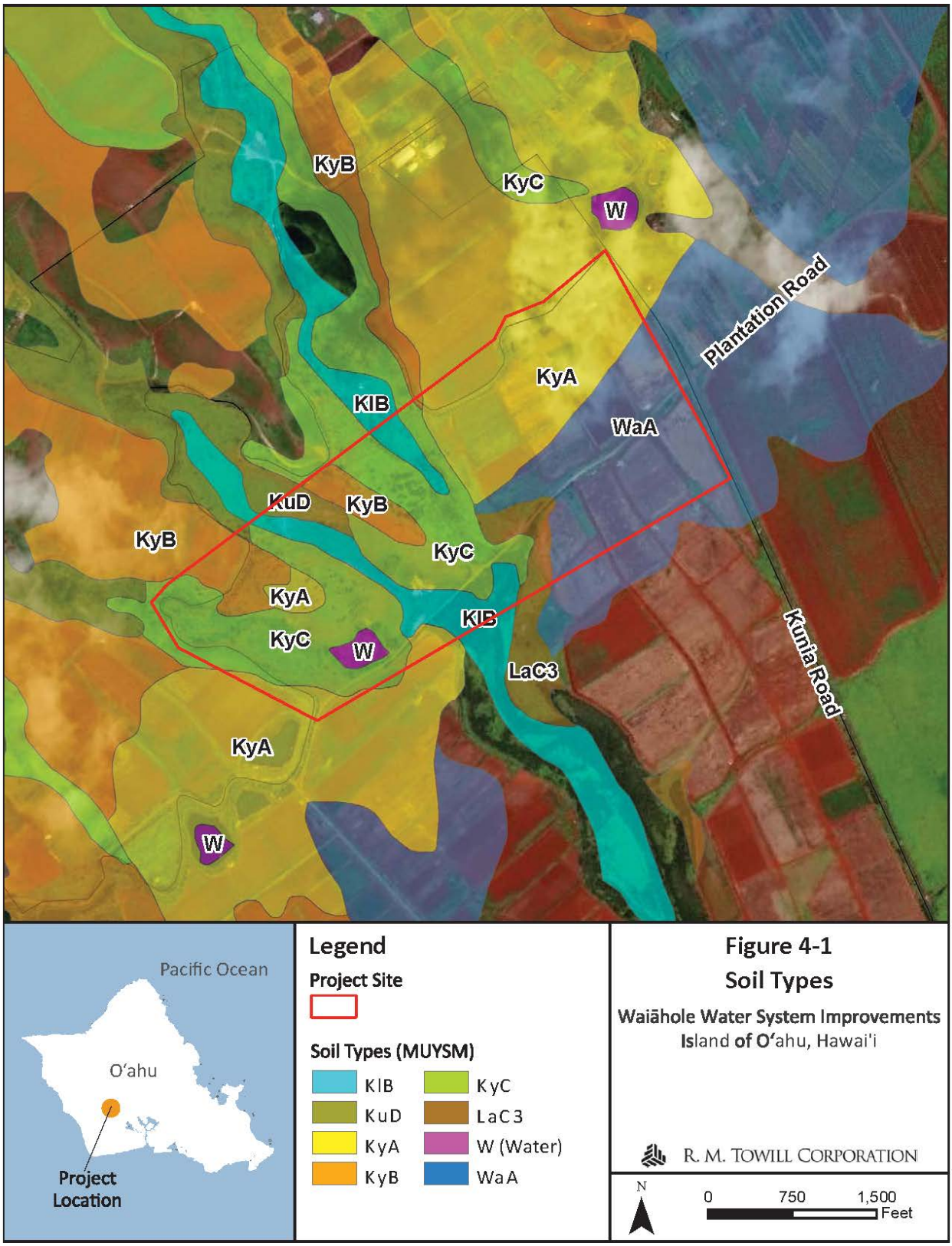
Oʻahu is the third largest island in the state of Hawaiʻi with an approximate land area of 604 square miles. It is composed of the Waiʻanae volcanic range to the west and the Koʻolau volcanic ranges to the east, both of which were formed by shield volcanoes. The Waiʻanae range is older than the Koʻolau range. Both volcanic ranges erupted a type of rock known as basalt. Eruption and lava flow from the Koʻolau range banked up against the older lava flows of the Waiʻanae coast to create a plateau; this plateau makes up Central Oʻahu and is where this project is located.

The island's current shape is from erosion and sea level change through the millions of years after its formation. Oʻahu is divided into four main areas—the Waiʻanae Range, the Koʻolau Range, the Schofield Plateau, and the coastal plains. This project is located on the Schofield Plateau. This plateau is in a youthful stage of erosion.

According to the U.S. Department of Agriculture (USDA), Soil Conservation Service publication, Soil Survey of the Islands of Kauaʻi, Oʻahu, Maui, Molokaʻi, and Lānaʻi, State of Hawaiʻi, 1972, the soil types Kawaihapai clay loam (KIB), Kolekole silty clay loam (KuB), Kunia silty clay (KyA), Koloa stony silty clay (KyB), Koloa stony silty clay (KyC), Lahaina silty clay (LaC3), and Wahiawa silty clay (WaA) are found at the project site and illustrated in Figure 4-1. Soils underlaying the project site are described below.

- KIB, 2 to 6 percent slopes, is generally found on smooth slopes. The runoff is slow, and the erosion hazard is slight.

Figure 4-1, Soils



- KuD, 12 to 25 percent slopes, is generally found on narrow side slopes, mainly along drainageways. Runoff is medium to rapid, and the erosion hazard is moderate to severe. Workability is difficult because of the slope.
- KyA, 0 to 3 percent slopes, is generally found on broad, smooth slopes. In a typical profile, the surface layer is approximately 22 inches of reddish-brown silty clay. The subsoil is approximately 40 to 71 inches of dark reddish-brown silty clay and silty clay loam. The substratum is dark reddish-brown gravelly silty clay. Permeability is moderate, runoff is slow, and the erosion hazards are no more than slight.
- KyB, 3 to 8 percent slopes, is generally found on upland slopes. In a typical profile, the surface layer is dark reddish-brown stony silty clay about 7 inches thick. About 13 inches thick, the subsoil is dark-red and dark reddish-brown stony silty clay with a subangular blocky structure. The substratum is hard rock. Permeability is moderate, runoff is medium, and the erosion hazard is moderate.
- KyC, 8 to 15 percent slopes, is generally found on narrow side slopes, mainly along drainageways. This soil has a profile similar to KyB. Permeability is moderate, runoff is medium, and the erosion hazard is moderate.
- LaC3, 7 to 15 percent slopes, severely eroded. This soil has a profile similar to that of Lahaina silty clay, 3 to 7 percent slopes, except that most of the surface layer and, in places, part of the subsoil has been removed by erosion. Runoff is medium, and the erosion hazard is severe.
- WaA, 0 to 3 percent slopes, is generally found on smooth, broad interfluves. The surface layer is very dusky red and dusky red silty clay about 12 inches thick in a typical profile. The subsoil, about 48 inches thick, is dark reddish-brown silty clay with a subangular blocky structure. The underlying material is a weathered basic igneous rock. The soil is medium acid in the surface layer and medium acid to neutral in the subsoil. Permeability is moderately rapid. Runoff is slow, and the erosion hazard is no more than slight.

4.1.2 Environmental Consequences

No Action Alternative

The No Action Alternative would consist of retaining the Kunia site facilities in their current condition. No construction or ground-disturbing activities that could directly or indirectly affect geologic resources would occur. Under the No Action Alternative, routine maintenance activities would continue to occur, as necessary. Furthermore, if improvements to the proposed repairs and improvements are not made, it is reasonable to assume that the long-term burden of maintenance and repairs at the Kunia site would increase, and the benefits of the expanded reservoir and irrigation pipes and reduced risk of failure, would not be realized.

Proposed Action Alternative

Ground disturbance caused by construction activities has the potential to increase erosion and sedimentation rates above existing conditions. Erosion and storm water pollution control measures would be consistent with National Pollutant Discharge Elimination System (NPDES) permit requirements and would be included in the Erosion Control Plan (ECP) and the Storm Water Pollution Prevention Plan (SWPPP)/Best Management Practices (BMPs) Plan. Temporary

erosion and/or runoff control BMPs are outlined in this section. They would minimize the potential for stormwater pollution resulting from erosion and sediment migration from the construction and staging area. After completing construction activities, temporary facilities related to erosion and/or runoff control would be removed, and disturbed areas would be restored and reclaimed appropriately. The Proposed Action would also include an application for compliance with the conditions outlined in the CCH Grading, Grubbing and Stockpiling Permit.

Based on a review of regional seismic conditions, the project area could be subject to earthquake-related hazards such as ground shaking. However, construction activities for the Proposed Action would be temporary and short-term. They would not expose people or structures to any increase in the existing potential for substantial effects from an earthquake, seismic ground shaking, or tsunamis. Implementing the Proposed Action would result in a less than significant impact.

4.1.3 Best Management Practices and Mitigation Measures

Since there would be no significant effects on geology and soils, no mitigation would be required. However, several BMPs have been identified to reduce the temporary effects of construction activities. The CCH's Minimum BMP Checklist for Large Projects includes the measures outlined below. The Contractor would implement those BMPs that are applicable to features of the Proposed Action.

Best Management Practices

- Stabilized Construction Entrance: All points of egress and ingress to a site shall be protected with a stabilized construction entrance.
- Stockpiles: Stockpiles shall not be located in drainage ways or other areas on concentrated flows.
- Sediment trapping devices such as fences, traps, basins or barriers shall be used around the base of all stockpiles.
- Dust Control: Dust control should be applied to reduce dust emissions. The Contractor, at his own expense, shall keep the project area and surrounding area free from dust nuisance. The work shall be in conformance with the air pollution control standards contained in Hawaiʻi Administrative Rules: Chapter 11-60, "Air Pollution Control."
- Sediment Fence/Barrier at Toe of Disturbed Area or Stockpile: Sediment Fences or barriers shall be used down slope of all disturbed areas or stockpile areas.
- Slope Protection: Surface flow from above an exposed slope shall not be allowed to flow over the slope without protection. Slope protection shall be used on areas with slopes greater than 50% and on areas of moderate slopes that are prone to erosion.
- Temporary Interceptor Dikes/Swales around Active Work Area: Temporary interceptor dikes and swales shall be installed around the active work areas to intercept storm water runoff from drainage areas above unprotected slopes and direct to a stabilized outlet and also to prevent runoff from leaving the disturbed site.

- Inlet Protection: All storm drain inlets on site, and those offsite which may receive runoff from the site shall use an inlet protection device.
- Sediment Basin: A sediment basin shall be created by excavation or by constructing an embankment. The basin shall be designed to retain or detain runoff to allow excessive sediment to settle.

Wet Weather Measures

- Established Grass: Grass shall be established on disturbed areas which are at final grade or will not be worked for longer than 14 days. Alternatives to grass will include 2" minimum straw mulch cover, erosion blankets with anchors, 6-mil plastic sheets, sediment traps or ponds, or interceptor dikes/swales.

Post Construction Measures

- Established Ground Cover: Established ground cover or landscape prior to removing erosion control measures.

See also discussion on BMPs to address comments from Department of Land and Natural Resources (DLNR), Division of Aquatic Resources (DAR), in Section 4.5.3, Best Management Practices and Mitigation Measures.

4.2 Climate and Precipitation

4.2.1 Affected Environment

The project area is located within the interior lowlands of Oʻahu, where cloud cover and showers are widespread. Average rainfall observed by the National Weather Service (NWS) Forecast Office at the Kunia Substation in 2014 shows an accumulated rainfall from 2 inches in January to 25 inches in July, with a monthly average ranging from approximately 1 to 4 inches, with occasional monthly highs of 12 to 13 inches (NWS 2014). The project area's average monthly temperature ranges from 66 to 80 degrees Fahrenheit (Western Regional Climate Center 2017).

The prevailing wind direction is from the east and northeast. Northeasterly trade winds prevail over Oʻahu approximately 80 percent of the time, with average wind speeds ranging from 10 to 15 miles per hour. The trade winds blow most strongly and consistently from April through November. Southerly or "Kona" winds occur roughly less than half the time during December through March.

In 2017, the Hawaiʻi Vulnerability and Adaptation Report was published to provide a basis for recommendations on reducing exposure and increasing adaptability to the impacts of sea level rise (SLR) resulting from human-generated global greenhouse gas (GHG) emissions, including carbon dioxide, methane, nitrous oxide, and fluorinated gases (Hawaiʻi Climate Change Mitigation and Adaptation Commission, 2017). Research agrees that GHG emissions are a key contributor to the unprecedented increases in global atmospheric warming over the past century.

Research within the report notes that natural disasters' intensity and frequency have increased and will continue to do so. It further provides technical projections of areas along the coast vulnerable to SLR based on the latest available science. The report includes recommendations to address risks associated with climate change. The report finds that for Oʻahu, with no mitigative actions, 3.2 feet of SLR projected by 2100, and its associated erosion, flooding, and waves will have significant impacts on the island's land building and land values, residents, structures, and major roadways. See Section 4.10, Natural Hazards to assess the possible impacts of SLR on the project site.

4.2.2 Environmental Consequences

No Action Alternative

The No Action Alternative would consist of retaining the reservoir and structures in their current condition. No construction or ground-disturbing activities that could directly or indirectly affect local climate conditions would occur. Under the No Action Alternative, routine maintenance activities would continue to occur, as necessary. Furthermore, if no improvements to the Kunia facility are made, it is reasonable to assume that the long-term burden of maintenance and repairs at this site would increase, and the benefit from a reduced risk of failure would not be realized.

Proposed Action Alternative

The development and operation of the Waiāhole Water System Kunia site improvements project will not affect the climate. However, the Proposed Action to construct improvements to existing system facilities on the project site would produce GHGs. Further discussion on mitigation measures is provided in Section 4.10 Natural Hazards. The Kunia facility improvements are not expected to impact the region's climate; therefore, no mitigation measures are recommended.

4.2.3 Best Management Practices and Mitigation Measures

Since there would be no adverse effects on climate and precipitation, no mitigation would be required.

4.3 Drainage and Flooding

4.3.1 Affected Environment

The project site is situated entirely within the Honouliuli Watershed. Natural drainage from three branches of Honouliuli Stream flows through the central and western portion of the project site. The drainage pattern flows from northwest-to-southeast, which is consistent with the topography of the Kunia plateau.

Artificial drainage originating from the catchment of stream water and rainwater runoff originating in the Koʻolau Mountains is conveyed via the Waiāhole Ditch for agricultural

irrigation throughout the project area. Irrigation water within the ditch flows northeast-to-southwest along the northern and western boundary for the project site. Water stored in the proposed 15 MG reservoir along the northern portion of the project site will discharge water out of the reservoir into a series of newly installed PVC irrigation piping that will connect back into the Waiāhole Ditch system.

According to the Federal Emergency Management Agency (FEMA) State of Hawaiʻi, Flood Insurance Rate Map (FIRM) (Panel 15003C0220F), the entire project site as illustrated in Figure 4-2 is designated as Zone D (Engineering Division, DLNR correspondence dated 2-1-21). The Zone D designation is used for areas where there are possible but undetermined flood hazards, as no analysis of flood hazards has been conducted (DLNR, 2014).

The project will not result in permanent facilities or site conditions that will significantly exacerbate property damage or increase the risk to the public's health and safety in the event of a flood. The project is at minimal risk from the threat of flooding.

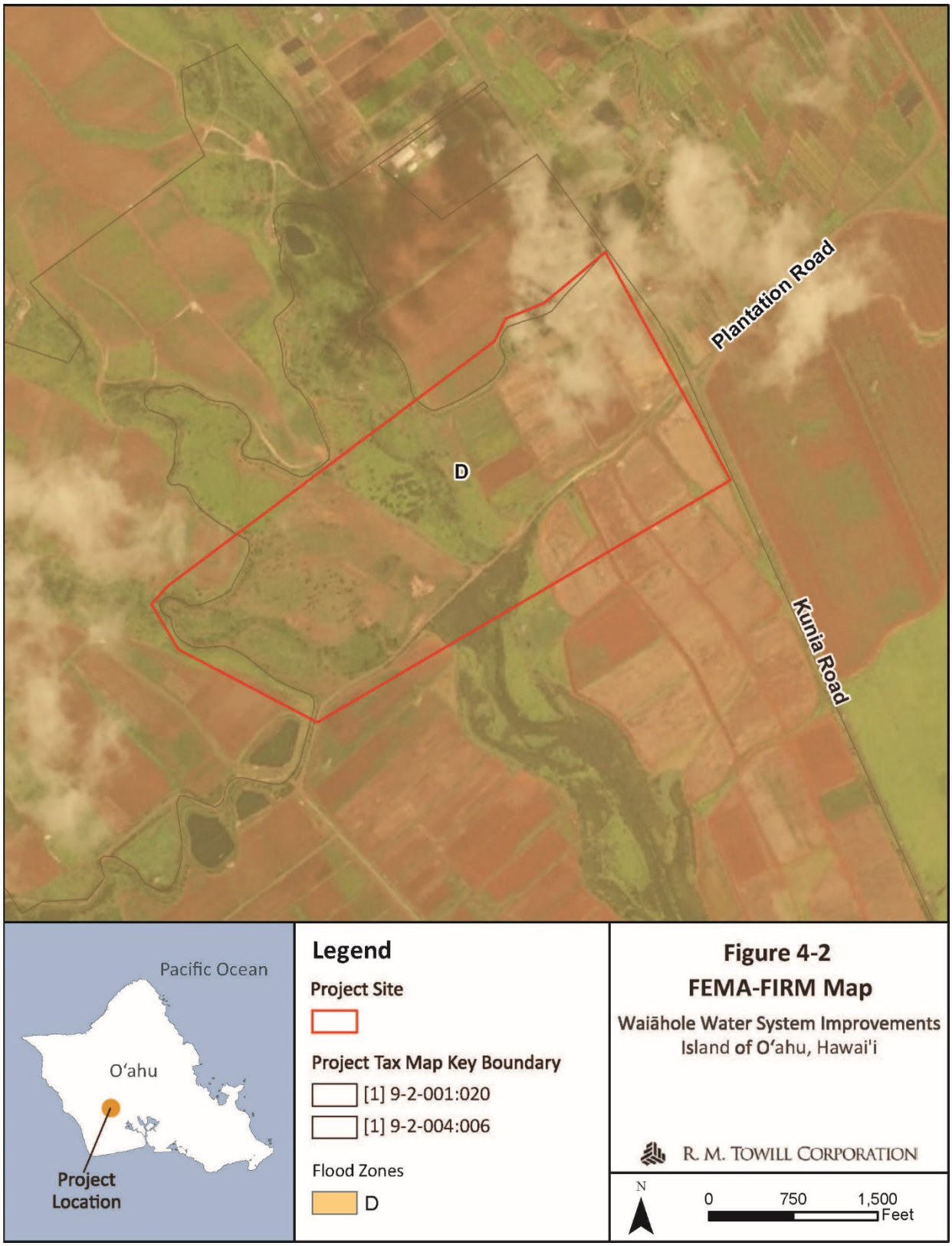
4.3.2 Environmental Consequences

No Action Alternative

The No Action Alternative would consist of the Kunia portion of the Waiāhole Ditch Water System remaining in its current condition. There would be no ground-disturbing activities, modifications to the existing condition of the Waiāhole Ditch, enlargement of the existing reservoir, or the addition of ancillary irrigation and drainage components within the project site. Due to water diversion from the Waiāhole Ditch and increased use of irrigation water to meet the expanding agricultural needs throughout the region, the amount of water retained in the existing reservoir within the project site has been limited, which may limit the possibility of flooding.

Drainage into and out of the project site would still be conveyed via Honouliuli Stream and the Waiāhole Ditch Water System. No construction activities would directly or indirectly affect drainage or contribute to flood conditions. Under the No Action Alternative, routine maintenance activities would continue. Furthermore, if improvements to existing facilities were not made, it is reasonable to assume that the long-term burden of maintenance and repairs of each project component would increase, and the benefits of increased safety and reduced risk of failure would not be realized.

Figure 4-2, FEMA FIRM



Proposed Action Alternative

The Proposed Action would include construction of the ditch diversion and intake piping, expansion of the existing reservoir, new water supply well, interconnecting pipelines and appurtenances for the Waiāhole Ditch Water System, and a new closed conduit at an existing hairpin bend in the Waiāhole Ditch. All proposed improvements are consistent with state laws, regulations, and permit requirements pertaining to the expansion's safety of the existing earth-lined reservoir.

The isolation valve on the proposed Irrigation Line B-1 will allow flow from Ditch Connection 1 to bypass the reservoir and flow directly to Ditch Connection 2. This will allow for maintenance of the reservoir while still bypassing the portions of the ditch between Ditch Connections 1 and 2, which have been prone to blockage and are more difficult to access than other portions of the ditch.

The Proposed Action is not expected to increase the magnitude of flood conditions throughout the project's vicinity. The proposed improvements would increase efficiency and decrease the likelihood of failure related to irrigation water conveyance for agricultural production throughout the Kunia plateau. Additionally, the expansion of the existing reservoir would ensure the storage of sufficient water quantities to meet agricultural needs. These proposed improvements would pass a 100-year storm event without changes to the FEMA-FIRM flood map and would not place any existing or proposed housing within a designated flood hazard zone.

4.3.3 Best Management Practices and Mitigation Measures

Drainage effects associated with construction activities would be minimal and only last a short duration. Upon completion of the proposed actions all drainage related effects would cease. As stated in the Proposed Action Alternative, specifically, the expansion of the existing reservoir and new water supply well will require ground disturbing activities and the importation of fill material. The expansion of the existing reservoir will reduce infiltration in the immediate area; however, once completed, the new reservoir will have a greater storage capacity. The installation of the irrigation water well will require building one (1) new small pad. The net result will be that added hardened surfaces will be limited to one. Water will be retained on-site for the pump and transformer. Due to the minimal size of this single pad in comparison to the overall project area, any resulting alteration to drainage will be negligible. Any increase in runoff caused by an increase in impervious surfaces will be retained on-site. There will be no other increases in impervious surface area as a result of the other proposed project improvements.

Other potential drainage effects related to the Proposed Action would include the discharge of sediments or other pollutants in construction-related stormwater runoff. To limit the transmission of sediments and pollutants, water supply in the existing reservoir would be disabled for irrigation uses prior to the initiation of ground-disturbing construction activities. Any inlet,

outlet, and spillway features of the existing reservoir would also be closed off to prevent flow from the Waiāhole Ditch from entering the construction area.

Project construction activities will be conducted in compliance with HAR, Chapter 11-54, Water Quality Standards and HAR, Chapter 11-55, Water Pollution Control. The enlargement of the existing reservoir will result in more than one acre of ground disturbance during construction. Therefore, project activities will be subject to a National Pollution Discharge Elimination System (NPDES), Notice of Intent (NOI) Form C Permit Application for Discharges of Storm Water Associated with Construction Activity from the DOH, CWB. This permit requires implementation of BMPs to reduce pollutants in construction stormwater runoff and ensure that the project complies with State water quality standards.

During construction, temporary BMPS (e.g., stabilized construction ingress/egress, catch basin inlet protections, and temporary filter sock perimeter controls) will minimize the potential for stormwater runoff and subsequent erosion and sedimentation form the construction and staging areas. After completion of construction activities, temporarily installed BMPS will be removed, and disturbed areas will be restored and reclaimed to their prior condition. The Proposed Action is not expected to result in any significant impact to drainage in and around the project site.

In the event of a flood event, construction activities will cease; equipment and materials will be secured; and all Federal, State, and City requirements will be implemented to ensure the safety of constructions crews and the public near the project area.

The project will adhere to ROH, Chapter 21A, Flood Hazards.

4.4 Surface Water, Groundwater, and Water Quality

4.4.1 Affected Environment

Surface Water

The Waiāhole Ditch Water System is one of the central surface-water diversion systems on Oʻahu that conveys stream water and rainwater from the Koʻolau Mountain Range to irrigate farmlands in leeward and central Oʻahu. The total length of the system is approximately 27 miles and consists primarily of tunnels. The Waiāhole Ditch Water System consists of 37 stream intakes connected by 27 different tunnels bored through ridges and spurs in windward Oʻahu, a main transmission tunnel through the Ko'olau Mountain Range, and additional tunnels and ditches in central Oʻahu. Once collected, water conveyed through Waiāhole Ditch Water System is then stored in reservoirs for agricultural irrigation. The Waiāhole Ditch diverts approximately 27 million gallons per day (MGD) of water from windward Oʻahu to leeward and central Oʻahu (USGS, 2007).

The Honouliuli Stream flows through a central portion of the project site from northwest-to-southeast. Honouliuli Stream is a tributary to the West Loch of Pearl Harbor, contiguous with the Pacific Ocean and located approximately four (4) miles south-southeast of the project site. At the end of the Waiāhole Ditch, subsequent flows are then discharged into various Honouliuli Stream branches, which then flows into the Pacific Ocean.

Water Management *Area*

The project's proposed water supply source is located in a designated water management area (DLNR CWRM correspondence dated 2-9-21). Surface Water Management Areas are special areas designated by the Commission requiring users of surface water sources (such as streams, diversions, and ditches) to obtain surface water use permits to withdraw and use water for various purposes. Individual surface water management areas coincide with individual hydrologic units (watersheds). The CWRM defines agriculture irrigation as the highest and best use of surface water (https://dlnr.hawaii.gov/cwrm/surfacewater),

The HRS, Chapter 174C, State Water Code, authorizes the CWRM to designate water management areas for regulation. The CWRM may only do so after (1) research and investigation and consultation with the appropriate county mayor, county council, and/or county water agency; and (2) after a public hearing and publication of public notice, when serious disputes respecting the use of surface water resources are occurring.

Groundwater

Sixty-eight percent of all the water used on Oʻahu is obtained from groundwater. Oʻahu is divided into seven major groundwater areas, primarily based on geologic or hydrologic conditions. An important source of groundwater supply for central and southern portion of Oʻahu is an exceptional lens of basal (freshwater in contact with seawater) groundwater in the Honolulu-Pearl Harbor area. According to the Summary of the Oʻahu, Hawaiʻi, Regional Aquifer-System Analysis, the entire project site is located within the designated Southern Oʻahu Groundwater Area. The area is divided into six smaller groundwater areas and the project site is located within the ʻEwa subordinate groundwater area. The ʻEwa area occur within flank formations (horizontally extensive lavas), are unconfined, and are identified as basal. There are five fresh groundwater flow systems on Oʻahu. The project site is located within the Southern Oʻahu groundwater flow system. The Southern Oʻahu groundwater flow has large amounts of basal groundwater.

The CWRM is responsible for collecting hydrologic data and conducting water availability analyses statewide. Through cooperative agreements with CWRM the United States Geological Survey (USGS) collects water level and deep monitor well data. A deep monitor well penetrates the freshwater basal aquifer into the underlying brackish and salt water. Data from the Kunia

Middle and Kunia Mauka deep monitor wells indicate that groundwater ranges from approximately 15 to 16.5 feet above MSL in the project area (CWRM, 2014).

The project site is located within the designated Kunia system that has an allocation of 19 million gallons (ADC, 2021). According to the DLNR, CWRM, a Water Use Permit will be required prior to the use of this source. If any new industrial or commercial development is planned, a dual line water system may be required. None are planned at this time.

Water *Quality*

Honouliuli Stream is an inland freshwater stream that flows perennially or intermittently (depending on its location within the watershed). The water quality of Honouliuli Stream has not been fully assessed and is therefore not included on the Hawaiʻi DOH, Chapter 303(d) list of impaired waterbodies (Oʻahu Resource Conservation and Development Council, 2013). Honouliuli Stream is rated as Category 3, meaning that there was insufficient data for determining a designated use attainment and water quality impairment.

AECOS Inc. collected a series of surface water samples at four locations in the project area. Two samples were taken out of the Waiāhole Ditch, one from the existing reservoir, which is to be expanded as part of the proposed project objectives. The second or final sample was taken from the flowing branch of the Honouliuli Stream in the project area. Biologists made a variety of *in situ* measurements (temperature, pH, conductivity, and dissolved oxygen). They then collected various samples for laboratory analyses (turbidity, total suspended solids, nitrate+nitrite, total nitrogen, and total phosphorus) (Appendix A). All surface water measurements taken met the specific water column criteria for Hawaiʻi streams as outlined in HAR, Chapter 11-54-5.2, Inland Water Criteria.

The surface water samples indicated slightly higher temperature and lower dissolved oxygen (DO) in the reservoir, which also had lower turbidity and total suspended solids (TSS) compared to the three other sampled sites. Honouliuli Stream had abnormally high turbidity, TSS, and total phosphorus results. An adjacent cattle pasture next to the project site may account for the high amounts of total phosphorus. Overall, water quality data revealed no significant water quality problems in the Waiāhole Ditch, reservoir, or Honouliuli Stream.

4.4.2 Environmental Consequences

No Action Alternative

The no action alternative would consist of retaining Kunia reservoir and appurtenant facilities in their current condition. There would be no ground-disturbing activities or any modifications to the existing reservoir. Therefore, no construction activities that could directly or indirectly affect drainage or flood conditions would occur. Under the no action alternative, routine maintenance activities would continue to occur. Furthermore, if improvements to the reservoir are not made, it

is reasonable to assume that the long-term burden of maintenance and repairs would increase, and the benefits of increased safety and reduced risk of failure would not be realized.

Proposed Action Alternative

The Proposed Action would include the ditch diversion and intake piping, expansion of the existing reservoir, new water supply well, interconnecting pipelines and appurtenances for the Waiāhole *Ditch* Water System and a new closed conduit at an existing hairpin bend in the Waiāhole Ditch. During construction, there is the potential that sediment and pollutants from construction stormwater discharges may enter the Waiāhole Ditch and Honouliuli Stream. However, the General Contractor would install pollution control measures and BMPs to ensure short-term adverse impacts to the water quality of the Waiāhole Ditch and Honouliuli Stream are avoided. Permanent post-construction BMPs would be installed when the project is complete to minimize long-term impacts on water quality and overall surface water integrity. The Proposed Action would not result in long-term impacts to Honouliuli Stream since no construction is proposed within the bed or banks of the stream. Additionally, the improvements to Waiāhole Ditch itself require minimal earth disturbance activities; thus, minimizing any adverse impacts to the quality of water conveyed by the Waiāhole Ditch over the long-term.

The Proposed Action is not anticipated to have a significant, long-term or cumulative adverse impact on groundwater resources in the project area. The project site is approximately 550 to 650 feet above MSL, and groundwater in the project area ranges from approximately 15 to 16.5 feet above MSL. Construction of the proposed improvements would not require extensive excavation and would be up to 12 feet below ground surface. Therefore, the construction of the proposed improvements is not anticipated to encounter groundwater.

4.4.3 Best Management Practices and Mitigation Measures

Project construction activities will be conducted according to HAR, Chapter 11-54, Water Quality Standards and HAR, Chapter 11-55, Water Pollution Control. The enlargement of the existing reservoir will result in more than one acre of ground disturbance during construction. Therefore, project activities will be subject to the filing of a NPDES, NOI, Form C Permit Application for Discharges of Storm Water Associated with Construction Activity from the DOH, CWB. This permit requires the implementation of BMPs to reduce pollutants in construction stormwater runoff and ensure that the project complies with State water quality standards.

As previously stated, pollution control measures and BMPs will be installed by the General Contractor to prevent soil loss and sediment discharges into the Waiāhole Ditch and Honouliuli Stream and to ensure that short-term adverse impacts to surface water are avoided. BMPs will be employed in all phases of the project. BMPs will be installed prior to the start of construction, will be maintained throughout the construction period, and permanent BMPs will be installed once construction is complete. BMPs will generally include a stabilized construction

ingress/egress, catch basin inlet protections, and temporary filter sock perimeter controls. For additional details, see preliminary construction drawing Sheets C120, C123, C124, C125 in Appendix D. The General Contractor may modify the proposed BMPs as necessary to account for unanticipated or site-specific conditions.

4.5 Biological Resources

4.5.1 Affected Environment

Biological field surveys were conducted in July 2020 to document existing flora and fauna in the project area, the findings of which are summarized in this section.

Vegetation *and Flora*

The vegetation across the survey area consists of weedy growth, farmed crops, and scattered shrubs and trees. Active cropland and pasture supporting mostly scrubby growth and sparse grass are both present. The vast majority (87%) of flowering plants are naturalized or non-native) species. The only native plant seen was *ʻuhaloa (Waltheria indica)*, an indigenous species regularly observed in disturbed environments. Two probably early Polynesian introductions present are primrose willow *(Ludwigia octovalvis)* and *honohono (Commelina diffusa)*. Both species are regularly observed in wet areas, as along the ditch and reservoir margins. Several ornamentals are planted near a pump house in the vicinity of the existing reservoir.

No plants of conservation concern or which enjoying statutory protection (that is, listed as threatened or endangered; HDLNR, 1998; USFWS, 2020) were identified in the survey and given the highly disturbed nature of the site, would not be expected to be growing in the project area.

Invertebrates, Avian Resources

No indigenous or endemic aquatic invertebrate species protected by state or federal endangered species statutes (HDLNR, 2015; USFWS, nd.) were observed in waterways at the Project area during the July 2020 survey. However, endemic orange-black damselfly *(Megalagrion xanthomelas)* was previously reported HDLNR-DAR surveys of Honouliuli Watershed (Parham et al., 2008) and is listed as endangered on state and federal endangered species statutes (HDLNR, 2015; USFWS, 2012; USFWS-PIFWO, nd). *M. xanthomelas* is known from the islands of Hawaiʻi, Maui, Lānaʻi, Molokai, Oʻahu, and formerly Kauaʻi. While introduced predatory fish and crustaceans in a range of aquatic environments, are major threats to the species, the *M. xanthomelas* species was not seen in the July 2020 survey.

All of the 27 avian species recorded at the Project site from this survey are naturalized species, non-native to the Hawaiian Islands. No indigenous or endemic bird species were counted. None

of the species recorded from the survey receive special protections under state or federal endangered species statutes.

Seabirds. No suitable nesting habitat for the protected night-flying seabirds, i.e., Hawaiian Petrel (*Pterodroma sandwichensis*), Wedge-tailed Shearwater (*Ardenna pacifica*), Newell's Shearwater (*Puffinus newelli*), and Band-rumped Storm-petrel (*Oceanodroma castro*), occur in the project area. The project area is beyond the westward extent of the known White Tern (*Gygis alba*), or *Manu o Ku*, nesting range, and there are few suitable nesting trees within the project area. This species is listed as threatened under State of Hawaiʻi endangered species statute, HRS, Chapter 195D, Conservation of Aquatic Life, Wildlife and Land Plants (HDLNR, 2015).

Owls. The Hawaiian endemic sub-species of Short-eared Owl or *pueo* (*Asio flammeus sandwichensis*) is state-listed as endangered on Oʻahu only. Short-eared Owl nest on the ground and are thus susceptible to mammalian predation. The species is increasingly scarce on Oʻahu but is known to utilize agricultural crop and pastureland for hunting and nesting. Short-eared Owl has been observed from the Makakilo and Pearl Harbor areas (Cotin and Price, 2018; AECOS, 2018). No evidence of the Short-eared Owl was found in the survey. However, some areas beyond the project, particularly outlying scrub and pastureland in Honouliuli Gulch, have the potential for harboring this species.

Mammals

Mammals found are consistent with the location of the project and habitats present. Small Indian mongoose (*Herpestes javanicus*) were observed to utilize the project area and are widespread throughout Oʻahu Island. Domestic cattle (*Bos taurus*) were encountered in pastureland at Honouliuli Gulch in the project area. Although no rodents were recorded, it is likely that one or more of the four established alien Muridae found on Hawaiʻi - roof rat (*Rattus rattus*), brown rat (*R. norvegicus*), Polynesian rat (*R. exulans [*subspecies *Hawaiiensis]*), and European house mouse (*Mus musculus*) use various resources within the general project area. It is highly likely that both cat (*Felis catus*) and domestic dog (*Canis lupis familiaris*) may also utilize resources at the project site. All of these aforementioned mammalian species are deleterious to native Hawaiian ecosystems and the native fauna dependent on them. It is possible that Hawaiian hoary bat or *ʻōpeʻapeʻa* (*Lasiurus cinereus semotus*) uses resources within the project vicinity on a seasonal basis.

Other Resources of Potential Concern

Critical Habitat. No federally designated Critical Habitat occurs in the project area; no equivalent statute exists under state law. No natural resources of preservation or conservation concern occur in the project area.

Jurisdictional Waters. Honouliuli Stream, Waiāhole Ditch, and the reservoir are water features in the project area with potential to qualify as jurisdictional waters under the Clean Water Act

(CWA). The Navigable Waters Protection Rule (NWPR), published by the EPA and USACE on June 22, 2020 (USACE and USEPA, 2020), redefines Waters of the U.S. (or jurisdictional waters) protected under the CWA.

The access roadway and proposed waterline at the Project will cross two Honouliuli Stream branches within Honouliuli Gulch. The more easterly branch (left branch) had flowing water at the time of the survey and was much overgrown with Guinea grass. The west (right) branch was dry. Honouliuli Stream is a perennial stream in the Hawaiʻi Stream Assessment (HCPSU, 1990) and Hawaiʻi Watershed Atlas (Parham et. al, 2008). As proposed, the waterline pipe crossing both branches will be located within a substantial berm of the existing access roadway. At the roadway, stream branches are in pipe culverts well below the ground surface. So long as the ditch to bury the proposed waterline pipe is above the culvert and no disturbance to the culverts or any depositions of fill into the stream beds will occur, a Department of the Army permit will not be required.

Waters within Waiāhole Ditch at the Project area are not considered to be jurisdictional. Under the NWPR, a jurisdictional ditch must meet all of the following conditions (USACE and USEPA, 2020): (1) has perennial or intermittent flow; (2) contributes surface flow in a typical year to an otherwise jurisdictional waterbody (e.g., ocean or perennial stream); (3) is constructed in a tributary (i.e., relocates an existing stream) or is constructed in an adjacent wetland. Waiāhole Ditch has perennial flow, but the Waiāhole Ditch segment at the Project is not constructed within a tributary or adjacent wetland, and therefore would not be considered a jurisdictional ditch.

Water within the reservoir at the project area is not jurisdictional. Under the NWPR, artificial lakes and ponds, including water storage reservoirs and farm, irrigation, stock watering, and log cleaning ponds, constructed or excavated in uplands are not jurisdictional, so long as the [reservoir] does not contribute surface water flow to a navigable waterway (USACE and USEPA, 2020).

4.5.2 Environmental Consequences

No Action Alternative

The No Action Alternative would consist of retaining the Kunia facility reservoir and components in their current condition. No construction or ground-disturbing activities that could directly or indirectly affect vegetation or wildlife would occur. Under the No Action Alternative, routine maintenance activities would continue to occur as necessary. Furthermore, if improvements to the reservoir or incidental structures were not made, it is reasonable to assume that the long-term burden of maintenance and repairs at the Kunia facility would increase, and the benefits of increased safety and reduced risk of failure would not be realized.

Proposed Action Alternative

No threatened or endangered plant species were found. Thus, the proposed project construction activities will not result in adverse effects on flora.

No threatened or endangered avian species were encountered or recorded by the July 2020 survey. Thus, the proposed project construction activities are not expected to result in adverse effects on avian species. However, best management practices during construction are recommended to be undertaken by the Contractor are discussed in Section 4.5.3 below to minimize the potentially adverse impact to transiting seabirds. Post-construction mitigation measures are further recommended in Section 4.5.3 Best Management Practices and Mitigation Measures.

The project is not anticipated to result in adverse effect on federally designated Critical Habitat, or natural resources of preservation or conservation concern, because none were found in the project site or area (AECOS, September 2020).

4.5.3 Best Management Practices and Mitigation Measures

If work occurs within a stream or riparian zone, ADC shall consult with USFWS. However, in the absence of evidence that any of the aquatic environments harbor endangered species, this consultation may be limited to providing the agency with a copy of this report or the Project EA.

Deleterious impacts to transiting seabirds can be avoided if project construction occurs during daylight hours and any outdoor lighting used/installed is fully "dark sky compliant" (HDLNR-DOFAW, 2016).

If project construction results in grubbing or grading of areas that are currently undeveloped, a survey for Short-eared Owl ground nesting activity should be undertaken in these locations immediately prior to the start of ground disturbance. If a nest is discovered, Hawaiʻi Department of Land and Natural Resources (DLNR) must be notified before proceeding with any activity that could disturb the nest.

While the project is not expected to have any adverse impacts on the aquatic environment, the DLNR Division of Aquatic Resources has recommended the following measures in its comments received during the Pre-Assessment phase of this DEA (2-5-21). These measures are intended to minimize the potential for erosion, siltation and pollution of adjacent or receiving water bodies:

1) Areas/lands denuded of vegetation should be planted or covered as quickly as possible to prevent erosion;
2) Scheduling site work (reservoir construction) during periods of minimal rainfall, and;
3) Prevent construction materials, petroleum products, debris and landscaping products from falling, blowing or leaching into the aquatic environment.

4.6 Historic and Cultural Resources

4.6.1 Affected Environment

An Archaeological Literature Review and Field Inspection Report (ALRFI) was prepared for this proposed project by Cultural Surveys Hawaiʻi (CSH) (October 2020), and findings are summarized in this section. As a State of Hawaiʻi project, the ALRFI has been prepared under HRS, Chapter 6E-8 and HAR, Chapter 13-275 to determine the likelihood that historic properties may be affected by the project and based on findings, consider cultural resource management recommendations. A copy of the ALRFI report is included in this EA as Appendix B.

ADC initiated consultation with SHPD in January 2021 and is seeking SHPD concurrence with its project effect determination of "no historic properties affected" and proposed reporting of any possible inadvertent discoveries. The ALRFI report was submitted, and date stamped as received by SHPD in December 2020 (CSH, 2020).

The project includes two relatively large areas, the proposed new 15-MG reservoir estimated at 4.6 acres and a proposed new irrigation well enclosure estimated at 0.4 acres, in addition to a total of approximately 7,030 linear feet (lf) of irrigation lines and amenities.

The generally dry nature of the project area and location approximately 3.7 miles from the coast would have discouraged traditional Hawaiian land uses. A major traditional Hawaiian trail became contemporary Kunia Road on the east end of the project area. It is suggested that most travelers on this trail would have just been passing through. During the Māhele land division of 1848, Miriam Keʻahikuni Kekauʻōnohi acquired a deed (Royal Patent #6971) to all unclaimed land *ahupuaʻa* (traditional Hawaiian land unit, including the present project area), which totaled 43,250 acres. The 72 kuleana awards, awards given to commoners, were located in the lower portions of Honouliuli Ahupuaʻa near Pearl Harbor with its fishponds and irrigated taro fields (Maly 1997). No kuleana claims were awarded within the project area.

The project area and the ʻEwa slope and plain in general was transformed by the Waiāhole Ditch completed in 1916. Sugarcane cultivation by the Oʻahu Sugar Company dominated the project area until the Oʻahu Sugar Company went out of business in 1994. This long span of intensive cultivation likely removed all indications of prior land use.

The only historic properties identified within the project area relate to twentieth century commercial sugarcane cultivation which included a westward extension of State Inventory of Historic Places (SIHP), site # 50-80-08-7671:3, Kupehau Road, which was a plantation road (and at one time, for part of the stretch in the project area, a plantation railway alignment; see the 1928/1929 USGS topographic map) and small portions of the Waiāhole Ditch, designated SIHP # 50-80-09-2268.

The ALRFI supports the conclusion of Wong and Spear (2015:54) that SIHP # 50-80-08-7671 is significant under Criterion d (only) as outlined in HAR §13-275-6 for having yielded information about prior Historic land use, particularly in association with former plantation agriculture in the area but that no further archaeological work is indicated on the basis that "what remains are remnant plantation features that have been adequately documented, and that little potential exists to encounter intact subsurface cultural deposits."

The Waiāhole Ditch (SIHP # 50-80-09-2268) has been determined to be significant and the present study supports significance under HAR §13-284-6 Criteria a, c, and d. The historic property has yielded information on the agricultural history of the area and contributed greatly to the development and evolution of the ʻEwa Plain throughout its history. The portions of the Waiāhole Ditch within the present project area retain integrity of location, design, materials, and workmanship. Based on the findings of the subject project ALRFI, SIHP # 50-80-09-2268 is assessed as significant under HAR §13-284-6 Criteria a, c, and d. The historic property has yielded information on the agricultural history of the area and contributed greatly to the development and evolution of the ʻEwa Plain throughout its history. The portions of the Waiāhole Ditch within the present project area retain integrity of location, design, materials, and workmanship.

The proposed project is regarded as routine maintenance, will have minimal impact on the Waiāhole Ditch, and is not anticipated to diminish the appearance, integrity or significance of this historic property.

4.6.2 Environmental Consequences

No Action Alternative

The No Action Alternative would consist of retaining the Kunia portion of the Waiāhole Water System in its current condition. No construction or ground disturbing activities that could directly or indirectly affect historic and cultural resources would occur. Therefore, none of the potentially significant resources that have been identified within the project area would be affected. Under the No Action Alternative, routine maintenance activities would continue to occur, as necessary. Furthermore, if expansion to the reservoir or construction of a new well or transmission pipes were not made, it is reasonable to assume that the long-term burden of maintenance and repairs at each structure associated with this part of the overall water system would increase, and the benefits of increased safety and reduced risk of failure would not be realized.

Proposed Action Alternative

The proposed project is regarded as part of on-going routine maintenance, thus, will have minimal impact on the Waiāhole Ditch (SIHP # 50-80-09-2268), and is not anticipated to diminish the *appearance*, integrity or significance of this historic property. Impacts to the

Waiāhole Ditch are understood to be limited to construction of: (1) a new sluice gate with operator at Ditch Connection Site 1; (2) a new headwall at Ditch Connection Site 2, and (3) a re-working of the previous re-working of the ditch at the Hairpin Turn.

Given the proposed project's impacts and the present documentation, the study supports a determination of "no historic properties affected" and no further historic preservation work required.

4.6.3 Best Management Practices and Mitigation Measures

In the unlikely event that cultural deposits and/or human skeletal remains are encountered during ground disturbing activities, work should be stopped immediately in the area and the SHPD notified of the nature of the discovery. The ALRFI study advised that while documentation of these areas within the present study is appropriate, early consultation with the SHPD archaeology and architecture branch is recommended regarding impacts to the Waiāhole Ditch and possible mitigation.

4.6.4 Cultural Resources

A Cultural Impact Assessment (CIA) for this project was undertaken for the purpose of considering the proposed project's potential effect on cultural beliefs, practices, and resources. (CSH, April 2021) . A preliminary list of parties with whom consultation has been attempted with substantial outreach consisted of 71 individuals, agencies and organizations to determine if cultural resources may be affected. Of the four respondents to the consultation outreach, testimonials were expressed as concerns in a cultural context.

One respondent indicated that *pueo* (Hawaiian endemic sub-species of Short-eared Owl) is known to frequent the slopes from Puʻu Kapuaʻi to West Loch, in the vicinity of project area. The same respondent stated *ōpeʻapeʻa* (Hawaiian hoary bat) is known to frequent the area at various times of the year. See also discussion in Section 4.5, Biological Resources of this DEA. The respondent suggested that Dr. Melissa Price and Dr. Javier Cotin of the Project *Pueo* Biologist Team and Department of Land and Natural Resources Division of Forestry and Wildlife (DOFAW) Biologist Afsheen Siddiqi be consulted regarding *pueo* protocol. The DLNR DOFAW is an ongoing consulted party in this project's HRS, Chapter 343 EA process.

Among those interviewed, Kamaʻaina were sought for the CIA to share knowledge of "storied places" (*wahi pana*) relative to the early visitation and land use of the project site. Nineteenth century maps such as the 1873 Alexander map and the 1894 Kanakanui map indicate no development in the vicinity of the project area (other than the trail extending up the central valley at the east end that would become Kunia Road) and are consistent with this area having been used solely as grazing land as indicated in the 1906 Donn map.

4.7 Land Use and Agriculture

4.7.1 Affected Environment

The project site is in Central Oʻahu, approximately 150 feet west of Kunia Road, near the convergence of the Waiāhole Ditch Irrigation System with Kunia Road. The property is zoned AG-1, including all abutting land to the project site.

Access to the project site is via Plantation Road. The existing earthen irrigation reservoir is located at the northern edge of the project site, approximately 1,000 feet west of Kunia Road. The project site is not located in the Special Management Area (SMA).

Project site landowners, Monsanto (Bayer) and Hartung Brothers, are operating commercial agricultural crop production on surrounding areas within the project parcels and are among the various ongoing users of ADC's Waiāhole Ditch irrigation water. Hartung Brothers land is located to the north of the project site, while Bayer land is to the south. The Hawaiʻi Agriculture Research Center (HARC) is located further south, near the Kunia Road/H-1 freeway interchange at 94-340 Kunia Road, Waipahu. ADC's Reservoirs 155 and 225 sites exist in the vicinity of the project site.

The proposed project is intended to provide maintenance and improvement of the Waiāhole Water System for the existing system users. Any increase in the number of farmers due to the proposed project is not proposed or anticipated.

Adjacent proposed project – Mahi Solar

The Mahi Solar project is planned to produce clean energy and support local agriculture in Kunia. At 120 MW(ac), this project could produce approximately 4% of Oʻahu's electricity annually, enough to power 37,000 local homes enabling HECO to burn less fossil fuel and emit less greenhouse gasses. The project also includes a 480 MWh battery system that would store solar energy generated during the day to provide power at night, supported by an electrical substation to connect to the Oʻahu grid.

This project would work with the Hawaiʻi Farm Bureau and local farmers to find innovative agricultural land uses between and under photovoltaic (PV) panels. The project would occupy 617 acres across several parcels of land, on the Ewa (west) side of Kunia Road. This land use is located west of the Waiāhole Water System site and will share use of land within portions of the proposed project parcels, TMK nos. 9-2-001:020 and 9-2-004:006. The existing Plantation Road which provides vehicular access to Kunia Road, will be shared between the developer of Mahi Solar project and the proposed Waiāhole Water System improvements project. Coordination between ADC and the developer of Mahi Solar project has been initiated via email (February 22, 2021) in conjunction with this HRS, Chapter 343 EA (CCH DPP in a letter dated 2-19-21 preassessment phase).

4.7.2 Environmental Consequences

No Action Alternative

The No Action Alternative would consist of retaining the Kunia water system facility in its current condition. No construction or ground disturbing activities that could change existing land uses would occur and agriculture designations within the project area would not change. Under the No Action Alternative, routine maintenance activities would continue to occur, as necessary, as would adjacent agricultural uses. If improvements to the existing Kunia facility were not made, it is reasonable to assume that the long-term burden of maintenance and repairs at this site would increase, and the benefits of increased safety and reduced risk of failure would not be realized.

Proposed Action Alternative

The Proposed Action would not result in the removal of land from agricultural production and would not result in any changes to the existing land uses in the project area. The Proposed Action would be consistent with the objectives, policies, and guidelines outlined in the CCH's General Plan, LUO, and Central Oʻahu Sustainable Communities Plan; would be consistent with the DPP ordinances and regulations governing the development and use of land; and would be consistent with the Hawaiʻi CZM Program. Coordination with the local landowners would also be undertaken to ensure that access to private parcels is maintained during construction activities. Further, the proposed improvements to the reservoir would benefit valuable agricultural lands by ensuring that a larger reservoir, new well, and transmission pipes would help ensure safe and reliable irrigation water supply and storage at the Kunia facility of the Waiāhole Water System for agricultural crops as well as landscaped areas and recreational lands in the ʻEwa region. Construction-related as well as post construction, operational traffic impacts resulting from the proposed backup irrigation well are expected to be minimal due to its proposed location west of the Kunia Road right-of-way. Should there be any issue concerning maintaining appropriate clearance, the plans will be submitted to HDOT for review (HDOT letter, 2/3/21).

As described in Section 3 Description of Proposed Action and Alternatives, it is anticipated that temporary staging areas and a borrow site would be developed on agricultural lands in the project area during project construction. Upon completion of construction, temporarily disturbed areas used for staging areas and the borrow site would be cleared of all equipment, materials, and project refuse, then regraded and restored. There would be no long-term direct conversion of prime farmland to nonagricultural uses within the staging areas or borrow site. Implementing the Proposed Action would result in a less than significant impact.

4.7.3 Best Management Practices and Mitigation Measures

Since there would be no adverse effects on land use and agriculture, no mitigation would be required.

4.8 Visual Resources

4.8.1 Affected Environment

The visual characteristic of the project vicinity could be described as agricultural plains with rather flat terrain. The visual expectation for this area is of agricultural lands with pockets of suburban development. Kunia Road is a state owned and maintained north-south arterial roadway that varies in the number of lanes. At the southern end of the road, near the H-1 Freeway, Kunia is a six-lane principal arterial and transitions, traveling north, to a four-lane principal arterial near the Royal Kunia area. Traveling further north, Kunia transitions to a two-lane minor road; it is a two-lane road nearest to the project site. Southeast of the property is Pearl Harbor. There is a visual view of downtown Honolulu from the project site. East of the property is a view of the Koʻolau mountain range; west of the property is a view of the Waiʻanae mountain range. The general, immediate, view is of agricultural plains.

The Central Oʻahu Sustainable Communities Plan (COSCP) includes, as a key element of its vision, a network of open space and greenways. This network is to be created by linking the local land uses (mountain and agricultural areas, parks, golf courses) via waterways and greenways to create an Open Space Network. Agricultural lands along Kunia Road, in which this project is located, are part of the mountain and agricultural areas vision for the Central Oʻahu Open Space Network.

4.8.2 Environmental Consequences

No Action Alternative

The No Action Alternative would consist of retaining the Kunia facility in its current condition. No construction or ground disturbing activities that could directly or indirectly affect the visual *character* of the project area would occur. Under the No Action Alternative, routine maintenance activities would continue to occur, as necessary. Furthermore, if improvements to the Kunia facility were not made, it is reasonable to assume that the long-term burden of maintenance and repairs at this facility would increase, and the benefits of increased safety and reduced risk of failure would not be realized.

Proposed Action Alternative

The proposed *reservoir*, well, and connecting lines would consist of improvements primarily below grade. A manhole cover may be the only surface evidence of the well location. Overall, the visual impact of the Proposed Action would be minor to negligible. No mitigation measures are required.

4.9 Hazardous, Toxic, and Radioactive Wastes

4.9.1 Affected Environment

The Central Oʻahu region has historically been agricultural fields of pineapple and *sugarcane*, which are known to have historically been subject to application of pesticides and herbicides during the years of crop production. At present, the project site is located within fallow agricultural fields west of Kunia Road. Lands surrounding the site consist mainly of large agricultural parcels.

The Environmental Health Administration under the Hawaiʻi DOH oversees several divisions and offices, including the Hazard Evaluation and Emergency Response (HEER) Office and the Environmental Management Division (EMD). The HEER Office's mission is to protect human health and the environment. The HEER Office reports directly to the Environmental Health Administration Deputy Director. The HEER Office provides leadership, support, and partnership in preventing, planning for, responding to, and enforcing environmental laws relating to releases or threats of releases of hazardous substances.

The project site is not currently included on any list of hazardous materials sites. Based on a review of readily ascertainable public information for the project site and vicinity, there are no listed hazardous materials sites or existing hazardous material contamination present. The DOH iHEER database was reviewed for potential hazardous materials sites or existing hazardous material contamination at or in the vicinity of the project sites, as listed by TMK numbers (https://health.Hawaiʻi.gov/heer/siteinfo). Research of the 6,901 sites listed by TMK number, last updated August 17, 2020, found that the project site was not listed as containing potential hazardous materials sites or existing hazardous material contamination.

4.9.2 Environmental Consequences

No Action Alternative

The No Action Alternative would consist of the Kunia portion of the Waiāhole Water System in its current condition. No construction or ground disturbing activities that could directly or indirectly create hazards for construction employees and the environment would occur. Under the No Action Alternative, routine maintenance activities would continue to occur, as necessary. Furthermore, if improvements to existing facilities were not made, it is reasonable to assume that the long-term burden of maintenance and repairs at each Kunia component would increase, and the benefits of increased safety and reduced risk of failure would not be realized.

Proposed Action Alternative

The Proposed Action would include the excavation of the existing embankment, removal of sediment from the interior of the reservoir, and the reconstruction of the embankment to meet DLNR design criteria. The proposed action would include new inlet, outlet and intake facilities.

Approximately 21,200 CY (cubic yards) of fill material would be excavated for construction of the 15 MG Reservoir, and approximately 3,100 CY would be required as fill material for construction of the new irrigation water well. These quantities are preliminary and will be finalized during final design of the project. Storage of the soil will be on-site.

Material used for borrow would be tested for contaminants and characterization prior to excavation to verify that the material is clean enough for use as fill. Upon completion of the proposed construction activities, the borrow site would be cleared of all equipment, materials, and project refuse, then re-graded and restored for future agricultural use.

Any excess excavated materials generated by the Proposed Action would be disposed of on-site or hauled off-site and deposited in a suitable disposal area. Construction debris and excess material requiring disposal in a landfill would be hauled off-site to a suitable facility.

A site search of the State DOH iHEER (November 16, 2020) database did not reveal any evidence of significant hazardous waste or petroleum contamination or threat of contamination in or near the project area. Therefore, existing hazards and hazardous materials concerns related to the Proposed Action are not anticipated. However, during excavation grading, and construction activities, it is anticipated that limited quantities of miscellaneous hazardous substances (such as petroleum-based products/fluids, solvents, and oils) would be employed at the project site and staging areas. As with any liquid or solid, the potential for an accidental release exists during handling and transfer from one container to another. Depending on the relative hazard of the material, if a spill were to occur of significant quantity, the accidental release could pose a hazard to both construction employees and the environment, resulting in a significant impact.

Compliance with laws and regulations pertaining to the use, handling, storage, disposal, and transportation of hazardous materials would minimize the potential for release and spill of hazardous materials, such as from equipment used during construction activities. Implementing the Proposed Action would result in a less than significant impact.

4.9.3 Best Management Practices and Mitigation Measures

Further, implementation of storm water and erosion control BMPs, described in further detail in Section 4.1 Geology and Soils, would also minimize hazards to construction employees and the environment.

4.10 Natural Hazards

4.10.1 Affected Environment

Flood. The Flood Insurance Rate Map (FIRM) prepared by the Federal Emergency Management Agency under the National Flood Insurance Program does not identify any major floodways or floodplains in the project area (Figure 4-2). According to the FIRM, the proposed project is located in Flood Zone D, which are unstudied areas where flood hazards are undetermined, but flooding is possible.

Due to water diversion from the Waiāhole Ditch and increased use of irrigation water for diversified agriculture, the amount of water retained in the Ditch has been diminished, which may result in a reduced possibility of flooding.

The site is located approximately four miles north from the West Loch and is at an elevation ranging from approximately 550 to 650 feet above mean sea level; the proposed project would not be affected by any tsunami inundation.

Seismic Hazards. Earthquakes occur frequently in Hawaiʻi with the majority on or near Hawaiʻi Island. Most of these earthquakes are too small to be felt and can only be detected by a seismometer. Earthquakes in Hawaiʻi fall into three main classes: volcanic, caused from magma travelling upward or laterally; tectonic, slippage along tectonic faults; and mantle, the bending of Earth's lithosphere (crust and upper mantle) from the weight of the islands and occurs deep below the earth's surface. The class of earthquake most likely to cause damage to Oʻahu is from the third earthquake category. The most recent earthquake to cause damage to Oʻahu, the 1973 Earthquake off the coast of Hawaiʻi Island, and the most severe earthquake on record, the Lānaʻi Earthquake of 1871, were both from the third earthquake class.

Thus, while earthquakes are a common occurrence within the State of Hawaiʻi, they are much less frequent on the island of Oʻahu. Today, mitigation from an earthquake's damage is through building codes that guide new design and construction as well as building alteration and maintenance. The International Building Code (IBC) applies to most types of new buildings.

Hurricanes. Hurricanes are part of the Tropical Cyclone storm family. They are characterized by high winds speeds (more than 74 miles per hour), storm surge, and heavy rains. Hurricanes can cause severe damage to life and property. The City and County's Department of Emergency Management uses a multi-layered warning system through television, radio, sirens, and internet

for events such as a hurricane. These early warning systems should provide residents with ample preparation time to evacuate susceptible areas and minimize or avoid life-threatening situations.

While hurricanes are rare events in Hawaiʻi, they can occur. The damage incurred by hurricanes is enhanced by the Hawaiian Islands' topography which may funnel and amplify winds across ridges and through island channels.16 Additionally, flying debris from structures (such as roofing materials and metal sidings), lawn furniture, signs and vegetation can be a danger to life and property. The most recent, and damaging, Hurricane to strike the Hawaiian Islands was Hurricane Iniki, a Category four Hurricane, in 1992.

Hurricane Iniki was the most destructive hurricane to strike Hawaiʻi in the 20th Century, and while Kauaʻi took the brunt, every island in the State suffered damage from strong winds and destructive surf.

Tsunami Hazard. The project site is located well outside the tsunami evacuation zone designated by the Hawaiʻi State Civil Defense agency.

Climate Change. According to recent findings by researchers at the Hawaiʻi Climate Change Commission and University of Hawaiʻi (IPRC, 2013, var.), the effects of climate change are increasingly evident in Hawaiʻi: air temperature has risen; rain intensity has increased while total rainfall has decreased; stream flows have decreased; sea surface temperatures and sea levels have increased; and the ocean is becoming more acidic (Hawaiʻi Climate Change Commission, 2017 and SB No. 2745, 2012).

Research is also in agreement that GHG emissions, including carbon dioxide, methane, nitrous oxide, and fluorinated gases, are a key contributor to the unprecedented increases in global atmospheric warming over the past century (EPA, 2011 and IPRC, 2013). These trends are projected to continue to increase in the future posing unique and considerable challenges to Hawaiʻi. Research at the University of Hawaiʻi, School of Ocean and Earth Science and Technology (SOEST) indicates that sea level has risen in Hawaiʻi by approximately 0.6 inches per decade (1.5 mm per year) over the past century (SOEST, 2012). Research in the 2017 *Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report* finds that 3.2 feet of SLR is expected by year 2100 (Hawaiʻi Climate Change Mitigation and Adaptation Commission, 2017).

According to the Intergovernmental Panel on Climate Change's Fifth Assessment Report, Climate Change 2013, Chapter 13, Sea Level Change, released in 2014, it is estimated that at most, a global sea-level rise of approximately 0.45 -0.82 m (1.48 – 2.70 ft) is likely to occur for the period of 2081-2100. There will be deviations of local and regional sea level change from the global change – it is estimated that about 70% of coastlines are projected to experience a relative sea level change within 20% of the global mean sea level change.

The project site ranges in elevation from approximately 550 to 650 feet above mean sea level and direct inundation due to sea level rise is not anticipated in the context of 21st century sea level rise projections. Furthermore, according to the Hawaiʻi SLR Viewer (accessed 2019), the project site is not within the 3.2-feet SLR Exposure Area. The Center for Island Climate Adaptation and Policy and the University of Hawaiʻi Sea Grant note that sea level is expected to rise one foot by 2050 and three feet by 2100 and recommends that state and local governments plan accordingly (Center for Island Climate Adaptation and Policy, 2011). While an accelerating rise in local sea level should be planned for, specific water levels should not be anticipated because sea level rise models are inherently uncertain. Sources of this uncertainty include sparse local data, intrinsic uncertainty in climate warming and ice melt models, and prospective shifts in human behavior to curb green-house gas emissions.

4.10.2 Environmental Consequences

No Action Alternative

The No Action Alternative would consist of the Kunia portion of the Waiāhole Water System in its current condition. No construction or ground disturbing activities that could directly or indirectly result in impact to existing the climate would occur. Under the No Action Alternative, routine maintenance activities would continue to occur, as necessary. Furthermore, if improvements to existing facilities were not made, it is reasonable to assume that the long-term burden of maintenance and repairs at each Kunia component would increase, and the benefits of increased safety and reliability would not be realized.

Proposed *Action Alternative*

The construction of improvements and operation of the Kunia facility of the Waiāhole Water System will not affect the climate. However, the Proposed Action to construct improvements to existing subareas including the reservoir, new well, and transmission pipelines on the project site would produce GHGs. Further discussion on mitigation measures is provided in Sections 4.1 Geology and Soils, and 4.2 Climate and Precipitation.

The proposed improvements to the Kunia site are not expected to have an impact on the region's climate; therefore, no mitigation measures are warranted.

4.10.3 Best Management Practices and Mitigation Measures

The proposed project supports the City's Multi-Hazard Pre-Disaster Mitigation Plan 2020 Mitigation Goal No. 4, which seeks that public actions,

"4. Ensure that all lifeline and information technology infrastructures are able to withstand hazard events or have contingency plans to quickly recover after a disaster," (City Department of Emergency Management, 2020).

4.11 Noise

4.11.1 Affected Environment

Vehicle traffic and farming activities are the primary noise sources in the project area. The major roadways in the project area are H-1 and Kunia Road. Traffic on project area roadways includes vehicle traffic associated with people traveling between the Honolulu area to the north shore, truck traffic, and movement of agricultural equipment.

Noise-sensitive land uses generally include those uses where exposure would result in adverse effects (e.g., sleep disturbance or annoyance), as well as uses where quiet is an essential element of their intended purpose (e.g., schools or libraries). Residences are of primary concern because of the potential for increased and prolonged exposure of residents to changes in both interior and exterior noise levels.

Other land uses typically considered to be "sensitive receptors" to noise include hospitals, parks, lodging facilities, churches, and other uses where low interior noise levels are essential. The project area is located in a more rural portion of Oʻahu and is primarily dominated by lands under agricultural use. The nearest sensitive receptors are the Hawaiʻi Country Club Golf Course, located approximately one mile north of the existing reservoir, and the Royal Kunia residential area, located over one mile south of the project site.

Hawaiʻi's Community Noise Control regulations are outlined in HAR Title 11, Chapter 46 (State of Hawaiʻi 1981) and state the maximum permissible sound levels in A-weighted decibels (dBA) for different land use zoning districts. dBA is an overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear. The project sites are located within a Class C zoning district, which includes all areas equivalent to lands zoned agriculture, country, industrial, or of a similar type. The maximum permissible dBA for Class C zoning districts is 70 dBA for both daytime (7am-10pm) and nighttime (10pm-7am). These guidelines apply to stationary noise sources, and equipment related to agricultural, construction, and industrial activities. The maximum permissible sound level for impulsive noise is ten dBA above the Class C maximum identified above.

The Community Noise Control regulations also place limitations on the use of construction equipment, which must have a muffler (with the exception of hand tools weighing less than fifteen pounds), and on-site vehicles, construction equipment, and tools with a motor and/or exhaust system cannot be altered, modified, or repaired without proof of effectiveness. Construction activities are permitted from 7am to 6pm, Monday through Friday and 9am to 6pm on Saturdays, with an approved Community Noise Permit. No construction activities are permitted on Sundays.

4.11.2 Environmental Consequences

No Action Alternative

The No Action Alternative would consist of retaining the water system component in Kunia in its current condition. No construction or ground disturbing activities that could create direct noise impacts and/or temporary noise disturbances would occur. The types of noise sources and sensitive receptors would be expected to remain the same as described for the existing conditions. Under the No Action Alternative, routine maintenance activities would continue to occur, as necessary. Furthermore, if repairs and improvements to the existing components and expansion of the reservoir were not made, it is reasonable to assume that the long-term burden of maintenance and repairs at this Kunia site would increase, and the benefits of increased safety and reduced risk of failure would not be realized.

Proposed Action Alternative

Construction activities such as trenching, grading of the new earthen reservoir, water transmission pipelines, and drilling, casing, and pumping of the proposed well will produce a short term, temporary noise impact. Construction is expected to take six months to a year. In cases where the construction noise is expected to exceed the State's "maximum permissible" level as provided in HAR, Chapter 46, Community Noise Control,12 a permit must be obtained from DOH prior to the construction activity. The site is zoned AG-1 and HAR 11-46-3 classifies lands zoned agriculture to be Class C for maximum permissible sound levels in dBA. Table I of HAR 11-46-4(a) states daytime and nighttime maximum permissible levels to be 70 dBA. Since the closest residence, in Royal Kunia, is 1.5 miles away and the land is zoned AG-1, there are no noise mitigation requirements for this project.

The Proposed Action would include the excavation of the existing embankment, removal of sediment from the interior of the reservoir, and the construction of new pipelines for irrigation water transmission. The Proposed Action would include new inlet, outlet and intake, and spillway facilities. A construction period of approximately 9 months is planned for the repairs and improvements. Estimated work hours are from 7:30am to 4:00pm, Monday through Friday. Implementation of the Proposed Action is anticipated to result in short-term noise impacts resulting from construction activities; however, no long-term operational noise impacts are anticipated.

Short Term

Construction activity noise levels associated with the Proposed Action would fluctuate depending on the type, number, and duration of use of various pieces of construction equipment. In addition, construction-related material haul trips would raise ambient noise levels along haul routes, depending on the number of haul trips made and types of vehicles used. Table 4-1 shows typical noise levels produced by various types of construction equipment. As described in

Section 3 Proposed Action and Alternatives, the types of equipment likely to be used during construction of the Proposed Action includes a backhoe/frontend loader, bobcat, dozer, scraper, compactor, grader, concrete truck, haul truck, hydraulic crane, and a water truck.

Table 4-1, Typical Noise Levels from Construction Equipment

Construction Equipment	Noise Level (dBA, Leq* at 50 ft)
Truck	88
Air Compressor	81
Grader	85
Scraper	89
Jack Hammer	88
Dozer	85
Generator	81
Loader	85

Sound Level (Leq): The equivalent steady-state sound level (average), in a stated period of time would contain the same acoustical energy.
Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment, 2006

Construction activities for the Proposed Action would generate temporary increases in noise levels that could affect sensitive receptors. However, based on the distance of the nearest sensitive receptors, there are no sensitive receptors near the project area that would be exposed to construction noise at, or above maximum levels set by the Hawaiʻi Community Noise Control regulations. Further, noise from construction activities generally attenuates (decreases in intensity) at a rate of 6 to 7.5 dBA per doubling of the distance. Therefore, considering the range of typical noise levels from construction equipment identified above in Table 4-1, at an approximate distance of 150 ft or more, noise levels resulting from construction activities for the Proposed Action would be less than the maximum levels set by the Hawaiʻi Community Noise Control regulations. Although noise from multiple sources at the same location results in louder levels than a single source alone, at a distance of one mile or more, the nearest sensitive receptors would not be exposed to noise levels exceeding the maximum levels identified above.

As described in Section 3 Description of the Proposed Action and Alternatives and above, construction activities for the Proposed Action would also result in a short-term increase in traffic on the local roadway network (see 4.15 Traffic and Circulation for further assessment of impacts on roadways). However, this increase would not be sufficient to significantly increase traffic noise levels. Based on the anticipated construction duration of 9 months and the anticipated size of the construction labor force, commute-related traffic would be relatively minimal on a daily basis. Based on the estimated number of truck trips, construction-related traffic would be spread over the duration of the construction schedule and would also be relatively minimal on a daily basis. In addition, the majority of construction truck traffic would move between the staging areas, borrow site, and the different work areas. These routes do not cross any major roads and therefore, would not be anticipated to increase noise levels above existing local vehicle traffic.

Any increase in noise levels resulting from implementation of the Proposed Action would be temporary and would cease when construction is complete. Adverse effects from construction noise are not anticipated to pose a hazard to public health and welfare due to the temporary nature of the work and the absence of sensitive land uses in the surrounding area. Further, all project activities would comply with HAR Chapter 11-46, Community Noise Control regulations. Excessive noise levels generated by construction activities would require that a Community Noise Permit application be filed with Hawaiʻi DOH, Noise, Radiation and Indoor Air Quality Branch. The provisions of the noise permit may include measures to further reduce the effects of construction-generated noise, such as properly maintaining construction and noise attenuation equipment. Implementing the Proposed Action would result in a less than significant impact.

Long Term

No long-term noise impacts are anticipated to result from implementation of the Proposed Action. The Proposed Action would lessen the long-term burden of maintenance and repairs at the reservoir and pipelines would not result in substantial changes to current operation and maintenance activities.

4.12 Air Quality

4.12.1 Affected Environment

Air quality around the project area is typical of agricultural lands in Central Oʻahu. The State Department of Health (DOH) operates four air quality monitoring stations around Honolulu and Leeward Oʻahu. These monitoring stations collect measurements of ambient level pollutants.

The two stations closest to the project site are in Kapolei and Pearl City. For the Kapolei Station, the monitoring equipment is located on Lauwiliwili Street and stands as an independent, secured, station. The Pearl City Station is located on a rooftop on Fourth Street in Pearl City. The Kapolei Station monitors for sulfur dioxide, carbon monoxide, nitrogen dioxide, particulate matter 10 microns or smaller diameter (PM10), and particulate matter 2.5 microns or smaller diameter (PM2.5). The Pearl City Station monitors PM10 and PM2.5. Air quality readings (for Kapolei and Pearl City) have typically shown a Good rating for air quality on a scale that ranged from Good to Hazardous. Higher readings are expected when extreme conditions occur, for instance on days when wind conditions are still, and nearby traffic is extremely heavy or congested.

4.12.2 Environmental Consequences

No Action *Alternative*

The No Action Alternative would consist of retaining the Kunia portion of the Waiāhole Water System in its current condition. No construction or ground disturbing activities that could directly or indirectly affect local or regional air quality would occur. Under the No Action Alternative, routine maintenance activities would continue to occur, as necessary, and air quality would continue to be influenced by climatic conditions, vehicle emissions, and agricultural activities. Furthermore, if improvements to the structures of the Kunia site were not made, it is reasonable to assume that the long-term burden of maintenance and repairs at each Kunia system component would increase, and the benefits of increased safety and reduced risk of failure would not be realized.

Proposed *Action Alternative*

Construction-related air emissions would not be significant as they would be short-term and controlled through implementation of required construction management procedures. Fugitive dust generated by earthwork or other site preparation activities would be controlled by BMPs such as sprinkling of water over exposed dirt areas, covering dirt stockpiles, and temporarily halting site preparation activities during gusty wind periods. Diesel-powered trucks and construction equipment will be properly maintained to mitigate dirty emissions. HAR, Chapter 11-60.1 permit will be obtained by the contractor for use of any regulated stationary source equipment in construction. After construction and during facility operations, no emissions from the Proposed Action would be generated. No mitigation measures are required.

4.12.3 Best Management Practices and Mitigation Measures

Construction activities are expected to have little to no impact based on the limited duration and scope of the project. Where engine exhausts may be a potential source of air pollution, all internal combustion equipment will be governed in accordance with applicable state regulations in HAR, Chapters 11-59 and 11-60, Air Pollution Control.

It is expected that no State or Federal air quality standards will be violated during or after construction. Construction activities such as site clearing and grading will be temporary, and all construction activities will comply with the provisions of HAR, Chapter 11-60.1-33, Fugitive Dust. An effective dust control plan will be implemented, as necessary. Measures to control dust during various phases of construction include:

- Providing an adequate water source at the site prior to start-up construction activities.
- Irrigating the construction site during periods of drought or high winds.

- Controlling dust debris being hauled away from the project site.
- Providing adequate dust control measures during weekends, after hours, and before daily start-up of construction activities.
- Installing silt screening in the areas of disturbance.

During construction, fugitive dust is expected to be generated. Fugitive dust will be controlled with regular wetting of the soil by the contractor and/or with the use of dust screens, as required. There will be no long-term or secondary effects to air quality once construction is completed.

In the long-term, improved operational efficiencies, equipment, and technology, as well as the use of cleaner-burning fuels and adherence to air pollution controls and regulations would help to offset the increased emissions. Construction and operational impacts are not expected to be significant.

Other past, present, and reasonably foreseeable actions have used and may use heavy machinery in the future. Eventually the project site is expected to be fully developed as the proposed roadway project would facilitate future planned residential development. This would limit opportunities for other future projects, and therefore the use of heavy machinery contributing to air quality impacts. Cumulatively, however, the impact on air quality from all future planned projects, including the proposed project, is not considered as significant due to the limited intensity and duration of construction.

4.13 Recreational Resources

4.13.1 Affected Environment

The Central Oʻahu region includes many recreational sites, such as the Central Oʻahu Regional Park, Wahiawa Botanical Garden, Wahiawa Freshwater Park, Waipahu Cultural Garden, neighborhood parks, and golf courses, as described in further detail below (CCH 2002):

- Central Oʻahu Regional Park is a new 269-acre park being developed on a triangle-shaped area across Kamehameha Highway from the Waipiʻo-Gentry planned community. The park includes a sports complex, picnic areas, and pedestrian paths.
- Wahiawa Botanical Garden is a 27-acre park with a unique collection of plants representing the mid-level rain forest habitat. It is located in a small ravine in the center of Wahiawa and is operated by the City Department of Parks and Recreation.
- Wahiawa Freshwater Park is a 66-acre state recreation area surrounding Lake Wilson, which includes picnic areas and year-round freshwater shoreline and boat fishing areas on Oʻahu.
- Waipahu Cultural Garden is a 49-acre park owned by the City. The park operates a recreated plantation village and a museum.

- Neighborhood parks in Central Oʻahu include the Kunia Neighborhood Park, which serves the Royal Kunia master planned community, the Kupuoni Neighborhood Park, and the Hoaeʻae Community Park.
- Central Oʻahu has eight public and private golf courses, including the City-operated Ted Makalena Golf Course on the Waipiʻo Peninsula and privately-operated Hawaiʻi Country Club, Mililani, Royal Kunia and Waikele golf courses. The U.S. military operates the Leileihua golf course near Wheeler Army Air Field and the Kalakaua golf course at Schofield Barracks.

There are no recreational resources in the project area or vicinity of the reservoir, as the majority of the project area is reserved for agricultural production and associated land uses. The nearest recreational resources are the Hawaiʻi Country Club Golf Course, located approximately one mile north, and the Kunia Neighborhood Park, approximately 2 miles south of the project site.

4.13.2 Environmental Consequences

No Action Alternative

The No Action Alternative would consist of retaining the Kunia portion of the Waiāhole Water System in its current condition. No construction or ground disturbing activities that could directly or indirectly affect recreational resources would occur. Under the No Action Alternative, routine maintenance activities would continue to occur, as necessary. Furthermore, if improvements to the Kunia site were not made, it is reasonable to assume that the long-term burden of maintenance and repairs at each Structure and the reservoir would increase, and the benefits of increased safety and reduced risk of failure would not be realized.

Proposed Action Alternative

The Proposed Action would not involve the construction of new housing, and therefore, would not increase demand for recreational facilities. The existing Kunia facility is used strictly for irrigation purposes and are not utilized by local residents for any recreational purposes. The Proposed Action would not permanently add, remove, or alter recreational facilities. Therefore, there would be no limitations on the use of existing recreation facilities or reduction in the availability of recreational opportunities in the project area. Implementing the Proposed Action would result in a less than significant impact.

4.14 Socioeconomics and Environmental Justice

4.14.1 Affected Environment

The project site is located entirely in an agricultural area and is surrounded by farmland. Upon completion of construction, the expanded reservoir and water transmission pipe improvements in Kunia will be integrated into the overall Waiāhole Water System and will serve surrounding and

‘Ewa district farmlands. The proposed project is approximately 1.5 miles from the residential neighborhood of Royal Kunia.

Recent data gathered by the U.S. Census shows Census Tract 89.24 (Table 4-1) to be home to 7,304 persons, 0.7% of the total population of the City. Most residents identify themselves as Asian. The share of occupied housing units is greater for this Census tract than for the County as a whole. The characterization of the residents that emerges is of a neighborhood of middle- to high-income workers.

Economic Considerations. The Proposed Action will involve construction for a period of approximately 9 months. The reservoir expansion and transmission pipes will not be operational until a later date. Consequently, the proposed project would have positive economic impacts by ensuring water security for users and businesses. If the proposed improvements are put into production, they will provide additional sources of irrigation water for the farmland crops for the region and island. Table 4-2 and Table 4-3 illustrates there is overall growth on O‘ahu relative to the Census Tract within the project site. The proposed project would support the projected population growth to about the year 2045.

Social Considerations. The Proposed Action is intended to repair the aging Waiāhole Water System in anticipation for diversified agricultural crop irrigation demand increase. There would be no need for displacement of existing structures or buildings or to relocate adjacent land uses.

The site is located on agricultural land with no surrounding residences. No noise mitigation is required for construction. If placed into production, the surrounding agricultural activity and the island will have optimally operational irrigation water sources for the ‘Ewa region.

Table 4-2, 2016 American Community Survey Indicators, Census Tract 89.24

Population Characteristics	Census Tract 89.24		City and County of Honolulu	
	Number	Percent	Number	Percent
Population	7,302		992,605	
Median Age (Years)	37.8		37.4	
Race (alone or in combination)				
White		25.4%		23.0%
Black or African American		0.7%		23.0%
American Indian and Alaska Native		2.0%		1.3%
Asian		78.3%		36.6%
Native Hawaiian and other Pacific Islander		17.9%		14.9%
Some other race		2.2%		1.3%
Average Number of Race Identifications	1.27		1.68	
Hispanic or Latino (of any race)	453		96,722	
Housing Units				
Total Housing Units	2,066		347,458	
Occupied Housing Units	2,017	97.6%	309,169	89.0%
Median Household Income	116,010		80,513	
Employment Status				
Armed	179		38,109	
Civilian	4,131		488,421	
Civilian Unemployment rate		3.1%		5.1%
Income Below Poverty Line (past 12 months)				
All People		1.7%		8.5%
Under 18 years		2.2%		9.6%
18 to 64 years		1.0%		8.0%
65 years and over		4.5%		8.9%
Total with Disability		7.8%		11.0%
Under 18 years		1.2%		2.9%
65 years and over		31.9%		33.9%

Source: 2012-2016 American Community Survey, five-year estimates for Census Tract data. 2016 American Community Survey 1-year data for the City and County of Honolulu data. Both are downloaded from http://census.Hawaiʻi.gov/acs/acs-2016/. Since 2005, economic and household information that had earlier been part of the decennial census long form is gathered annually by the U.S. Census.

Table 4-3, 2010-2045 DBEDT Long Range Forecast

Population Characteristics	City and County of Honolulu		Average Annual Growth rate
	Number	Percent Change	
Population 2010	956,325		
Population 2045	1,073,796	1.2%	0.3%

Source: Population and Economic Projections for the State of Hawaiʻi to 2045. Data Downloaded from http://dbedt.Hawaiʻi.gov/economic/economic-forecast/2045-long-range-forecast/

4.15 Public Services and Utilities

4.15.1 Public Roads

Traffic and *Circulation*

Affected Environment. The proposed reservoir, water transmission facilities and well site vary in proximity from the corner of Kunia Road (State Route 750) and Plantation Road on the western shoulder of Kunia Road to approximately 1-mile west of this location. Approximately 2.5 miles south of the project site is the Interstate Route H-1 (H-1 Freeway) with Kunia Road being the closest highway interchange. Kunia Road is a principal north-south road that is a two-lane minor roadway starting at Anonui Street to Schofield Barracks; the project site is located within this area. Access to the project site is via a westbound unnamed cane haul dirt road off Kunia Road and across from Plantation Road which runs eastbound. Traffic on this dirt road is minimal and not open to the public.

4.15.2 Sewer, Electricity and Telecommunications

Affected Conditions. There are no restroom facilities on-site for this property. There is no sewer service to this site and no wastewater is currently discharged. Electrical service is provided by the Hawaiian Electric Company (HECO) through overhead lines along Kunia Road. Electricity is primarily used to power the existing instrument house and lighting on the property. Hawaiian Telecom and Spectrum (aka Ocean TWC) also provide services for the site.

4.15.3 Solid Waste

Affected Conditions. Solid waste generated at the site consists primarily of vegetation clippings and debris from regular maintenance of the reservoir grounds.

4.15.4 Education

Affected Conditions. The proposed reservoir, water transmission facilities and well are located in the State Department of Education's Pearl-City Waipahu Complex Area. It contains seventeen public schools, including elementary, middle, and high schools. The nearest public school is Kaleiopuʻu Elementary which is located less than half a mile from Kunia Road, close to the H-1 Freeway.

4.15.5 Parks and Recreation

Affected Conditions. The DPR operates parks and recreational facilities throughout the island. This project is in the Leeward park system with the closest park to the project site being located at 94-709 Kaʻaholo Street, Waipahu, Hoʻaeʻae Community Park. This park is approximately 3.2 miles from the project site. Additionally, the Royal Kunia Country Club, located at 94-1509 Anonui Street, Waipahu, is approximately 3.3 miles from the project site.

4.15.6 Medical and Emergency Services

Affected Conditions: The nearest full-service hospital is the Queens Medical Center, located approximately 4 miles from the project site at 91-2141 Fort Weaver Road, ʻEwa Beach. Emergency medical service (EMS) is provided by the City with an EMS ambulance unit based at the Waipahu Fire Station, approximately 4 miles from the project site.

4.15.7 Fire Protection

Affected Conditions. The HFD provides emergency service to the project area from its Waipahu Fire Station located approximately 4 miles south from the project site. Support could come from the Waikele Fire Station, located approximately 5.1 miles southeast of the project site.

4.15.8 Police

Affected Conditions. The project area is in Sector 1 (Waipahu, Waikele) of the HPD Patrol District 3 – Pearl City. The district uses the department's office at the Pearl City Police Station located off Waimano Home Road as its district's headquarters.

Environmental Consequences and Mitigation Measures.

No Action Alternative

The No Action Alternative would consist of retaining existing components at the Kunia site in their current condition. No construction or ground disturbing activities that could directly or indirectly affect utilities and public services would occur. Under the No Action Alternative, routine maintenance activities would continue to occur, as necessary. Furthermore, if improvements to the reservoir were not made, it is reasonable to assume that the long-term burden of maintenance and repairs at each component would increase, and the benefits of increased safety and reduced risk of failure would not be realized.

Proposed Action *Alternative*

The construction labor force is estimated to average approximately 10-20 persons per work day over the 9-month construction period.

The ADC utilizes a portion of the project site for the storage of materials for repair and maintenance. The availability of this space has enabled the storage of sufficient materials consisting of piping and appurtenances that can be used for the construction of the project. It is expected that because this material would be used for the project, that this would significantly reduce the need for the delivery using the Kunia Road, and Interstate H-1 and H-2.

The project contractor will also have at their disposal, the use of the following mitigative measures:

- The scheduling of deliveries of other required construction materials and equipment to occur throughout the construction period to avoid peak-periods and minimize daily disruption to area residents. As noted, this is facilitated by a project site that is relatively large with open spaces for staging and storage of materials/equipment.

- The majority of construction truck traffic would move between the staging area and the project subareas. These routes do not cross any major roads and therefore, would not impact local vehicle traffic. However, materials and equipment would need to be brought to the site from sources within the Honolulu area. Delivery of these materials and equipment would use Kunia Road and either Interstate H-1 or Interstate H-2, depending on the location of the materials.

- The project contractor could evaluate construction materials and equipment that can be pre-assembled prior to transportation to the project site to reduce the total number of truck trips required along the Kunia Road, H-1 or H-2. Most of these trips are expected to occur during construction mobilization when materials are brought to the reservoir and staging area.

- Material and soil removed at the reservoir would be reused to the maximum extent possible during construction. Any construction debris and waste materials would be disposed of off-site at a permitted and approved waste disposal site such as the PVT Construction and Demolition Debris Landfill. Excess excavated material not reused for embankment will also be transported to an on-site ADC stockpile location.

The contractor's preliminary estimate of truck traffic would be on the order of from approximately four to five total truck trips along the Kunia Road, Interstate H-1, and/or Interstate H-2 over the period of construction.

Construction activities at the project site should have no long-term impacts on traffic for Kunia Road and the dirt road. Operations at the project site are self-operating and run without an operations crew; only routine maintenance is required to monitor and service the facility. The project site should not affect commuter traffic on the surrounding roadways. During reservoir and related water system improvements construction, some traffic will be generated to transport equipment and supplies. These trips would be short-term, infrequent, and temporary. The construction contractor would schedule these deliveries during off-peak hours to avoid any delays in travel time by the public. A Traffic Plan along with the Engineering Plans will be submitted to the CCH for review and approval prior to the commencement of construction activities at the project site. Post construction, operational impacts on traffic resulting from the proposed backup irrigation well are expected to be minimal due to its proposed location west of the Kunia Road right-of-way. Should there be any issue concerning maintaining appropriate clearance, engineering plans will be submitted to HDOT for review.

Solid waste and minor construction debris generated at the site during construction is not anticipated to have a notable effect on the island's landfills or solid waste disposal sites. Any recycling or reuse of construction debris by the contractor would help minimize the amount of solid waste disposal.

When construction is completed, little or no increase in generated solid waste over existing generated solid waste from the site is expected to occur.

No police assistance is required to control traffic during the construction of the Waiāhole Water System improvements. Security of construction equipment stored on the staging site during construction would be the responsibility of the contractor.

After construction of the proposed facilities, long-term well operations are not expected to impact regular police operations serving the area. No mitigation is needed.

If the Waiāhole Water System improvements are put into operation, they will provide increased irrigation water supply for the area school grounds. The Proposed Action is not expected to generate any adverse effect on the functioning of the State's educational system. No mitigation is needed.

The Proposed Action is not expected to generate adverse effects on the functions of the City's parks system. No mitigation is needed.

If the proposed Waiāhole Water System improvements are put into production, they would provide an additional irrigation water supply to the City's medical facilities grounds. The Proposed Action would not adversely affect existing medical and emergency services in the community. No mitigation is needed.

As part of the ADC's objective of system reliability and adequacy, the proposed Waiāhole Water system improvements, if implemented and once operational, would ensure uninterrupted reliable future irrigation water supplies to grounds of emergency services facilities such as the fire department. No mitigation is required.

SECTION 5 RELATIONSHIP TO LAND USE POLICIES, PLANS, AND CONTROLS

Federal Government, State of Hawaiʻi and City and County of Honolulu policies, plans, and land use controls are established to guide development in a manner that enhances the environment and quality of life. The establishment of policies, plans, and land use controls at all levels of government are further promulgated to help ensure that the long-term social, economic, environmental, and land use needs of the community and region can be met. The proposed project's relationship to land use policies, plans, and controls for the region and proposed activity are as follows.

5.1 Federal

The access roadway and proposed waterline at the Project will cross two Honouliuli Stream branches within Honouliuli Gulch. The more easterly branch (left branch) had flowing water at the time of our survey and was much overgrown with Guinea grass. The west (right) branch was dry. Honouliuli Stream is a perennial stream in the Hawaiʻi Stream Assessment (HCPSU, 1990) and Hawaiʻi Watershed Atlas (Parham et. al, 2008). As proposed, the waterline pipe crossing both branches will be located within a substantial berm of the existing access roadway. At the roadway, stream branches are in pipe culverts well below the ground surface. So long as the ditch to bury the proposed waterline pipe is above the culvert and no disturbance to the culverts or any depositions of fill into the stream beds will occur, a Department of the Army permit will not be required.

5.2 State of Hawaiʻi

5.2.1 Hawaiʻi State Plan

The Hawaiʻi State Plan, adopted in 1978, and promulgated in HRS, Chapter 226, consists of three major parts:

> Part I, describes the overall theme including Hawaiʻi's desired future and quality of life as expressed in goals, objectives, and policies.
>
> Part II, Planning Coordination and Implementation, describing a statewide planning system designed to coordinate and guide all major state and county activities and to implement the goals, objectives, policies, and priority guidelines of the Hawaiʻi State Plan.
>
> Part III, Priority Guidelines, which express the pursuit of desirable courses of action in major areas of statewide concern.

The proposed project is consistent with the objectives and policies of the Hawaiʻi State Plan. Specifically, the Proposed Action will increase and diversify the State's economic base through enabling the availability of a reliable irrigation water supply in the ʻEwa district. An analysis of the project's ability to meet the objectives, policies, and priority guidelines of the Hawai'i State Plan are provided in **Table 5-1** below.

Table 5-1, Hawaiʻi State Plan Applicability to the Proposed Project

Hawaiʻi State Plan Objectives, Policies, and Priority Guidelines	Applicability to the Proposed Project
Objectives and Policies	
§226-5 Objective and policies for population	Not Applicable
§226-6 Objectives and policies for the economy--in general	Not Applicable
§226-7 Objectives and policies for the economy—agriculture	Applicable
§226-8 Objective and policies for the economy--visitor industry	Not Applicable
§226-9 Objective and policies for the economy--federal expenditures.	Not Applicable
§226-10 Objective and policies for the economy--potential growth activities	Not Applicable
§226-10.5 Objectives and policies for the economy--information industry	Not Applicable
§226-11 Objectives and policies for the physical environment--land-based, shoreline, and marine resources.	Not Applicable
§226-12 Objective and policies for the physical environment--scenic, natural beauty, and historic resources.	Not Applicable
§226-13 Objectives and policies for the physical environment--land, air, and water quality	Not Applicable
§226-14 Objective and policies for facility systems--in general	**Applicable**
§226-15 Objectives and policies for facility systems--solid and liquid wastes	Not Applicable
§226-16 Objective and policies for facility systems--water	Applicable
§226-17 Objectives and policies for facility systems--transportation	Not Applicable
§226-18 Objectives and policies for facility systems--energy	Not Applicable
§226-18.5 Objectives and policies for facility systems--telecommunications	Not Applicable
§226-19 Objectives and policies for socio-cultural advancement--housing	Not Applicable
§226-20 Objectives and policies for socio-cultural advancement--health	Not Applicable
§226-21 Objective and policies for socio-cultural advancement--education	Not Applicable
§226-22 Objective and policies for socio-cultural advancement--social services	Not Applicable
§226-23 Objective and policies for socio-cultural advancement--leisure	Not Applicable
§226-24 Objective and policies for socio-cultural advancement--individual rights and personal well-being	Not Applicable
§226-25 Objective and policies for socio-cultural advancement--culture	Not Applicable
§226-26 Objectives and policies for socio-cultural advancement--public safety	Not Applicable
§226-27 Objectives and policies for socio-cultural advancement--government	Not Applicable
Priority Guidelines	
§226-102 Overall Direction	**Applicable**

Table 5-2, Applicable Sections of the Hawaiʻi State Planning Act

Section	Chapter – Part I. Overall Theme, Goals, Objectives and Policies
226-16	**OBJECTIVES AND POLICIES FOR FACILITY SYSTEMS – WATER**
(a)	Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational and other needs within resource capacities.
(b)	To achieve the facility systems water objective, it shall be the policy of this State to:
(1)	Coordinate development of land use activities with existing and potential water supply.
(2)	Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.
(4)	Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.
(5)	Support water supply services to areas experiencing critical water problems.

Comments: The proposed Waiāhole Water System improvements project purpose and intent is consistent with this State objective because the goal of the project is to achieve reliable irrigation water to meet future water requirements for Oʻahu.

226-14	OBJECTIVES AND POLICIES FOR FACILITY SYSTEMS – IN GENERAL
(a)	Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.
(b)	To achieve the general facility systems objective, it shall be the policy of this State to:
(1)	Accommodate the needs of Hawaiʻi's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.
(2)	Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.
(3)	Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.

Comments: ADC intends to coordinate its plans with State and City and County of Honolulu plans to allow flexibility in design and development of facility systems to provide compliance with minimum agency design standards.

Table 5-3, Applicable Sections of the Hawaiʻi State Planning Act

Section	Chapter – Part I. Overall Theme, Goals, Objectives and Policies
(4)	Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.
(5)	Consider multiple uses in watershed areas, provided such uses do not detrimentally affect water quality and recharge functions.
(8)	Pursue compatible relationships among activities, facilities, and natural resources.

Comments: The Proposed Action would occur on an existing ADC site on agricultural lands in south central Oʻahu. There will be no impact to shoreline or marine resources because of its inland location. This project will not adversely impact the surrounding environment and is compatible with existing uses. This EA, prepared for ADC, evaluated the potential impacts of the project and, where applicable, indicated potential mitigation measures to minimize or avoid impacts.

226-12	OBJECTIVES AND POLICIES FOR THE PHYSICAL ENVIRONMENT – SCENIC, NATURAL BEAUTY, AND HISTORIC RESOURCES
(a)	Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaiʻi's scenic assets, natural beauty, and multicultural/historical resources.
(b)	To achieve the scenic, natural beauty, and historic resources objective, it shall be the policy of this State to:
(1)	Promote the preservation and restoration of significant natural and historic resources.
(3)	Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.
(4)	Protect those special areas, structures, and elements that are an integral and functional part of Hawaiʻi's ethnic and cultural heritage.

Comments: The Proposed Action would involve primarily underground improvements which would not interfere with aboveground scenic amenities or visual corridors. The historic and cultural assessment conducted by CSH found "no historic properties affected." Historic properties in the vicinity of the project, such as the Waiāhole Ditch, will not be impacted by the proposed project.

226-13	OBJECTIVES AND POLICIES FOR THE PHYSICAL ENVIRONMENT – LAND, AIR, AND WATER QUALITY
(a)	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 Hawaiʻi's land, air, and water resources.
(2)	Greater public awareness and appreciation of Hawaiʻi's environmental resources.
(b)	To achieve the land, air, and water quality objectives, it shall be the policy of this State to:
(2)	Promote the proper management of Hawaiʻi's land and water resources.

Section	Chapter – Part I. Overall Theme, Goals, Objectives and Policies
(3)	Promote effective measures to achieve desired quality in Hawaiʻi's surface, ground, and coastal waters.

Comments: It is in the ADC's inherent responsibility to exercise proper management of Oʻahu's land and water resources as well as to maintain and pursue their optimal operational storage and efficient transmission facilities in a sustainable way so as not to hinder the physical environment's long-term integrity.

5.2.2 State Land Use Law

The Hawaiʻi State Legislature adopted the State Land Use Law in 1961 to protect Hawaiʻi's valuable land from development that resulted in short-term gains from a few developments and long-term losses to the income and growth potential of the state's economy. Accordingly, the Legislature established an overall framework of land-use management. HRS, Chapter 205, placed all lands in the state in one of four land use districts: Urban, Agricultural, Conservation, or Rural (the Rural District was added in 1963), and established the State Land Use Commission to administer the law.

The State Land Use District Maps, which designates the location of the various land use districts, identifies this site in the Agricultural District. The proposed reservoir expansion, transmission pipes, and well are permitted in the designated Agricultural District. As such, the Proposed Action would take place in an agricultural environment where agricultural lands are anticipated and planned. No costly changes in land use, buildup of infrastructure, or consequent adverse impacts are anticipated.

5.2.3 State Environmental Policy

The State Environmental Policy under HRS Chapter 344 established an environmental policy that (1) encourages productive and enjoyable harmony between people and their environment; (2) promotes efforts that would prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity; and (3) enriches the understanding of the ecological systems and natural resources important to the people of Hawaiʻi.

The Proposed Action is consistent with Section 344-3(1) of the State Environmental Policy which states:

> *Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony and fulfill the social, economic, and other requirements of the people of Hawaiʻi.*

The ADC's mission is to provide a safe, efficient, and reliable irrigation water storage and delivery system for its customers. Efforts are also focused on protecting the natural environment, important watersheds, and water sources by monitoring the island's rainfall and aquifer water levels; and taking appropriate precautions to ensure the sustainability of the island's irrigation water supplies.

5.2.4 State Agriculture Functional Plan

The State Functional Plan promotes the broader goals, objectives, and policies of the State Plan through specific actions identified as Implementing Actions (IA). The proposed project is consistent with the objectives and actions of the State Agriculture Functional Plan (DBEDT 1991) by facilitating continued growth, diversification and increased self-sufficiency of diversified agriculture through the State's support of infrastructure systems.

5.2.5 Coastal Zone Management Act (CZMA)

The Federal Coastal Zone Management (CZM) enforcement authority (Public Law 92-583), as amended, has been delegated to the state and enacted as HRS, Chapter 205A. The Hawaiʻi CZM Program was promulgated in 1977 in response to the federal CZM Act of 1972. The areas encompassed by the CZM are all the lands and waters of the state, including the northwestern Hawaiian Islands. Following is a list of the CZM's main objective and policy headings and an assessment of the project's relationship to those public parameters.

Recreational Resources
The proposed project is not located near the coast and would not interfere with, nor obstruct public efforts to meet the CZM objective and policies relating to coastal recreational opportunities accessible to the public.

Historic Resources
There are no archaeological, cultural, or historic resources of significance directly related to the project site. The Waiāhole Ditch is itself designated SIHP # 50-80-09-2268 and has been the subject of several archaeological studies along portions of its approximately 22-mile length. The present project area connects with the Waiāhole Ditch at "Ditch Connection Site 1", "Ditch Connection Site 2", and at the hairpin turn site. While these are understood to involve very minor changes to the Waiāhole Ditch, they would arguably have a small effect on SIHP # -2268. Based on the findings of this study, SIHP # 50-80-09-2268 is assessed as significant under HAR §13-284-6:

> Criteria a – Be associated with events that have made a significant contribution to the broad patterns of our history.
>
> Criteria c - Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value.
>
> Criteria d - Have yielded or is likely to yield, information important for research on prehistory or history.

The historic property has yielded information on the agricultural history of the area and contributed greatly to the development and evolution of the ʻEwa Plain throughout its history, and the portions of the Waiāhole Ditch within the present project area retains integrity of location, design, materials, and workmanship.

The proposed project is regarded as routine maintenance, will have minimal impact on the Waiāhole Ditch, and is not anticipated to diminish the appearance, integrity or significance of this historic property. Therefore, the Proposed Action is not expected to adversely affect the identified historic features within proximity the property.

Scenic and Open Space Resources
The proposed action would not interfere with nor obstruct public efforts to meet the CZM objective and policies relating to protection, preservation, and restoration or improvement of the quality of coastal scenic and open space resources.

Coastal Ecosystem
The proposed project is inland, located in Central Oʻahu, and thus, would not adversely affect valuable coastal ecosystems, including reefs.

Economic Uses
The CZM objective and policies pertaining to economic uses provide for public or private facilities and improvements important to the state's economy in suitable locations. The selected location is critical to the effective and efficient operation of the Waiāhole Ditch Kunia facility for increased demand on diversified agriculture on Oʻahu as part of the State's objective of achieving food security and sustainability. An ADC goal is to ensure a reliable, safe and dependable supply for current and projected requirements.

Coastal Hazards
The proposed project is located more than 4 miles, upland, from the West Loch of Pearl Harbor. It would not be adversely affected by coastal hazards, such as tsunami inundation, storm waves, stream flooding near the shoreline, and coastal erosion, subsidence, or pollution.

Managing Development
The Proposed Action would not interfere with public efforts to improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Public Participation
The Proposed Action is engaged in public participation by undertaking this EA preparation and public comment and response process. Through this environmental review, information and public awareness are generated on the project and its affected environment.

Beach Protection
The Proposed Action would not interfere with public efforts to protect beaches for public use and recreation. If placed into production, operations of the proposed project would not have any direct adverse impact on these natural resources of the state.

Marine Resources
The Proposed Action would not obstruct public efforts to implement the State's ocean resources management plan.

5.2.6 Commission on Water Resource Management

According to the DLNR Commission on Water Resource Management (CWRM), the proposed water supply source for the project is in a designated water management area (correspondence dated 2-9-21). The purpose of the proposed project is to repair and improve the Waiāhole Water System for agricultural irrigation in Kunia. As such, agricultural irrigation is considered the highest and best use of surface water (CWRM 2008). The proposed backup irrigation water well in Phase 2 may require a Well Construction Permit prior to well construction (CWRM 2021).

5.3 City and County of Honolulu

5.3.1 General Plan

The City's General Plan is comprised of 11 sections relating to: *Population; Economic Activity; Natural Environment; Housing; Transportation and Utilities; Energy; Physical Development and Urban Design; Public Safety; Health and Education; Culture and Recreation;* and *Government Operations and Fiscal Management*.

The sections on *Natural Environment*, and *Transportation and Utilities,* are relevant to the Proposed Action and this EA, and are presented and described in Table 5-4.

Table 5-4, Applicable Sections of the City and County of Honolulu General Plan

Section	Objective/Policy
NATURAL ENVIRONMENT	
Objective A	To protect and preserve the natural environment.
Policy 4	Require development projects to give due consideration to natural features such as slope, flood and erosion hazards, water-recharge areas, distinctive land forms, and existing vegetation.
Policy 7	Protect the natural environment from damaging levels of air, water, and noise pollution.
Policy 10	Increase public awareness and appreciation of Oʻahu's land, air, and water resources.
Objective B	To preserve and enhance the natural monuments and scenic views of Oʻahu for the benefit of both residents and visitors.
Policy 1	Protect the Island's well-known resources: its mountains and craters; forests and watershed areas; marshes, rivers, and streams; shoreline, fishponds, and bays; and reefs and offshore islands.
Objective B	To meet the needs of the people of Oʻahu for an adequate supply of water and for environmentally sound system of waste disposal.
Policy 1	Develop and maintain an adequate supply of water for both residents and visitors.
Policy 2	Develop and maintain an adequate supply of water for agricultural and industrial needs.
Policy 4	Encourage a lowering of the per-capita consumption of water and the per-capita production of waste.
Objective C	To maintain a high level of service for all utilities.
Policy 1	Maintain existing utility systems in order to avoid major breakdowns.

Section	Objective/Policy
Policy 2	Provide improvements to utilities in existing neighborhoods to reduce substandard conditions.
Policy 3	Plan for the timely and orderly expansion of utility systems.
Objective D	To maintain transportation and utility systems which will help Oʻahu continue to be a desirable place to live and visit.
Policy 1	Give primary emphasis in the capital -improvement program to the maintenance and improvement of existing roads and utilities.
Policy 2	Use the transportation and utility systems as a means of guiding growth and the pattern of land use on Oʻahu
Policy 4	Evaluate the social, economic, and environmental impact of additions to the transportation and utility systems before they are constructed.

Comments: The Proposed Action is consistent with the above City objectives and policies. It is a project of limited scope and scale calling for maintenance improvements consisting of a reservoir, transmission pipes, and a well in anticipation of future irrigation water uses within Central Oʻahu and elsewhere on the island. The project is proposed to provide a safe and reliable irrigation water system for diversified agriculture, and landscape areas to meet demand from the ʻEwa-Waipahu area.

The proposed Waiāhole Water System Improvements would have no significant impact on the environment. The ADC is responsible for ensuring a reliable and efficient irrigation water storage and distribution system and are consistent with City objectives and policies.

5.3.2 Central Oʻahu Sustainable Communities Plan

"In 1989, the Honolulu City Council approved changes to the General Plan which designated the urban fringe areas in Central Oʻahu as one of Oʻahu's principal residential development areas. Since then, Central Oʻahu, along with the Primary Urban Center and the Secondary Urban Center and urban fringe areas in ʻEwa, have provided the bulk of the new housing developed on the island".

The intent of the COSCP is to guide public policy, investment, and decision-making through the 2025 planning horizon with population growth in planned community developments as they are built out and to look beyond 2025 in order to better understand what Central Oʻahu would look like "fully" developed. The intent is to manage growth by balancing the need to accommodate development and preserve agricultural land and open space. As noted in a letter from the City and County of Honolulu DPP (February 19, 2021), revisions to the GP and COSCP and Bill 41 (2019), CD2, respectively, are currently pending review and approval by the Honolulu City Council.

The vision for the COSCP's future emphasizes containing urban fringe growth with preservation of open spaces and agricultural lands. The key elements of the COSCP include:

- Protect agricultural lands, open space, and natural, historic, and cultural resources;
- Provide adequate infrastructure to meet the needs of new and existing development.

The ADC is aware of the need to integrate water resource planning for landscape amenities in urban development, in-stream uses, agricultural uses, possible use of reclaimed water, and the sustainability of groundwater aquifers. As a result, ADC is engaged in long-range integrated water resources planning in coordination with the CWRM. The project action therefore is consistent with COSCP's objectives.

Adequate Facilities Requirement
Section 5.4.1 of COSCP emphasizes the adequacy of infrastructure to facilitate orderly development. The proposed project seeks to ensure safe and dependable supply of irrigation water. The project, therefore, meets the objectives of "Adequate Facilities Requirement".

5.3.3 City and County of Honolulu

Land Use Ordinance
The LUO of the City regulates land uses on the island of Oʻahu. The LUO is a set of regulations, consisting of permitted land uses for specific agricultural areas, development standards, application procedures, and criteria for granting permits and other land use approvals.

The project parcels, TMK nos. 9-2-001:020 and 9-2-004:006, are designated as AG-1. This zoning designation allows ADC to continue use of the property for public utility purposes.

Climate Change and Sea Level Rise Guidance (June 5, 2018)
The City's Climate Change Commission issued its Sea Level Rise and Climate Change Briefs ((Revised Charter of Honolulu Section 6-107(h), June 5, 2018). The goals of the charter revisions include the need for projects to demonstrate mitigation measures are being taken to reduce greenhouse gas emissions and build sustainability and resilience in the face of rapidly changing climate. While construction activities will be expected to increase GHGs, such impacts will be temporary and short-term in duration. Upon project completion, the increased ditch conveyance efficiency is in the best interest of farmers and the natural environment. The objectives of the Central Oʻahu Water Security Plan are to reduce water loss and enhance the system's efficiency by increasing storage capacity, thereby supporting the long-term facilitation of the island and State's health of the diversified agriculture industry which is a foundation for Hawaiʻi's goal of achieving self-resilience through a steady and sustainable food supply.

SECTION 6
SECONDARY AND CUMULATIVE IMPACTS

The proposed project does not appear to have the potential to involve any significant secondary impacts to property valuation, population, housing, community services, public facility needs, employment, and compatibility with surrounding land uses. While there are anticipated changes in several environmental and social categories, as noted above, these uses are consistent with prior uses in the area. These changes are less than significant.

Cumulative impacts are those that result from past, present, and reasonably foreseeable future actions, combined with the potential impacts of a specific (proposed) project. Cumulative impacts may result from a series of projects that individually do not generate significant adverse effects, but collectively add up to a significant negative impact on the environment.

The cumulative impacts of the proposed project along with past and reasonably foreseeable future projects proposed were assessed based upon available information. Potential future projects or ongoing activities that could affect the same resources as, or involve similar impacts to the proposed project are listed below:

- Halekua-Kunia, LLC and HRT, Ltd., are owners of approximately 210 acres that are to be developed as the Royal Kunia, Phase II project (Hawaiʻi DOH 2013). Halekua-Kunia has received approval of its application for a Planned Development-Housing permit from the DPP. Plans for Royal Kunia, Phase II include 2,007 single-family and multi-family dwelling units, and will also include several community parks and associated recreational facilities.

- The HDOA has the authority to plan, develop and manage agricultural parks on public lands to increase the supply of diversified agricultural lands. The proposed Kunia Agricultural Park would be located on approximately 150 acres of State lands known to be highly suited to a variety of crops and currently under cultivation (State of Hawai'i 2013). The proposed Kunia Agricultural Park would afford about 24 lessees the ability to both farm and live on the property through lease of farm dwelling lots with an associated cluster home to be developed and owned by the State. HDOA will be responsible for developing and maintaining the agricultural infrastructure and for securing irrigation water for the Kunia Agricultural Park. The HDOA's request for an allocation of agricultural water from the Waiāhole Ditch is pending before the DLNR, CWRM.

- The 617-acre Mahi Solar project proposes to produce clean energy and support local agriculture in Kunia, enabling HECO to burn less fossil fuel and emit less greenhouse gasses. The project also includes a 480 MWh battery system that would store solar energy generated during the day to provide power at night, with further support from an electrical substation to connect to the Oʻahu grid.

Named *Mahi* (which means "to cultivate"), this project plans to work with the Hawaiʻi Farm Bureau and local farmers to find innovative agricultural uses for land between and under PV panels. Preliminary locational information indicates both the Mahi and Waiāhole Water System improvements projects will only share use of existing Plantation Road for access to the respective sites via Kunia Road. The Mahi Solar project would occupy 617 acres of land within portions of project parcels, TMK nos. 9-2-001:020 and 9-2-004:006, west of the 8.23 acres of the same parcels on which the Waiāhole Water System facilities exist.

Coordination between ADC and the developer of Mahi Solar project has been initiated via email (February 22, 2021) in conjunction with this Chapter 343 HRS EA (CCH DPP in a letter dated 2-19-21 preassessment phase).

The proposed project is being developed as a single project, and no substantial effect to existing environmental conditions are anticipated to result. The proposed project does not involve a commitment to larger actions. Sections in this document have discussed how the proposed project would not lead to adverse impacts. Where potentially adverse impacts have been identified, BMPs have been proposed to further reduce adverse effects. Further, anticipated benefits of the proposed project include ensuring a reliable supply of water and expanding the size of the existing reservoir to reduce water losses and leakage in the system, thereby improving the availability of water resources for agricultural purposes. Therefore, the incremental effects of the proposed project combined with the effects of present, past, and probable future projects are not cumulatively considerable.

SECTION 7
AGENCIES, ORGANIZATIONS, AND INDIVIDUALS CONSULTED

Early consultation for the proposed action was carried out in January 2021 with 13 agencies and stakeholder groups as part of the scoping/Draft EA preparation process. Five agencies provided Draft EA preparation comments and a summary of these comments are included in Table 7-1 below. Comment letters received during the Draft EA preparation period are provided in Appendix C.

7.1 Federal Government

U.S. Army Corps of Engineers Regulatory Branch
U.S. Fish and Wildlife Service

7.2 State of Hawaiʻi

Agribusiness Development Corporation
Office of Environmental Control
Department of Agriculture
Department of Business Development and Tourism Office of Planning
Department of Land and Natural Resources
- Commission of Water Resources Management
- Division of Forestry and Wildlife

State Historic Preservation Division
Department of Health
- Clean Water Branch

Department of Transportation
- Highways Division

7.3 City and County of Honolulu

Department of Planning and Permitting
Office of Climate Change, Sustainability and Resiliency

7.4 Others

Monsanto Company
Hartung Brothers Hawaiʻi, LLC

Table 7-1 Summary of Comments and Responses

DEA Summary of Responses and Comments		
Commenter	**Comments**	**Responses**
Hawaiʻi Department of Health, Safe Drinking Water Branch (DOH-SDWB)	The SDWB will no longer be responding directly to requests for comments for EAs. Please utilize the DOH-SDWB Standard comments regarding your project's responsibilities to maintain drinking water quality and any necessary permitting at https://health.hawaii.gov/sdwb/.	The ADC acknowledges the SDWB's comments. All applicable standards shall be adhered to during construction and operation of the facility.
DLNR, Engineering Division	The Applicant is required to: (1) identify the flood zone; (2) include water demand and infrastructure required to meet project requirements; and (3) provide water demand and calculations to the DLNR Engineering Division for inclusion in the State Water Projects Plan Update projections.	The DEA Sect. 4.3.1. Affected Environnent, paragraph 4, describes the project's FEMA Flood Zone. Sect. 3.1.2. Proposed Action, para. 1, describes water demand. The ADC will provide calculations to the Engineering Division for use in the State Water Projects list.
DLNR, Land Division	No comments.	The ADC acknowledges this response.
Hawaiʻi Department of Transportation	(1) The DEA should address how the new water well is proposed to be located at the property frontage on Kunia Road, as it may impede or have an impact on future improvements.	The DEA Sect. 3.2. New Backup Irrigation Water Well, describes the well siting due to site constraints including the location of the Kunia Road and access roadway. Should there be any issue concerning maintaining clearance, plans will be submitted to HDOT. See also Sects. 4.7 Land Use and Agriculture, and 3.2.3 Long-term maintenance.
Hawaiʻi Department of Transportation	(2) The DEA should explain and identify any new expansion of farm operation and associated land use relating to the proposed irrigation system, reservoir and water well that will support them.	See DEA Sect. 2.3, Purpose and Need, and Sect. 4.7 Land Use and Agriculture. The ADC does not anticipate any expansion of existing farm operations and related land use by the proposed action. The project's Purpose and Need is to increase water security, integrity of the existing capacity and system efficiency of the Waiāhole water system.
Hawaiʻi Department of Transportation	(3) A full evaluation is required on whether the proposed work, drainage pattern or daily operation will have any local impacts to the roadways or the nearby State highways. This should be provided in the DEA and/or if relevant, a Traffic Assessment or a Traffic Impact Analysis Report should be included and prepared by a traffic engineer licensed in the State of Hawaiʻi.	See DEA Sect. 3.2.3 Long-term maintenance, pg. 19. The ADC does not anticipate any expansion of existing farm operations and related land use relating to the proposed action. The project's Purpose and Need is to increase water security, integrity of the existing capacity and system efficiency of the Waiāhole water system. See also Sect. 4.7 Land Use and Agriculture. Should there be any issue concerning maintaining adequate clearance, engineering plans will be submitted to HDOT for review.

DEA Summary of Responses and Comments		
Commenter	**Comments**	**Responses**
DLNR, Division of Aquatic Resources	The proposed project is not expected to have any adverse impacts on the aquatic environment, as it is part of the Waiāhole Ditch Irrigation Transmission System to move surface water and groundwater from the windward side of O'ahu to agricultural areas on the leeward and central parts of O'ahu. Best Management Practices (BMPs) should be implemented.	See DEA Sect. 4.5.3 Best Management Practices and Mitigation Measures. This comment is addressed and BMPs are included per DAR.
DLNR, Division of Aquatic Resources	(1) Areas/lands denuded of vegetation should be planted or covered as quickly as possible to prevent erosion.	
DLNR, Division of Aquatic Resources	(2) Scheduling site work (reservoir construction) during periods of minimal rainfall.	
DLNR, Division of Aquatic Resources	(3) Prevent construction materials, petroleum products, debris and landscaping products from falling, blowing or leaching into the aquatic environment.	
DLNR, Commission on Water Resource Management	(1) The proposed water supply source for the project is in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.	ADC would have to obtain water allocation. There is capacity in the Kunia system. See DEA Sect. 4.1.3 Best Management Practices and Mitigation Measures, and Sect. 4.4.1 Water Management Area.
DLNR, Commission on Water Resource Management	(2) A Well Construction Permit(s) is (are) are required before the commencement of any well construction work.	See DEA Sect. 1 and Sect. 3.3
DLNR, Commission on Water Resource Management	(3) A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.	See DEA Sect. 1 and Sect. 3.3
DPP, Planning Division	(1) The Draft EA should include a list of all required city, state, and federal permits and approvals for the Project, as well as a schedule.	See DEA Sect. 1. Project Summary; Sect. 3.3. Anticipated Permits and Approvals That May be Required
DPP, Planning Division	(2) The Draft EA should include a discussion on how the Project addresses the objectives and policies of the Oahu General Plan (GP).	See DEA Sect. 5.3.1. General Plan

DEA Summary of Responses and Comments		
Commenter	**Comments**	**Responses**
DPP, Planning Division	(3) The Draft EA should indicate if other land uses, other than infrastructure development and improvements, are proposed on or near the Project site. If other land uses are proposed, the Draft EA should include more detailed information on the proposed uses.	No new structures are proposed beyond the reservoir and irrigation pipes that are to be dedicated to ag. Infrastructure. See DEA Sect. 4.7.1. Land Use and Agriculture. Affected Environment; and Sect. 6. Secondary and Cumulative Impacts.
DPP, Planning Division	(4) The Draft EA should include a discussion on how the Project will comply with the City's prevailing drainage standards and storm water quality rules as required.	The drainage design will comply with the City's drainage standards and storm water quality rules. Sediment and runoff are the only pollutants of concern. See DEA Sect. 4.3. Drainage and Flooding, Best Management Practices, new hardened surfaces to be added will be limited to 1 small pad. Storm water will be retained on-site.
DPP, Planning Division	(5) The Draft EA should include a discussion on climate change, assess the possible consequences, and evaluate potential adaptation strategies that will mitigate the potential impacts of climate change on the Project during its anticipated lifetime, particularly the potential impacts to changes in rainfall patterns.	The project purpose is to anticipate climate change; i.e., water storage. RMTC spoke with the City Office of Climate Change (OCC) 2/25/21-continued coordination will be ensured by adding the OCC to the consulted parties list. See DEA Sect. 2.3 Purpose and Need; Sect. 4.10. Natural Hazards; Sect. 5.3.3. City and County of Honolulu, and Sect. 7. Agencies, Organizations, and Individuals Consulted.
DPP, Planning Division	(6) The Draft EA should detail the applicant's consultation with the State Historic Preservation Division (SHPD) regarding this historic site listed on the State Register of Historic Places as Site 50-80-09-2268.	The ADC initiated consultation with SHPD in January 2021 and is seeking SHPD concurrence with a project effect determination of "no historic properties affected" and proposed reporting of any possible inadvertent discoveries, in accordance and in adherence with the ALRFI report submitted and date stamped as received by SHPD in December 2020 (CSH, 2020). See DEA Sect. 4.6 Historic and Cultural Resources.
DPP, Planning Division	(7) The Draft EA should detail how this project is being coordinated with the Mahi Solar Project that is proposed on sections of the same properties (TMKs 9-2-001: 020 and 9-2-004: 006).	The Mahi Solar project will be sharing an access road off of the Kunia Road. Bayer (landowner) is also on the DEA consulted parties list. See DEA Sect. 4.7, Land Use and Agriculture.
DPP, Planning Division	(8) The Draft EA should include a discussion on how this project fits into the Agribusiness Development Corporation's comprehensive plans for irrigation improvements in Central Oahu and other parts of the island.	Per the Central Oʻahu Water Security Plan, original service supported the first 100 years of Hawaiʻi's agricultural industry which featured sugar; the proposed repairs and maintenance project is needed to support agriculture for the next 100 years (ADC 2016). See DEA Sect. 2.3 Purpose & Need; and Sect. 5.3.3 CCH.

DEA Summary of Responses and Comments		
Commenter	**Comments**	**Responses**
DPP, Planning Division	(9) The Draft EA should discuss what the economic impacts will be from the proposed Project on the agricultural industry, particularly the growing of diversified crops.	The proposed repairs would generate positive economic impact by ensuring water security for users and businesses. See DEA Sect. 4.14 Socioeconomics and Environmental Justice.
DPP, Planning Division	(10) The Draft EA should discuss how the proposed Project will impact O'ahu streams.	No impacts are anticipated as the project would improve existing conditions. See DEA Sect. 4.4 Surface Water, Groundwater and Water Quality.
DPP, Planning Division	(11) The Draft EA should describe how the proposed Project impacts the operation of the Waiāhole Ditch Irrigation System as a whole, and whether future plans include additional improvements to the system.	Repairs and maintenance will add approximately 100 years to the life of the system. The Objectives of the Central Oahu Water Security Plan ("Plan") are to reduce water loss, enhance the system's efficiency by increasing storage capacity. See DEA Sect. 2.3 Purpose & Need.
State Historic Preservation Division	SHPD is in the process of moving to an online submission system. The Hawaiʻi Cultural Resource Information System (HICRIS) will be the only way for SHPD to accept and process submittals. We are not accepting submissions currently, while we migrate the data from our existing systems to HICRIS. The transition period is from November 28 to December 16, 2020. Additional information on HICRIS and the launch date can be found on our website. http://dlnr.hawaii.gov/shpd/.	ADC re-initiated consultation with SHPD in January 2021 and is seeking SHPD concurrence with a project effect determination of "no historic properties affected" and proposed reporting of any possible inadvertent discoveries, in accordance and in adherence with the ALRFI report submitted and date stamped as received by SHPD in December 2020 (CSH, 2020).

SECTION 8
SIGNIFICANCE CRITERIA EVALUATION

The proposed project was evaluated relative to the 13 significance criteria factors as described in HAR, Chapter 11-200.1-13, Significance Criteria:

1. *Irrevocably commit a natural, cultural, or historic resource*

   The proposed project calls for the expansion of an existing reservoir, construction of irrigation waterlines and pipes, and drilling of a well within the Waiāhole Water System Kunia area. Modifications to the site would be minimal with the proposed project. Construction work associated with the proposed project would not impact any natural resource or historic structures or cultural resources as identified by biological resource and historic and cultural studies recently conducted on the property.

2. *Curtail the range of beneficial uses of the environment*

   The proposed project would be constructed on a site with existing infrastructure for irrigation water supply. There would be no change in use of the project site and therefore would not curtail the range of beneficial uses of the environment.

3. *Conflict with the state's long-term environmental policies or long-term environmental goals established by law*

   The proposed project is consistent with the environmental policies, goals and guidelines as delineated in HRS, Chapter 344, and as documented in this EA.

4. *Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and State*

   The proposed project is expected to have little to no effect on the social and economic environment. The proposed project will not, by itself, stimulate economic growth and welfare, but would accommodate current and future need for an operational and reliable irrigation water system in the ʻEwa region. See also Sections 4.6, Historic and Cultural Resources, and 4.14, Socio-Economic Environment.

5. *Have substantial adverse effect on public health*

   The proposed project will be developed in accordance with Federal, State, and CCH rules and regulations governing public safety and health. Potential sources of adverse impacts have been identified and appropriate mitigative measures developed. The primary public health concerns are anticipated to involve air, water, noise, and traffic impacts. However, these impacts will be either minimized or brought to negligible levels by the appropriate use of the mitigation measures as described in this document. Construction noise would be

minimized through compliance with HAR, Chapter 11-46, Community Noise Control, requirements and recommendations.

6. *Involve adverse secondary impacts, such as population changes or effects on public facilities*

   The proposed project will not, by itself, stimulate unexpected changes in population. It will, however, accommodate current and future requirements for safe and reliable irrigation water supply to agricultural activity and landscaped areas within communities. Access shared with a neighboring proposed Mahi PV project will be closely coordinated during construction. In the long term, the proposed irrigation system improvements will have a positive impact on the area's public facilities and common areas.

7. *Involve a substantial degradation of environmental quality*

   The proposed project will be developed in accordance with the environmental policies of HRS, Chapter 343. The analysis provided in this EA indicates that no substantial environmental degradation is anticipated or expected.

8. *Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions*

   The proposed project addresses the need for irrigation water and related improvements and represents a commitment by the State of Hawaiʻi ADC toward maintaining this critical infrastructure system. It is being developed as an ongoing effort to maintain the system to meet existing and projected future service demands. The project will not by itself, involve a commitment to larger actions.

9. *Have a substantial adverse effect on rare, threatened, or endangered species, or its habitat*

   There are no threatened or endangered flora or fauna species within or immediately surrounding the project site. No adverse environmental effects to rare, threatened, or endangered species, or habitat are anticipated. See also Section 4.5, Biological Resources.

10. *Have a substantial adverse effect on air or water quality or ambient noise levels*

    Any potential for adverse impacts to air, water quality, or noise levels will be addressed by use of appropriate mitigative measures in accordance with applicable federal, state, and county government statutes, laws, ordinances, rules and regulations, and permits.

11. *Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters*

    The proposed project is located in an area that is already in use as part of the Waiāhole Water system within the system's Kunia reservoir area. The project itself does not possess any sensitive characteristics that would detract from or adversely impact the surrounding environment. See also Sections 4.1, Geology and Topography; 4.4, Water Resources and Hydrology; 4.3, Drainage and Flooding; and 4.10, Natural Hazards.

12. *Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies*

    The Proposed Action does not involve the construction of structures substantially above the surface of the ground. There would be no effects on existing scenic vistas or viewplanes as identified in current County or State plans.

13. *Require substantial energy consumption or emit substantial greenhouse gases.*

    Energy that is used will be in the form of fossil fueled internal combustion equipment, machinery, and vehicles, and electricity supplied to the site by either an existing Hawaiian Electric Company power connection or by the use of portable generator(s). The use of these forms of energy is not expected to be greater or significantly greater than that used for the development of similar projects.

Preliminary Finding

In accordance with the provisions set forth in HRS, Chapter 343, and the significance criteria in HAR, Chapter 11-200.1-13, signed into law on August 8, 2019, this Draft EA has preliminarily determined that the project will have no significant adverse impact to air and water quality, existing utilities, noise, archaeological or cultural sites, or wildlife habitat. All anticipated impacts will be temporary and will not adversely impact the environmental quality of the area.

SECTION 9
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APPENDICES

APPENDIX A

Biological Resources

AECOS No. 1629

A natural resources assessment for planned improvements to the Waiāhole irrigation ditch in Kunia, central Oʻahu

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Suite 104
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September 4 2020

A natural resources assessment for planned improvements to the Waiāhole irrigation ditch in Kunia, central Oʻahu

September 4, 2020 | DRAFT | AECOS No. 1629

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Introduction

The State of Hawaiʻi, Agribusiness Development Corporation (ADC), under the Waiāhole Water System Improvement Project (herein, the "Project"; see Figure 1) proposes to undertake various improvements to the Waiāhole irrigation ditch and an associated storage reservoir in Kunia. Improvements have been designed to enhance irrigation system efficiency and water supply security and encompass the following elements: 1) new ditch diversion and intake piping; 2) construction of a new earthen reservoir; 3) development of a new water supply well; 4) improving various interconnections of pipelines and appurtenances; and 5) repair/installation of a closed conduit at an existing hairpin bend in the ditch system. The new reservoir will incorporate the footprint of an existing smaller reservoir in the Project area.

AECOS Inc. was contracted by RM Towill Corporation to conduct a natural resources survey and assessment of the Project and prepare this report of findings.[1]

Site Description

The Project is located in the central valley of Oʻahu at around the 640-ft elevation above sea level (ASL) between the Waianae and Koʻolau volcanic mountains (Figure 1). The land is gently sloping to the southeast and fully

[1] This document is produced for inclusion in an EA for the subject Project and will become part of the public record.

developed in agriculture: mostly cropland with some pasture land in an area of greater relief and poorer soil where the Project crosses Honouliuli Stream branches.

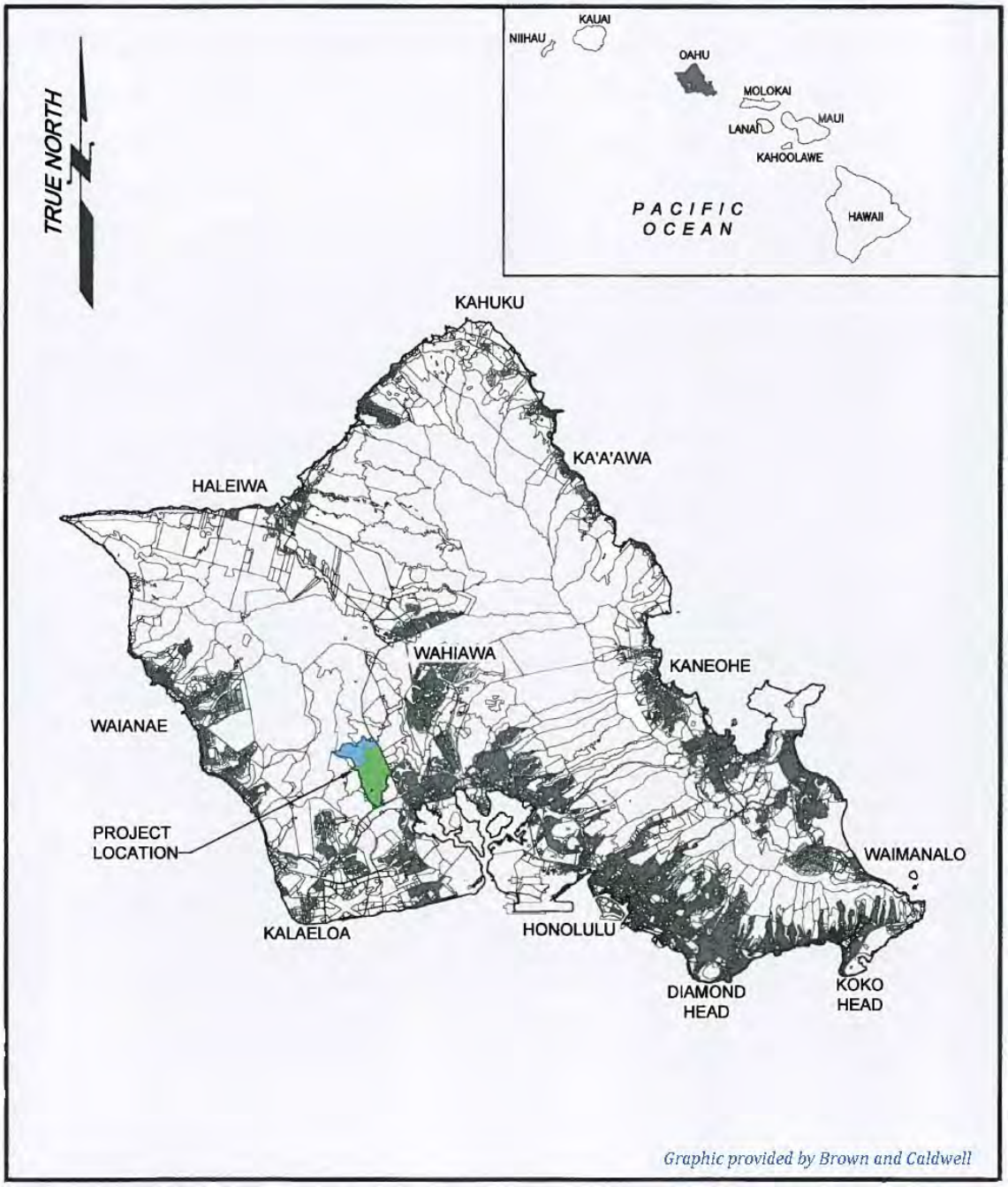

Figure 1. Project location on the Island of Oʻahu.

Methods

Water Quality

Water samples were collected on July 22, 2020 at four locations in the Project area: Station "Ditch In" at Waiāhole ditch immediately downstream of the culvert beneath Kunia Road; Station "Ditch out" in Waiāhole ditch where the proposed pipe would discharge back into the ditch; Station "Reservoir" from an existing Project site dich that is part of the existing reservoir; and Station "Stream" from the flowing branch of Honouliuli Stream in the Project area (see Figure 2) . At each of these stations, biologists made *in situ* measurements (temperature, pH, conductivity, and dissolved oxygen or DO) and collected samples for laboratory analyses: turbidity, total suspended solids (TSS), nitrate+nitrite (NO_3+NO_2), total nitrogen (TN), and total phosphorus (TP). Samples were collected from just below the water surface in precleaned plastic bottles. Samples were placed on ice and taken to the *AECOS* Laboratory in Kāneʻohe for analyses (*AECOS* Laboratory Log No. 40409). Table 1 lists analytical methods used for each of the water quality parameters monitored.

Table 1. Analytical methods used for basic water quality analyses of Waiāhole Ditch in Kunia sampled on July 22, 2020.

Analysis	Instrument	Method	Reference
Temperature	YSI Pro plus	SM 2550 B	SM (1998)
Conductivity	YSI Pro plus	SM 2510 B	SM (1998)
pH	Hanna pHep 5	SM 4500 H+	SM (1998)
Dissolved Oxygen	YSI Pro plus	SM 4500-O G	SM (1998)
Turbidity	HACH 2100N Turbidimeter	EPA 180.1 Rev 2.0	USEPA (1993)
Total Suspended Solids	Mettler Balance	SM 2540 D	SM (1998)
Nitrate + Nitrite	Lachat Quickchem 8500 Series 2 Flow Injection Analyzer	EPA 353.2	USEPA (1993)
Total Nitrogen	Shimazdu TNM-1	ASTM D5176-08	ASTM (2015)
Total Phosphorus	Lachat Quickchem 8500 Series 2 Flow Injection Analyzer	Persulfate digestion EPA 365.5	USGS (2003) USEPA (1997)

Figure 2.

Map of survey area showing survey and water quality sampling locations.

LEGEND:

Waiāhole ditch

Survey areas

Pipelines (proposed)

Botanical Survey

The natural resources survey of flora in the Project area was undertaken by Eric Guinther on July 20, 2020. A survey area map (corresponding to Figure 2) was loaded onto a Trimble 6000 Series GNSS unit (Trimble GeoXH) for use during the survey. The GNSS unit provided guidance while recording the progress track of the botanist, providing real time feedback on location and adequacy of coverage during a wandering (pedestrian) transect.

Plant species were identified as they were encountered. Species names follow *Manual of the Flowering Plants of Hawaiʻi* (Wagner, Herbst, & Sohmer, 1990; Wagner & Herbst, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples & Herbst, 2005) for ornamental plants. More recent name changes for naturalized plant species follow Imada (2012).

Aquatic Flora and Fauna Survey

AECOS biologists Eric Guinther and Bryson Luke made notes and identified plants and animals observed in the ditch and several reservoirs visited during the survey on July 20 and July 22. We noted relative abundances (e.g., rare, common, abundant) of each species encountered as the survey progressed. Nomenclature and identifications generally follow *Hawaiʻi's Native and Exotic Freshwater Animals* (Yamamoto and Tagawa, 2000) and *Manual of the Flowering Plants of Hawaiʻi* (Wagner, Herbst, & Sohmer, 1990; Wagner & Herbst, 1999).

Two 30-minute time-dependent waterbird counts were conducted at two existing reservoirs at 650 ft and 638 ft above sea level (ASL) on July 22, 2020.

Terrestrial Vertebrates Survey

A survey of extant birds and mammals was conducted by Bryson Luke on the mornings of July 20 and July 22, 2020. Four, 8-minute avian point-count stations were made in the Project area, as well as two 30-minute time-dependent waterbird counts at two water reservoirs (see above). Surveys were conducted in the early morning hours when birds are most active. Birds were identified to species by visual observation, aided by Leica 8 X 42 binoculars, and by listening for vocalizations. Avian species observed in the Project area outside of timed-duration counts were noted as incidental observations. The avian phylogenetic order and nomenclature used in this report follows the 61st supplement to the AOS *Check-List of North and Middle American Birds* (Chesser et al., 2020) and *2017 Hawaiian Islands Birds Checklist* (Vanderwerf, et al. 2018).

We compiled a list of mammals encountered during the surveys. Indicators of mammalian presence, such as tracks, scat, and other sign were also noted. Mammalian phylogenetic order and nomenclature follow *Mammal Species of the World* (Wilson and Reeder, 2005).

No survey was conducted for Hawaiian hoary bat (*ʻōpeʻapeʻa; Lasiurus cinereus semotus*), the only native land mammal in the Hawaiian Islands. The population of this bat is sparse on Oʻahu and detection requires night surveys and deployment of special detection equipment. Negative results from one or even several such surveys cannot be taken as evidence of absence of this bat from a project area. Rather, trees that could potentially serve as roost-sites for the species were noted where present.

Results

Water Quality

The results of the water quality sampling at two ditch stations, the Project site reservoir, and Honouliuli Stream are shown in Tables 2 and 3. Major differences between the sampled waters indicated in our results of physical parameters include slightly higher temperature and lower dissolved oxygen (DO) in the reservoir, which also had lower turbidity and TSS than at the other stations. Honouliuli Stream sample had abnormally high turbidity and TSS results.

Table 2. Physical parameter results for Waiāhole Ditch samples, Kunia

Date	Time	Temp	Cond.	pH	DO	DO Sat.	Turbidity
Site		(°C)	(µS/cm)		(mgm/L)	(%)	(NTU)
7/22/2020							
Ditch In	0945	23.1	96.2	7.39	9.25	108	3.22
Ditch Out	0835	23.7	101	6.62	7.96	94	3.99
Reservoir	0925	25.0	102	6.74	5.21	63	1.90
Stream	0900	23.4	99.8	6.85	7.05	82	52.8

With respect to (plant) nutrient parameters (Table 3), we note especially low nitrate+nitrite in the reservoir ditch, reflecting uptake of soluble nitrates by the bordering and aquatic plants. The Honouliuli Stream sample showed unusually

high total phosphorus (typically around 30 µg P/L in streams), which may be related to the land immediately surrounding being a cattle pasture.

Table 3. TSS and nutrient parameter results for Waiāhole Ditch samples, Kunia.

Date	Time	TSS	Nitrate+nitrite	Total N	Total P
Site		(mg/L)	(µg N/L)	(µg N/L)	(µg P/L)
7/22/2020					
Ditch In	0945	3.1	53	168	78
Ditch Out	0835	5.4	44	100	51
Reservoir	0925	1.9	3	179	49
Stream	0900	44.3	24	146	107

Vegetation

Vegetation across the survey area consists of weedy growth, farmed crops, and scattered shrubs and trees. Active cropland and pasture supporting mostly scrubby growth and sparse grass are both present. Figures 3A and 3B show typical vistas of the extant environment and vegetation in the Project area. Figure 3B is taken from the road, beneath which a new connection pipe will be laid (Fig. 2).

Flora

Table 4 is a listing of flowering plants (angiosperms) observed during the survey with 62 taxa identified from the survey area (includes two aquatic plants listed in Table 5). The vast majority (87%) are naturalized or non-native) species. The only native plant seen was *ʻuhaloa* (*Waltheria indica*), an indigenous species regularly observed in disturbed environments. Two probably early Polynesian introductions present are primrose willow (*Ludwigia octovalvis*) and *honohono* (*Commelina diffusa*). Both species are regularly observed in wet areas, as along the ditch and reservoir margins. Several ornamentals have been planted near a pump house in the vicinity of the existing reservoir.

Figure 3A (upper). Waiāhole Ditch just west of Kunia Road where agricultural fields lie beyond the tall grass border (on left) and fence (on right). Figure 3B (lower) Vegetation characteristic of the dry scrubland in Honouliuli Gulch, here pasture for cattle grazing.

Table 4. Plant species observed along and adjacent to the Waiāhole irrigation channel and other Project sites in the Project area.

Species listed by family	Common name	Status	Abundance	Notes
	FLOWERING PLANTS			
	DICOTYLEDONES			
AMARANTHACEAE				
Alternanthera pungens Kunth	khaki weed	Nat	U	
Amaranthus spinosus L.	spiny amaranth	Nat	U	
ANACARDIACEAE				
Schinus terebinthefolius Raddi	Christmas berry	Nat	R	<1>
ANNONACEAE				
Annona squamosa L.	sugar apple	Orn	R	
ASTERACEAE (COMPOSITAE)				
Bidens alba (L.) DC.	---	Nat	AA	
Conyza canadensis (L.)Cronq.	horseweed	Nat	U	
Emilia fosbergii Nicolson	Flora's paintbrush, *pualele*	Nat	R	
Spagneticola trilobata (L.) Pruski	wedelia	Nat	O	
Tridax procumbens L.	coat buttons	Nat	O	
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	Nat	O	
Xanthium strumarium L.	*kīkānia*, cocklebur	Nat	U	
BIGNONIACEAE				
Spathodea campanulata P. Beauv.	African tulip tree	Nat	R	
BORAGINACEAE				
Heliotropum procumbens Mill.	---	Nat	U	
BRASSICACEAE				
Lepidium virginicum L.	---	Nat	AA	
CARICACEAE				
Carica papaya L.	papaya	Nat	R	
CONVOLVULACEAE				
Ipomoea obscura (L.) Ker-Gawl	---	Nat	C	
CUCURBITACEAE				
Momordica charantia L.	wild bitter melon	Nat	O	
EUPHORBIACEAE				
Euphorbia heterophylla L.	*kaliko*	Nat	R	

Table 4 (continued).

Species listed by family	Common name	Status	Abundance	Notes
EUPHORBIACEAE (Cont.).				
Euphorbia hypericifolia L.	graceful spurge	Nat	C	
Euphorbia hirta L.	garden spurge	Nat	R	
Ricinus communis L.	castor bean	Nat	R	
FABACEAE				
Acacia confusa Merr.	Formosan koa	Nat	U	
Albizia saman (Jacq.) F. Muell.	monkeypod	Nat	R	<1>
Cassia x nealiae H.S. Irwin & Barneby	rainbow shower tree	Orn	R	<1>
Chamaecrista nictitans (L.) Moench	partridge pea	Nat	U	
Crotalaria sp.	rattlepod	Nat	AA	<3>
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	Nat	R	
Indigofera hendicaphyla Jacq.	creeping indigo	Nat	C	
Indigofera suffruticosa Mill.	indigo	Nat	U	
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat	O	
Macroptilium atropurpureum (DC.) Urb.	---	Nat	C	
Mimosa pudica L.	sensitive plant	Nat	R	
Neonotonia wightii (Wight & Arnott) Lackey	glycine vine	Nat	R	
Vachellia farnesiana (L.) Willd.	*klu*	Nat	C	
GOODENIACEAE				
Scaevola sericea Vahl	*naupaka kahakai*	Nat	R	<1>
LAMIACEAE				
Hyptis pectinata (L.) Poit.	comb hyptis	Nat	R	
Leonotis nepetifolia (L.) R. Br.	lion's ear	Nat	O	
LECYTHIDACEAE				
Barringtonia asiatica (L.) Kurz	autograph tree, juv.	Nat	R	
MALVACEAE				
Malvastrum coromandelianum (L.) Garcke	false mallow	Nat	O	
Sida ciliaris L.	---	Nat	U	
Sida rhombifolia L.	---	Nat	R	
Sida spinosa L.	prickly sida	Nat	C	
Waltheria indica L.	*ʻuhaloa*	**Ind**	O	
MYRTACEAE				
Psidium guajava L.	common guava	Nat	U	

Table 4 (continued).

Species listed by family	Common name	Status	Abundance	Notes
NYCTAGINACEAE				
Boerhavia coccinea Mill.	false *alena*	Nat	A	
ONAGRACEAE				
Ludwigia octovalvis (Jacq.) Raven	primrose willow	**Pol?**	U	<2>
PLANTAGINACEAE				
Plantago lanceolata L.	nrw-lvd. plantain	Nat	R	
RUTACEAE				
Citrus aurantiifolia (Christmann) Swingle	Mexican lime	Orn	R	
SAPOTACEAE				
Chrysophyllum oliviforme L.	satin leaf	Nat	R	
SOLANACEAE				
Solanum torvum Sw.	---	Nat	R	
FLOWERING PLANTS				
MONOCOTYLEDONES				
COMMELINACEAE				
Commelina diffusa N.L. Burm.	*honohono*	**Pol?**	C	
POACEAE				
Bambusa multiplex (Lour.) J.A. & J. H. Schultes	hedge bamboo	Orn	O	
Cenchrus echinatus L.	sand bur	Nat	C	
Chloris barbata (L.) Sw.	swollen fingergrass	Nat	AA	
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat	A	
Digitaria insularis (L.) Mez ex Ekman	sourgrass	Nat	U	
Eleusine indica (L.) Gaertn.	wiregrass	Nat	R	
Megathyrsus maximus (Jacq.) B.K. Simon & W.L. Jacobs	Guinea grass	Nat	AA	
Setaria verticillata (L.) P. Beauv.	bristly foxtail	Nat	O	
Zea mays L.	sweet corn, *kūlina*	Orn	AA	<1>

Legend to Table 1

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.

Orn = A cultivated plant; a species not thought to be naturalized (spreading on its own) in Hawaiʻi.

Table 4 (continued).

Pol = An early Polynesian introduction. Introduced before 1778.
ABUNDANCE = occurrence ratings for plant species:

R – Rare	seen in only one or perhaps two locations.
U - Uncommon	seen at most in several locations
O - Occasional	seen with some regularity
C - Common	observed numerous times during the survey
A - Abundant	found in large numbers; may be locally dominant.
AA - Very abundant	abundant and dominant; defining vegetation type.

NOTES: <1> – Located distant from Project APEs.
<2> - Associated with wetter areas, as along the ditch.
<2> – Plant an agricultural species not known to the author.

Aquatic biota

A list of aquatic biota found in waterways along the Project (Waiahole Ditch, 650 ft Reservoir, and Honouliuli Stream) from our aquatic survey are listed in Table 5. The table provides estimates to qualitative abundance for species observed in the Project area during the survey. The table also includes, without abundance values, species previously reported from Honouliuli Watershed from State of Hawaii Dept. of Land and Natural Resources, Div. of Aquatic Resources (HDLNR-DAR) surveys (Parham et al., 2008). The species observed are all naturalized, non-native aquatic species, and no aquatic species observed during our survey are native to the Hawaiian Islands. It is worth noting that, for this survey, no aquatic fauna was observed in the short section of Honouliuli Stream surveyed,

Familiar bluet (*Enallagma civile*), a non-native damselfly with a light blue coloration, was especially abundant along flowing waters in Waiāhole Ditch. The damselfly feeds on a variety of aquatic insects, including mosquito and mosquito larvae.

No waterbirds were counted during the waterbird count surveys, nor were any waterbirds seen in any of the reservoirs or the ditch on July 20 and 22, 2020. However, habitats suitable for some waterbird species are present (Figure 4).

Table 5. Aquatic biota noted on July 20 and 22, 2020 from the Project area in Kunia, O'ahu, Hawaiʻi.

Species	Common name	Relative abundance	Status	ID Code
FLORA				
Angiosperms – Flowering Plants				
HYDROCHARITACEAE				
Egeria densa Planchon	elodea, anacharis	C	Nat	<1>
Vallisneria americana Mich.	tape grass	A	Nat	<1>
INVERTEBRATES				
Mollusks				
MOLLUSCA, BIVALVIA (clams)				
Corbicula fluminea O.F. Müller	Asian flume clam	C	Nat	<1,2>
MOLLUSCA, GASTROPODA (snails and slugs)				
Pomacea canaliculata Lam.	channeled applesnail	U	Nat	<1>
Melanoides tuberculata Muller	red-rimmed melania	U	Nat	<1>
Insects				
ARTHROPODA, INSECTA, ODONTA (dragonflies and damselflies)				
Anax junius (Drury)	green darner	O	**I**	<1>
Crocothemis servilia Drury	---	R	Nat	<1>
Enallagma civile Hagen	familiar bluet	A	Nat	<1,2>
Ischnura ramburii Selys	Rambur's forktail	C	Nat	<1,2>
Megalagrion xanthomelas Selys	orange-black damselfly	-	**E**	<2>
Orthenis ferruginea Fabricius	roseate skimmer	C	Nat	<1>
Crustaceans				
ARTHROPODA, MALACOSTRACA, DECAPODA				
Procambarus clarkii Girard	crayfish	†	Nat	<1>
VERTEBRATES				
Fishes				
LORICARIIDAE (armored catfish)				
Hypostomus cf. *watwata* Hancock	armored catfish	C	Nat	<1>
CICHLIDAE (cichlids)				
Tilapia sp.	unid. tilapia	A	Nat	<1,2>
Oreochromis mossambicus Peters	Mozambique tilapia var. Hawaiian gold	O	Nat	<1>

Table 5 (continued).

Species	Common name	Relative abundance	Status	ID Code
CICHLIDAE (cont.)				
Hemichromis elongatus Peters	banded jewel cichlid	A	Nat	<1>
Cichla ocellaris Bloch & Schneider	tucunare	C	Nat	<1>
CYPRINIDAE	(carps)			
Cyprinus carpio	koi	R	Nat	<1>
Carassius auratus Linnaeus	goldfish	-	Nat	<2>
POECILIIDAE	(top minnows)			
indet. poeciliid	indet. poecliid	O	Nat	<1>
Poecilia spp.	indet. molly	O	Nat	<1>
Amphibians				
ANURA, BUFONIDAE	(toads)			
Rhinella marina Linnaeus	cane toad	O	Nat	<1>
Reptiles				
TESTUDINES, TESTUDINOIDEA	(pond turtles)			
Trachemys scripta Wied	red-eared slider	R	Nat	<1>

KEY TO SYMBOLS USED:

ABUNDANCE CATEGORIES:

† - Not observed alive.
R – Rare – only one or two individuals observed.
O – Occasional – seen irregularly in small numbers.
C – Common – observed everywhere, although generally not in large numbers.
A – Abundant – observed in large numbers and widely distributed in survey area.

STATUS CATEGORIES:

Nat – Naturalized – species introduced to Hawaiʻi intentionally or accidentally.

ID CODES:

<1> – Observed in survey area on July 20, 2020.
<2> – Reported as occurring in the Honouliuli Watershed by Parham et al. (2008).

Birds

A total of 266 individual birds of 26 species was recorded from the point-count survey (Table 6). One additional species, Ring-necked Pheasant (*Phasianus colchicus*), is listed as an incidental species; one Ring-necked Pheasant rooster was flushed while walking between count stations. Of 23 bird species identified in the Project area, all are fairly common, non-native (alien) species established

in the Hawaiian Islands. No indigenous or endemic Hawaiian birds were observed, and no bird species protected under state or federal endangered species statutes were counted.

Figure 4. Existing reservoir in survey area looking northeast.

Table 6. Avian species detected on July 21 and 23, 2020 from the Project area at Halawa Stream, O'ahu, Hawai'i.

ORDER FAMILY *Species*	**Common Name**	**Status**	**Relative Abundance**
ANSERIFORMES			
GALLIFORMES			
PHASIANIDAE			
Francolinus pondicerianus	Gray Francolin	NN	1.2
Francolinus francolinus	Black Francolin	NN	2.2
Gallus gallus	Domestic Chicken	NN	0
Phasianus colchicus	Ring-necked Pheasant	NN	1 †
Pavo cristatus	Indian Peafowl	NN	0.2

Table 6 (continued).

ORDER FAMILY *Species*	**Common Name**	**Status**	**Relative Abundance**
COLUMBIFORMES			
COLUMBIDAE			
Columba livia	Rock Pigeon	NN	21.8
Streptopelia chinensis	Spotted Dove	NN	1.5
Geopelia striata	Zebra Dove	NN	3.8
PELECANIFORMES			
ARDEIDAE			
Bubulcus ibis	Cattle Egret	NN	2
PSITTACIFORMES			
PSITTACULIDAE			
Psittacula krameri	Rose-ringed Parakeet	NN	0.5
PASSERIFORMES			
ALAUDIDAE			
Alauda arvensis	Eurasian Skylark	NN, Va	0.5
PYCNONOTIDAE			
Pycnonotus cafer	Red-vented Bulbul	NN	4.5
CETTIIDAE			
Horornis diphone	Japanese Bush-Warbler	NN	0.5
ZOSTEROPIDAE			
Zosterops japonicus	Warbling White-eye	NN	1
TIMALIIDAE			
Leiothrix lutea	Red-billed Leiothrix	NN	1.2
MUSCICAPIDAE			
Copsychus malabaricus	White-rumped Shama	NN	0.2
STURNIDAE			
Acridotheres tristis	Common Myna	NN	5.5
CARDINALIDAE			
Cardinalis cardinalis	Northern Cardinal	NN	1
THRAUPIDAE			
Paroaria coronata	Red-crested Cardinal	NN	0.2
Sicalis flaveola	Saffron Finch	NN	1.5
FRINGILLIDAE			
Haemorhous mexicanus	House Finch	NN	3
PASSERIDAE			
Passer domesticus	House Sparrow	NN	0.2
ESTRILDIDAE			
Estrilda astrild	Common Waxbill	NN	7.5
Amandava amandava	Red Avadavat	NN	0.8
Lonchura oryzivora	Java Sparrow	NN	3.5
Lonchura punctulata	Scaly-breasted Munia	NN	0.5
Lonchura atricapilla	Chestnut Munia	NN	1.5

Table 6 (continued).

Legend to Table 6.

Status I = Indigenous species.
NN = Naturalized, non-native species (introduced).
Va = Vagrant
Relative Abundance = Total individuals/number of stations (n=4).
† = Incidental observation (observed beyond point-count survey)

Avian diversity and densities observed in this survey are consistent with agricultural and grassland habitat found in the Project area. Rock Pigeon (*Columba livia*) were, by far, the most common bird species counted, representing one-third of the total birds counted. Large flocks of Rock Pigeon were seen to forage and loaf in the outlying agricultural fields and along the edges of reservoirs in the vicinity. Rock Pigeon, Common Waxbill (*Estrilda astrild*), and Common Mynah (*Acridotheres tristis*) were the most common species observed and cumulatively account for over half (52%) of the total birds counted.

Mammals

Two mammalian species—domestic cattle (*Bos taurus*) and small Indian mongoose (*Herpestes javanicus*)—were encountered in pastureland at Honouliuli Gulch in the Project area. No other mammals were recorded.

Discussion and Recommendations

Recommendations are partly based on U.S. Fish and Wildlife Service, Animal Avoidance and Minimization Measures (USFWS-PIFWO, nd). Implementation of the recommendations (provided below as bulleted items) by the Project contractor will minimize impacts to listed species to the maximum extent practicable.

Water Quality

We collected water quality data and this effort revealed no major problems with respect to water quality in the ditch, reservoir, or stream. Project plans are not expected to have an impact on water quality of aquatic environments in the area.

Floral Resources

No plants of conservation concern or enjoying statutory protection (that is, listed as threatened or endangered; HDLNR, 1998; USFWS, 2020) were noted in the survey and, given the highly disturbed nature of the site, would not be expected to be growing there.

Invertebrates

Several insects are now listed as endangered in the Hawaiian Islands: specifically seven species of the yellow-faced bee (*Hylaeus anthracinus*, *H. assimulans*, *H. facilis*, *H. hilaris*, *H. kuakea*, *H. longiceps*, and *H. mana*; USFWS, 2016); Blackburn's sphinx moth (*Manduca blackburnii*; USFWS, 2000); and several species of Hawaiian damselflies.

No individual yellow-faced bee species was observed during the survey and no potential habitat or food sources were noted.

Blackburn's sphinx moth (*Manduca blackburnii*) is federally listed as endangered in Hawaiʻi (USFWS, 2020). The caterpillar of this moth feeds exclusively on plants in the Family Solanaceae (USFWS 2003; HDLNR, 2005). In particular, where this moth is found, caterpillars are often associated with the widely-distributed, non-native tree tobacco plant (*Nicotiana glauca*). No tree tobacco plants were noted from the botanical survey of the Project site. The only plant present at the Project area to be classified in the Family Solanaceae was *Solanum torvum*. This species is not known to be used by the caterpillar. Threat to this species due to project activities as extremely remote for the reason that the Island of Oʻahu is not presently known to support a population of Blackburn's sphinx moth.

No indigenous or endemic aquatic invertebrate species protected by state or federal endangered species statutes (HDLNR, 2015; USFWS, nd.) were observed in waterways at the Project area during the course of the survey on July 20, 2020. However, endemic orange-black damselfly (*Megalagrion xanthomelas*) was previously reported HDLNR-DAR surveys of Honouliuli Watershed (Parham et. al, 2008) and is listed as endangered on state and federal endangered species statutes (HDLNR, 2015; USFWS, 2012; USFWS-PIFWO, nd). *M. xanthomelas* is known from Hawaiʻi, Maui, Lānaʻi, Molokai, Oʻahu, and formerly Kauaʻi. It breeds in a widespread number of aquatic environments, including anchialine pools, coastal wetlands, small streams, and artificial ponds at low elevations (USFWS-PIFWO, nd). *M. xanthomelas* are considered to be vulnerable to extinction and is on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Odonata Specialist Group, 1996).

Introduced predatory fish and crustaceans are major threats to the species. The species was not seen in our survey.

- If work occurs within a stream or riparian zone, consult with USFWS. However, in the absence of evidence that any of the aquatic environments harbor endangered species, this consultation may be limited to providing the agency with a copy of this report or the Project EA.

Avian Resources

All of the 27 avian species recorded at the Project site from this survey are naturalized species, non-native to the Hawaiian Islands. No indigenous or endemic bird species were counted. None of the species recorded from this receive special protections under state or federal endangered species statutes.

Seabirds

Protected night-flying seabirds in Hawaiʻi include Hawaiian Petrel (*Pterodroma sandwichensis*), Wedge-tailed Shearwater (*Ardenna pacifica*), Newell's Shearwater (*Puffinus newelli*), and Band-rumped Storm-petrel (*Oceanodroma castro*). Hawaiian Petrel and Newell's Shearwater nest in upland mountainous habitat and have been detected on the Island of Oʻahu (Young et al. 2019). In the summer and fall, nocturnally flying seabirds (especially fledglings) transiting to the sea from inland locations can become disoriented by exterior lighting. When disoriented, seabirds can collide with man-made structures or the ground. If not killed outright, dazed or injured birds are easy targets of opportunity for feral mammals (Podolsky et al., 1998; Ainley et al., 2001; Day et al., 2003). The primary cause of mortality in both Hawaiian Petrel and Newell's Shearwater is predation by alien mammalian species at the nesting colonies (USFWS, 1983; Ainley et al., 2001). Collision with man-made structures is considered the second most significant cause of mortality of these seabirds in Hawaiʻi. No suitable nesting habitat for seabird species occur in the Project area.

- Deleterious impacts to transiting seabirds can be avoided if Project construction occurs during daylight hours and any outdoor lighting used/installed is fully "dark sky compliant" (HDLNR-DOFAW, 2016).

White Tern (*Gygis alba*), or *manu o Kū*, is an indigenous seabird listed as threatened under State of Hawaiʻi endangered species statute, HRS 195D (HDLNR, 2015). In the main Hawaiian Islands, the majority of White Tern population is restricted to central urban and suburban Honolulu, with a known

breeding range extending from Niu Valley to Aloha Tower. Isolated pairs have been observed as far west as Hickam Air Force Base at Pearl Harbor (VanderWerf and Downs, 2018). The Project area is beyond the westward extent of the known White Tern nesting range, and there are few suitable nesting trees within the Project area. White Tern are unlikely to utilize the Project area and Project activities are not likely to impact the species.

Owls

The Hawaiian endemic sub-species of Short-eared Owl or *pueo* (*Asio flammeus sandwichensis*) is state-listed as endangered on Oʻahu only. Short-eared Owl nest on the ground and thus susceptible to mammalian predation. The species is increasingly scarce on Oʻahu, but is known to utilize agricultural crop and pastureland for hunting and nesting. Short-eared Owl has been observed from the Makakilo and Pearl Harbor areas (Cotin and Price, 2018; *AECOS*, 2018). No evidence of Short-eared Owl was found in our survey, but some areas beyond the Project, particularly outlying scrub and pastureland in Honouliuli Gulch, have the potential for harboring this species.

- If Project construction results in grubbing or grading of areas that are currently undeveloped, a survey for Short-eared Owl ground nesting activity should be undertaken in these locations immediately prior to the start of ground disturbance.

- If a nest is discovered, Hawaiʻi Department of Land and Natural Resources (DLNR) must be notified before proceeding with any activity that could disturb the nest.

Mammals

The findings of the mammalian survey are consistent with the location of the Project and habitats present. Small Indian mongoose (*Herpestes javanicus*) were observed to utilize the Project area, and are widespread throughout Oʻahu Island. Although no rodents were recorded, it is likely that one or more of the four established alien Muridae found on Hawaiʻi—roof rat (*Rattus rattus*), brown rat (*R. norvegicus*), Polynesian rat (*R. exulans hawaiiensis*), and European house mouse (*Mus musculus*)—use various resources within the general Project area. It is highly likely that both cat (*Felis catus*) and domestic dog (*Canis lupis familiaris*) may also utilize resources at the Project site. All of these aforementioned mammalian species are deleterious to native Hawaiian ecosystems and the native fauna dependent on them.

It is possible that Hawaiian hoary bat or *ʻōpeʻapeʻa* (*Lasiurus cinereus semotus*) uses resources within the Project vicinity on a seasonal basis. The principal potential impact that improvements to the site might pose to bats is clearing and grubbing of tall vegetation. However, since no trees are present in the project site, displacement of individual bats using a tree as a roosting location would not occur.

Other Resources of Potential Concern

Critical Habitat

No federally designated Critical Habitat occurs in the project area; no equivalent statute exists under state law. No natural resources of preservation or conservation concern occur in the Project area.

Jurisdictional Waters

Honouliuli Stream, Waiahole Ditch, and the reservoir are water features in the Project area with potential to qualify as jurisdictional waters under the Clean Water Act (CWA). The Navigable Waters Protection Rule (NWPR), published by the EPA and USACE on June 22, 2020 (USACE and USEPA, 2020), redefines Waters of the U.S. (or jurisdictional waters) protected under the CWA.

The access roadway and proposed waterline at the Project will cross two branches of Honouliuli Stream within Honouliuli Gulch. The more easterly branch (left branch) had flowing water at the time of our survey and was much overgrown with Guinea grass. The west (right) branch was dry. Honouliuli Stream is listed as a perennial stream in the Hawaii Stream Assessment (HCPSU, 1990) and Hawaii Watershed Atlas (Parham et. al, 2008). As proposed, the waterline pipe crossing both branches will be located within a substantial berm of the existing access roadway (Figure 5). At the roadway, stream branches are located in pipe culverts well below the ground surface. So long as the ditch to bury the proposed waterline pipe is above the culvert and no disturbance to the culverts or any depositions of fill into the stream beds will occur, a Department of the Army permit will not be required.

Waters within Waiahole Ditch at the Project area are not considered to be jurisdictional. Under the NWPR, a jurisdictional ditch must meet all of the following conditions (USACE and USEPA, 2020): (1) has perennial or intermittent flow; (2) contributes surface flow in a typical year to an otherwise-jurisdictional waterbody (e.g., ocean or perennial stream); (3) is constructed in a tributary (i.e., relocates an existing stream) or is constructed in an adjacent wetland. Waiahole Ditch has perennial flow, but the segment of Waiahole Ditch

at the Project is not constructed within a tributary or adjacent wetland, and therefore not a jurisdictional ditch.

Figure 5. Agricultural road across Honouliuli Gulch. Proposed pipeline would be buried within this road, the surface of which is 4-5 m (12-16 ft) above the two branches of Honouliuli Stream.

Water within the reservoir at the Project area is not jurisdictional. Under the NWPR, artificial lakes and ponds, including water storage reservoirs and farm, irrigation, stock watering, and log cleaning ponds, constructed or excavated in uplands are not jurisdictional, so long as the [reservoir] does not contribute surface water flow to a navigable waterway (USACE and USEPA, 2020).

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APPENDIX B

Historic and Cultural Resources:

ALFRI and CIA

Draft
Archaeological Literature Review and Field Inspection Report to Support Consultation with the SHPD for the Waiāhole Water System Improvements Project Honouliuli Ahupuaʻa, ʻEwa District, Oʻahu TMKs: [1] 9-2-001:020 por. and 9-2-004:006 por.

Prepared for
R.M. Towill Corporation
on behalf of the
State of Hawaiʻi Agribusiness Development Corporation (ADC)

Prepared by
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Management Summary

Reference	Archaeological Literature Review and Field Inspection Report to Support Consultation with the SHPD for the Waiāhole Water System Improvements Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMKs: [1] 9-2-001:020 por. and 9-2-004:006 por. (Belluomini and Shideler 2020)
Date	October 2020
Project Number(s)	Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: HONOULIULI 186
Investigation Permit Number	CSH completed the fieldwork component of this study under archaeological fieldwork permit number 20-07, issued by the Hawai‘i State Historic Preservation Division (SHPD) per Hawai‘i Administrative Rules (HAR) §13-13-282.
Agencies	SHPD, State of Hawai‘i Agribusiness Development Corporation (ADC)
Land Jurisdiction	The City and County Department of Planning and Permitting website shows the TMK: [1] 9-2-001:020 portion of the project area as part of a 1,689-acre parcel owned by Monsanto Company and the TMK: [1] 9-2-004:006 portion of the project area as part of a 725-acre parcel owned by Hartung Brothers Hawaii LLC
Project Proponent	ADC
Project Funding	ADC
Project Location	The project area lies on agricultural land in Kunia, on the southwest slope of O‘ahu’s central valley on the west side of Kunia Road with the elevation in the project area ranging from approximately 560 feet (ft) to 640 ft, or 170-195 m above mean sea level (AMSL) in Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMKs: [1] 9-2-001:020 por. and 9-2-004:006 por. The project area is depicted on a portion of the 1998 Schofield Barracks U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), tax map plats (Figure 2 and Figure 3) and a 2017 aerial photograph (Figure 4).
Project Description	The ADC is proposing improvements to the Waiahole Ditch system to improve the irrigation system’s efficiency and enhance water supply security. The project includes five major components: • Ditch diversion and intake piping; • New lined earthen reservoir; • New water supply well; • Interconnecting pipelines and appurtenances/control valves for the system; • New closed conduit at an existing hairpin bend in the ditch. Substantial excavation is indicated for the construction of a new 15-million gallon (MG) reservoir and for new irrigation lines (designated A, B, and C) with lesser excavation for certain connections and repair and for a new irrigation water well.

Project Acreage	The project includes two relatively large areas, the proposed new 15-MG reservoir estimated at 4.6 acres and a proposed new irrigation water well enclosure estimated at 0.4 acre, in addition to a total of approximately 7,030 ft of linear irrigation lines and amenities. These irrigation lines may well involve ground disturbance less than 3 ft wide but the precise alignment was often unclear and thus an estimated width of the study area for these lines is somewhat arbitrarily 20 ft; this yields an estimated project area for the lines of 140,600 square (sq) ft (3.23 acres) and an estimate for the total project area of 8.23 acres (3.33 hectares).
Document Purpose	This is a state “governmental” project needing review under Hawai‘i Revised Statutes (HRS) §6E-8 and HAR §13-275. This investigation was designed—through detailed historical, cultural, and archaeological background research and a field inspection of the project area—to determine the likelihood that historic properties may be affected by the project and, based on findings, consider cultural resource management recommendations. This document is intended to facilitate the project’s planning and support the project’s historic preservation and environmental review compliance. This study was prepared specifically to support the obtaining of a determination letter from the SHPD as per HAR §13-275-3.
Fieldwork Effort	A field inspection of the project area was undertaken by David W. Shideler, M.A., on 15 July 2020 and took approximately 5 hours to complete.
Consultation	A companion cultural impact assessment for this project is actively ongoing with substantial outreach.
Results Summary	The project area lies far from the coast approximately 6 km northeast of the West Loch of Pearl Harbor on a relatively featureless south slope of the central valley of O‘ahu. There is a significant tributary valley of Honouliuli Gulch in the central portion of the project area which would have carried flowing water intermittently but this is believed to be dry most of the time. The project area averages about 710.6 mm (28.0 inches) of rainfall annually (Field 140 Station) which would be marginal at best for non-irrigated agriculture. The generally dry nature of the project area and distance from the coast would have discouraged traditional Hawaiian land use. There was a major traditional Hawaiian trail that became contemporary Kunia Road on the east end of the project area but it is suggested that most travelers on this trail would have just been passing through. During the Māhele land division of 1848, Miriam Ke‘ahikuni Kekau‘ōnohi acquired a deed (Royal Patent #6971) to all unclaimed land within the *ahupua‘a* (traditional Hawaiian land unit, including the present project area), which totaled 43,250 acres. The 72 *kuleana* awards, awards given to commoners, were located in the lower

	portions of Honouliuli Ahupua‘a near Pearl Harbor with its fishponds and irrigated taro fields (Maly 1997). No *kuleana* claims were awarded within the project area. There were no “storied places” (*wahi pana*) in the immediate vicinity as would have attracted early visitation and land use. Nineteenth century maps such as the 1873 Alexander map and the 1894 Kanakanui map indicate no development in the vicinity of the project area (other than the trail extending up the central valley at the east end that would become Kunia Road) and are consistent with this area having been used solely as grazing land as indicated in the 1906 Donn map. The project area and the ‘Ewa slope and plain in general was transformed by the Waiahole Ditch completed in 1916. Sugarcane cultivation by the Oahu Sugar Company dominated the project area until Oahu Sugar Company went out of business in 1994. This long span of intensive cultivation likely removed all indications of prior land use.
Recommendations	The only historic properties identified within the project area relate to twentieth century commercial sugarcane cultivation which included a westward extension of State Inventory of Historic Places (SIHP) # 50-80-08-7671:3, Kupehau Road, which was a plantation road (and at one time, for part of the stretch in the project area, a plantation railway alignment; see the 1928/1929 USGS topographic map) and small portions of the Waiahole Ditch, designated SIHP # 50-80-09-2268. This study supports the conclusion of Wong and Spear (2015:54) that SIHP # 50-80-08-7671 is significant under Criterion d (only) as outlined in HAR §13-275-6 for having yielded information about prior Historic land use, particularly in association with former plantation agriculture in the area but that no further archaeological work is indicated on the basis that “what remains are remnant plantation features that have been adequately documented, and that little potential exists to encounter intact subsurface cultural deposits.” The case of the Waiahole Ditch (SIHP # 50-80-09-2268) is more complicated in that the ditch has been determined to be quite significant and the present study supports significance under HAR §13-284-6 Criteria a, c, and d. The historic property has yielded information on the agricultural history of the area and contributed greatly to the development and evolution of the ‘Ewa Plain throughout its history. The portions of the Waiahole Ditch within the present project area retain integrity of location, design, materials, and workmanship.

	The proposed project is regarded as part of on-going routine maintenance, will have minimal impact on the Waiahole Ditch (SIHP # 50-80-09-2268), and is not anticipated to diminish the appearance, integrity or significance of this historic property. Impacts to the Waiahole Ditch are understood to be limited to: 1) a new sluice gate with operator at Ditch Connection Site 1, a new headwall at Ditch Connection Site 2, and 3) a re-working of the previous re-working of the ditch at the Hairpin Turn. It is suggested that documentation of these areas within the present study is appropriate and enough but early consultation with the SHPD archaeology and architecture branch is recommended regarding impacts to the Waiahole Ditch and possible mitigation. Given the nature of the proposed project’s impacts and the present documentation, the present study supports a determination of “no historic properties affected” and no further historic preservation work.

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Section 1 Introduction

1.1 Project Background

At the request of R.M. Towill Corporation and on behalf of the State of Hawai‘i Agribusiness Development Corporation (ADC), Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this literature review and field inspection report (LRFI) to support consultation with the State Historic Preservation Division (SHPD) for the Waiāhole Water System Improvements project, located in Kunia, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu (TMKs: [1] 9-2-001:001 por. and 9-2-004:006 por.). This is a state "governmental" project needing review under Hawai‘i Revised Statutes (HRS) §6E-8 and Hawai‘i Administrative Rules (HAR) §13-13-275.

The project has a number of components located west of Kunia Road at approximately 600-foot (ft) elevation located adjacent to the Waiahole Ditch and Kupehau Road. The project area is depicted on a portion of the 1998 Schofield Barracks U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), tax map plats (Figure 2 and Figure 3), and a 2017 aerial photograph (Figure 4) and is described in greater detail below.

ADC is proposing improvements to the Waiahole Ditch system to improve the irrigation system's efficiency and enhance water supply security. The project has five major components:

- Ditch diversion and intake piping;
- New lined earthen reservoir;
- New water supply well;
- Interconnecting pipelines and appurtenances/control valves for the system;
- New closed conduit at an existing hairpin bend in the ditch.

These components are discussed and summarized in greater detail further below.

1. Ditch Connection 1 – Involves a new intake for the reservoir near Kunia Road and a new Irrigation Line "B" extending along the southeast side of an existing unimproved road to the new 15-million gallon (MG) reservoir (Figure 5). This work will include the following:
    a. Constructing a new shallow manhole over existing plugged 24-inch culvert connected to existing diversion on Waiahole Ditch;
    b. Installing a new trash rack and new 24-inch cast iron sluice gate at the existing diversion;
    c. Unplugging an existing 24-inch culvert;
    d. Connecting a new 30-inch Irrigation Line "B" to the new shallow manhole.
2. A new 15-MG reservoir to be built adjacent to the southeast side of an existing reservoir (Figure 6) will involve the following:
    a. Water from Waiahole Ditch will be diverted into an existing ditch between the reservoir and Waiahole Ditch and then into the existing reservoir.
    b. An existing pump will draw water from the existing reservoir and pump water *makai* (seaward) of the existing reservoir.

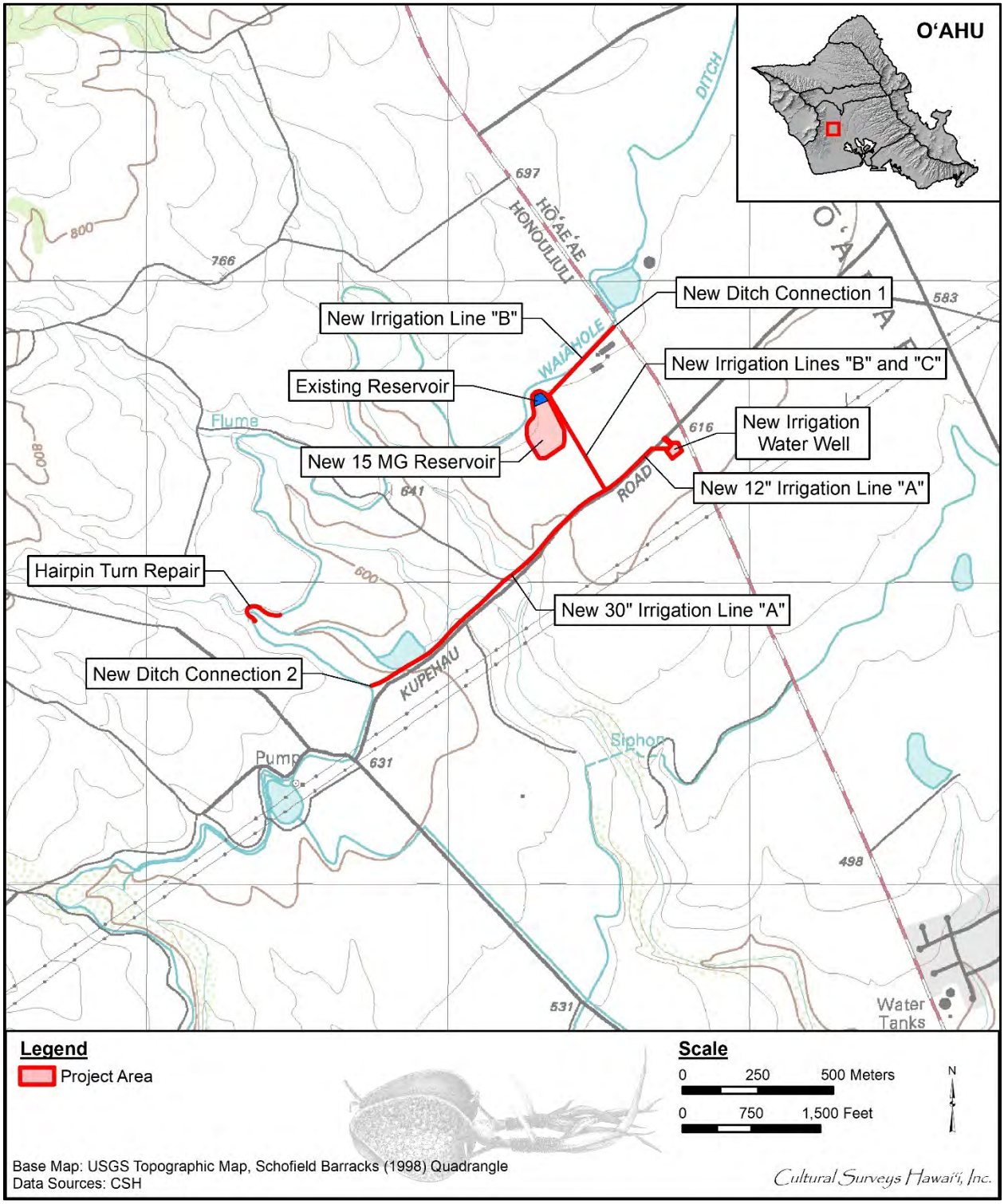

Figure 1. Portion of the 1998 Schofield Barracks USGS 7.5-minute topographic quadrangle showing the location of the project area

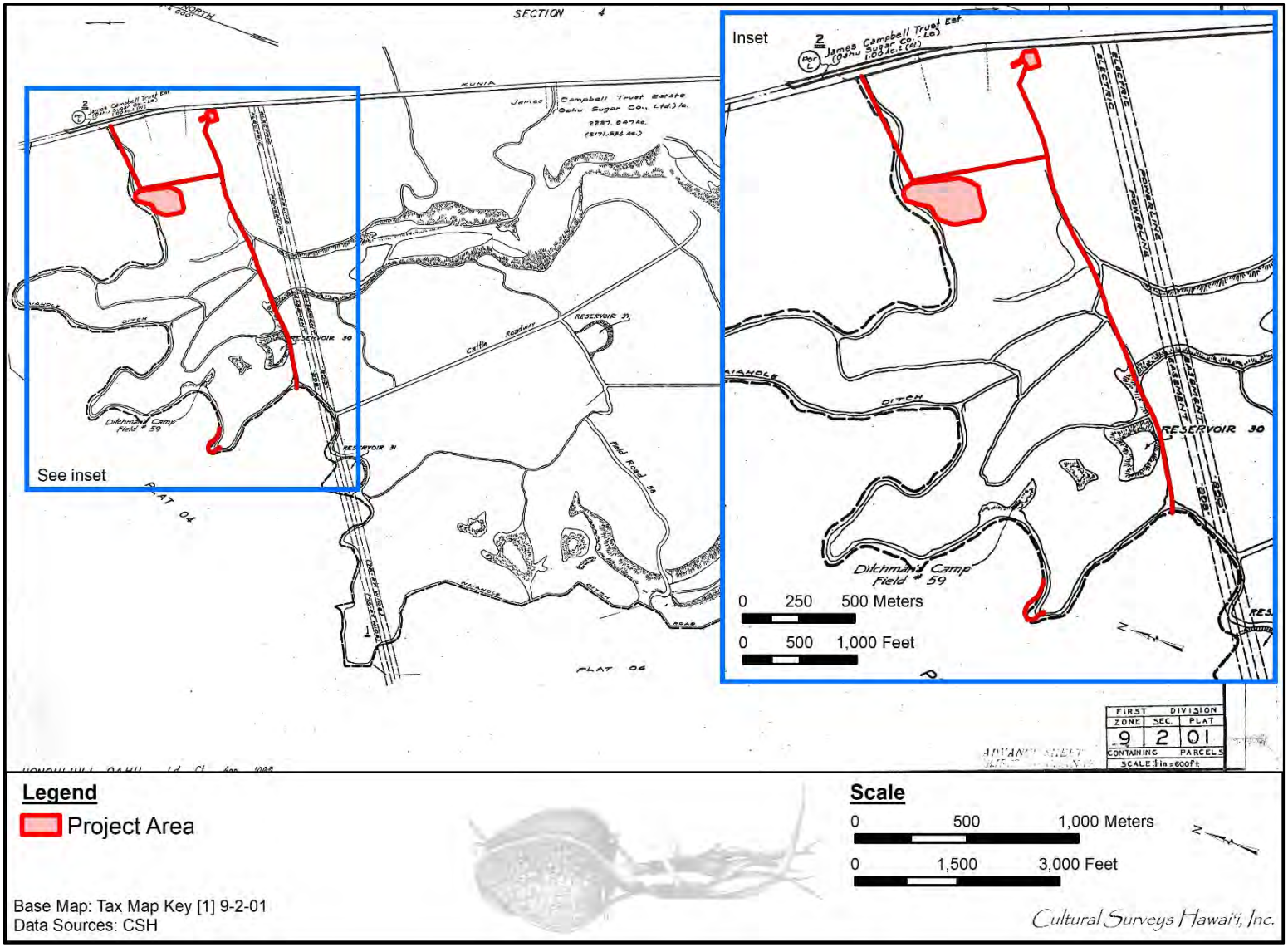

Figure 2. Tax Map Key (TMK) [1] 9-2-001 showing the project area (Hawai‘i TMK Service 2014)

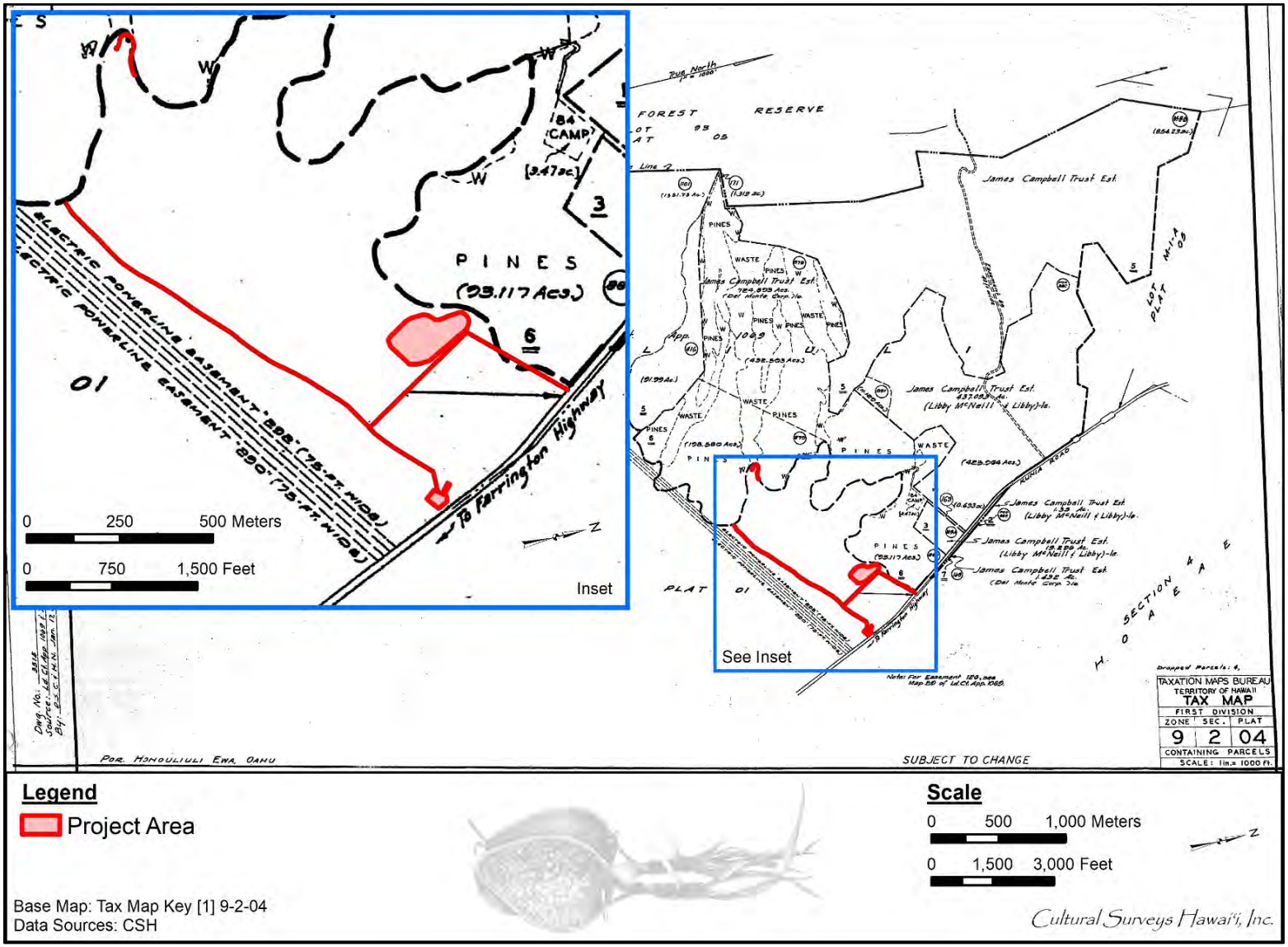

Figure 3. TMK: [1] 9-2-004 showing the project area (Hawai‘i TMK Service 2014)

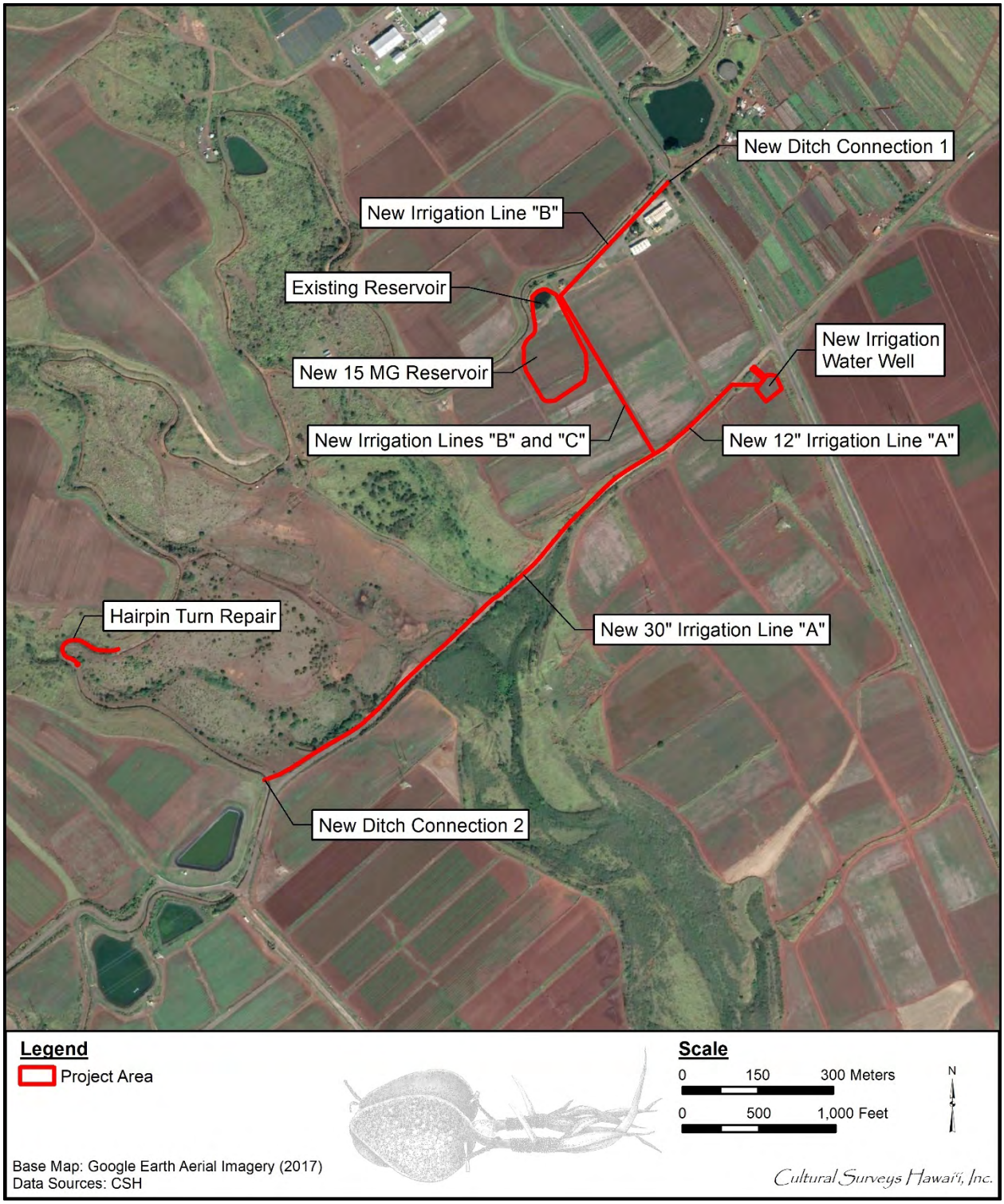

Figure 4. Aerial photograph showing the location of the project area (Google Earth Aerial Imagery 2017)

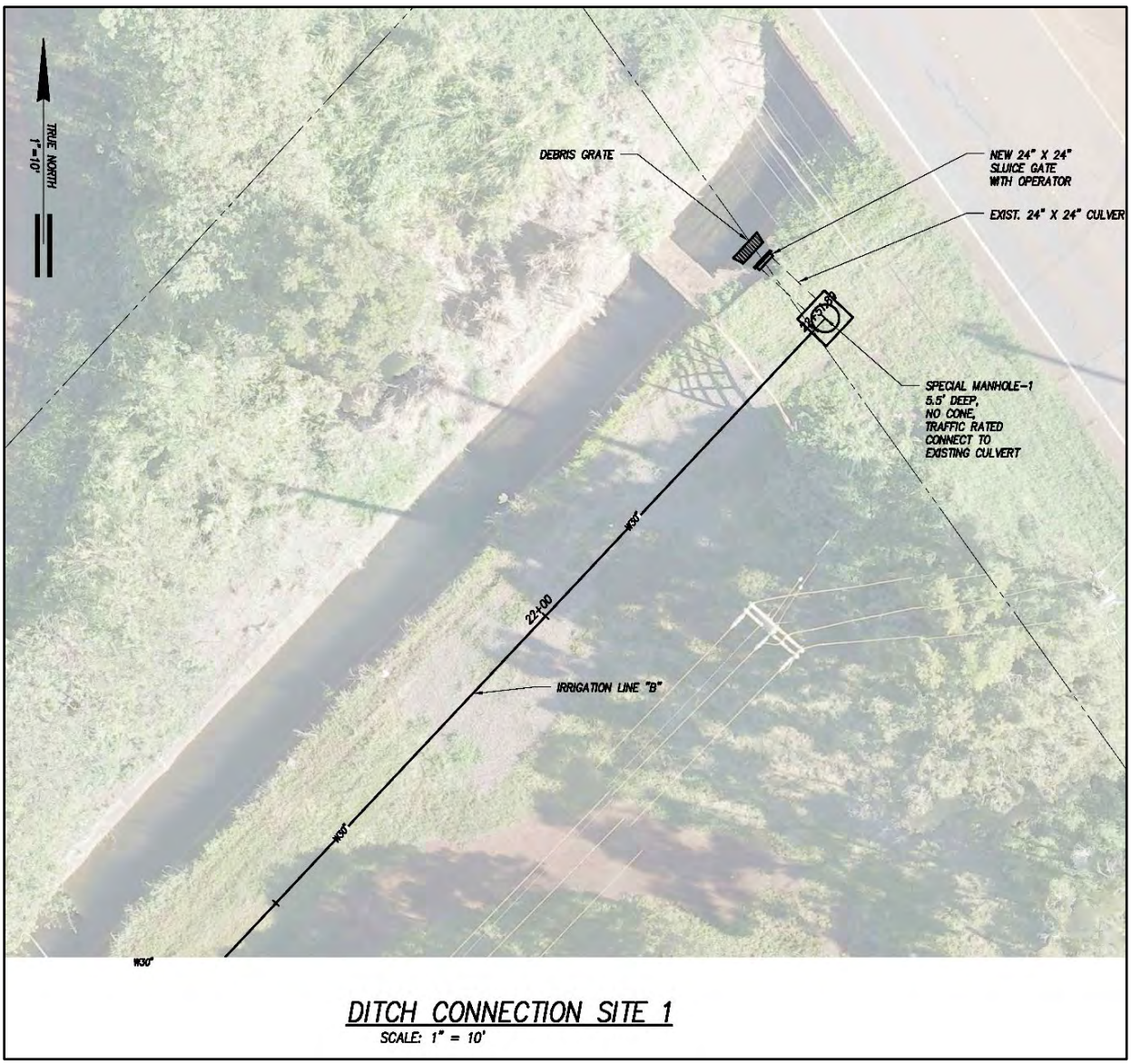

Figure 5. Ditch Connection 1 – Involves a new intake off the existing Waiahole Ditch (with new debris gate, sluice gate, and short connecting culvert) and a new Irrigation Line “B” extending along the southeast side of an existing unimproved road (parallel to and southeast of the existing Waiahole Ditch) to the new 1-MG reservoir (courtesy of client)

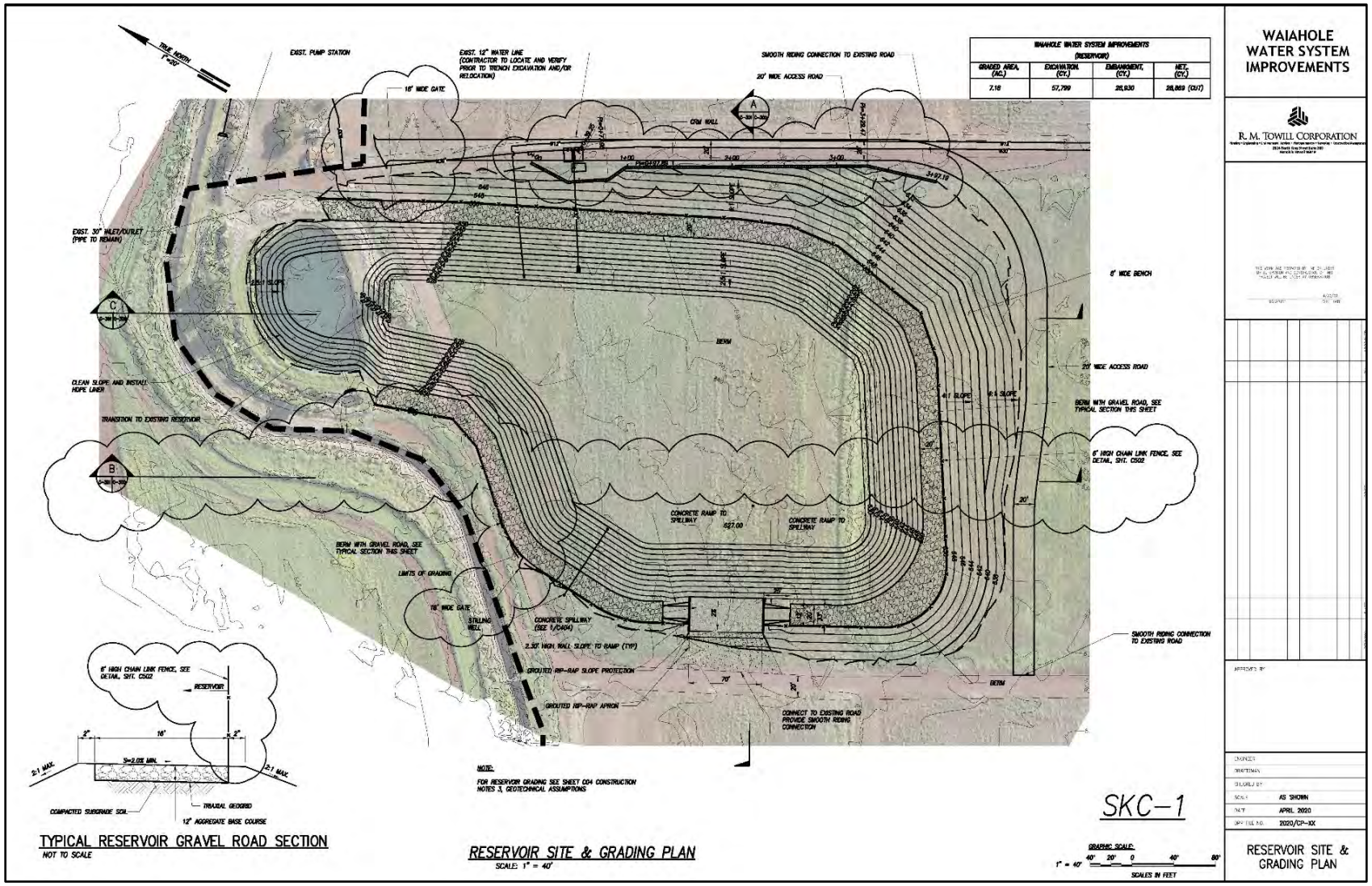

Figure 6. Reservoir site and grading plan (courtesy of client); the new 15-MG reservoir is to be built adjacent to the southeast side of an existing reservoir

c. A new 15-MG reservoir will be built connected to the southeast side of the existing reservoir.

d. The new reservoir will receive water from Ditch Connection 1 through the new Irrigation Line “B-1” through the northeast embankment or through new Irrigation Line “D” connected to the existing reservoir ditch.

e. The new reservoir may also receive water from a new backup irrigation water well through Irrigation Line “C-1” through the northeast embankment.

3. New Irrigation Lines “B” and “C” will be built extending southeast from the existing reservoir and the to-be-built reservoir.

   a. The alignment of a new 30-inch Irrigation Line “B” will be along existing roads connecting to the existing reservoir and adjacent to the northeast embankment of new reservoir, from Ditch Connection 1 to connection to the 12-inch Irrigation Line “A.”

   b. Alignment of 12-inch Irrigation Line “C” will be along an existing road adjacent to northeast embankment of the new reservoir, from connection to Irrigation Line “C-1” to the southeast to connect to Irrigation Line “A” that will run perpendicular (northeast/southwest).

4. A new backup irrigation water well will be built close to the west side of Kunia Road west of the new reservoir (Figure 7).

   a. Connection to 12-inch Irrigation Line “A.”

5. New Irrigation Line “A”

   a. Alignment will be along the existing dirt plantation road from Ditch Connection 2 on Waiahole Ditch to the site of the new well.

   b. Size will be 30-inch from Ditch Connection 2 to connection to 30-inch Irrigation Line “B” then reduce to 12-inch before connecting to 12-inch Irrigation Line “C.”

   c. A 30-inch beveled-gear gate valve (normally closed) will isolate the 12-inch pumped system (from the new well) from the 30-inch gravity system.

6. Ditch Connection 2 – Downstream from hairpin turn (Figure 8)

   a. Construct new headwall at the existing cut in Waiahole Ditch

   b. Construct new 30-inch sluice gate at new headwall

7. Repair at hairpin turn (Figure 9)

   a. Remove two existing 20-inch HDPE pipes from ditch and bulkheads at inlet and outlet.

   b. Place new 36-inch HDPE on new concrete saddles at center of ditch and strap to saddles; bend pipe to match curve of ditch.

   c. Encase new pipe in CLSM (controlled low-strength material).

   d. Construct new inlet and outlet concrete bulkheads.

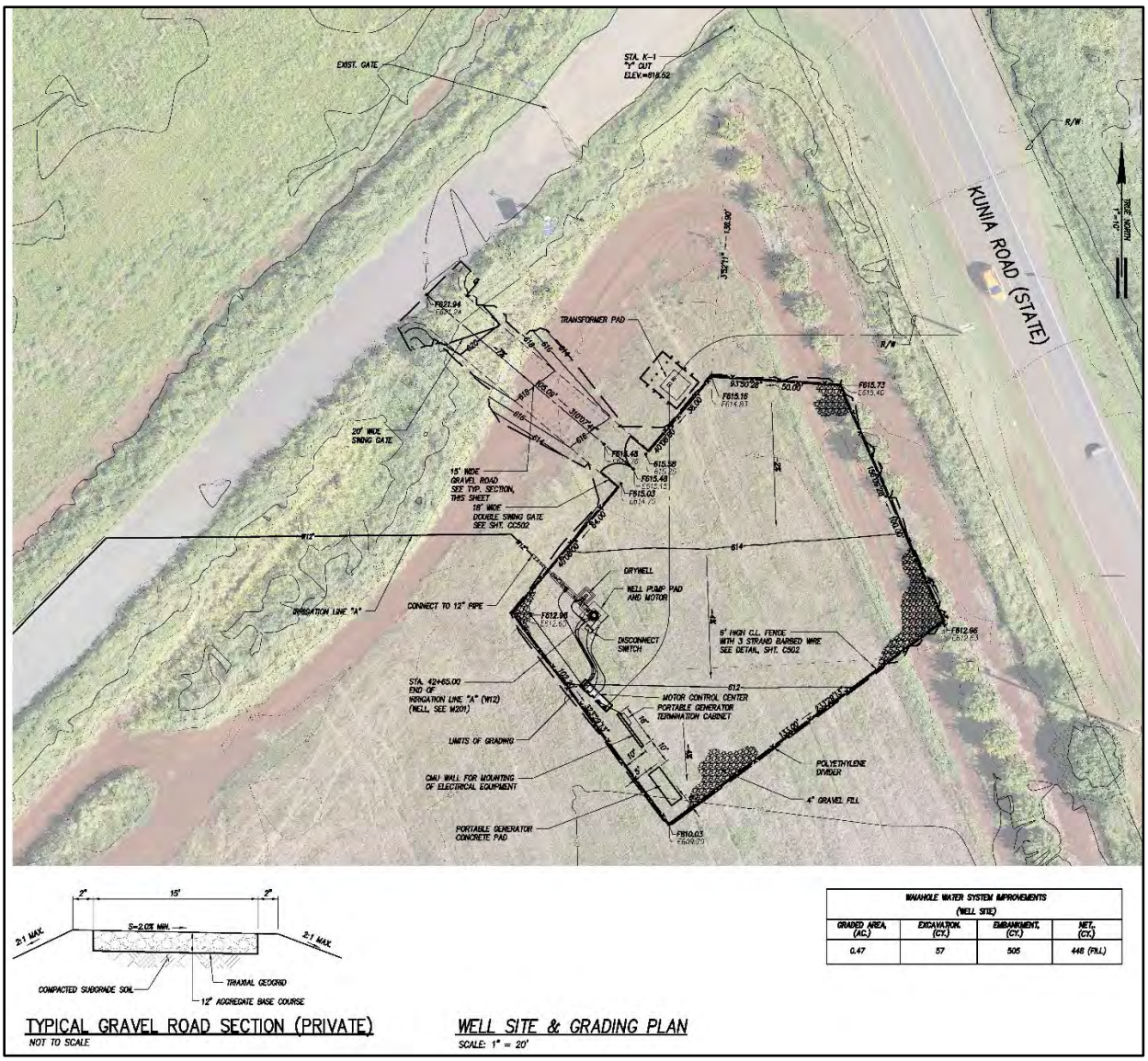

Figure 7. Well site and grading plan (courtesy of client); this new backup irrigation and water well within a chain link fence enclosure with a connecting 12-inch Irrigation Line “A” (extending to the southwest) is to be built close to Kunia Road (east of the new reservoir) with a short connecting driveway connecting with an access road to the northwest

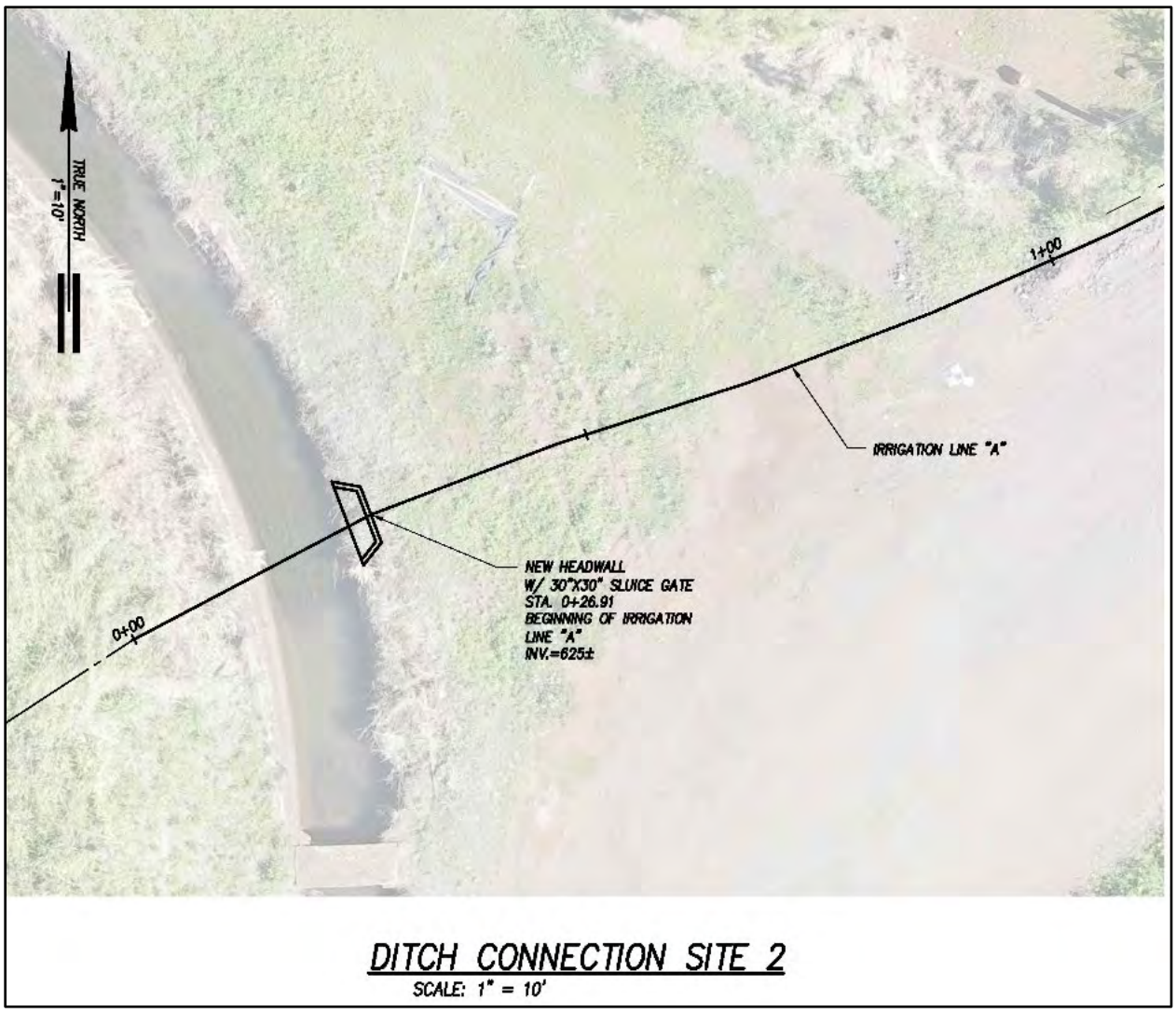

Figure 8. New Ditch Connection Site 2 is located at the extreme southwest end of the project area where the new 30-inch Irrigation Line “A” intersects the Waiahole Ditch involving the construction of a new headwall and sluice gate

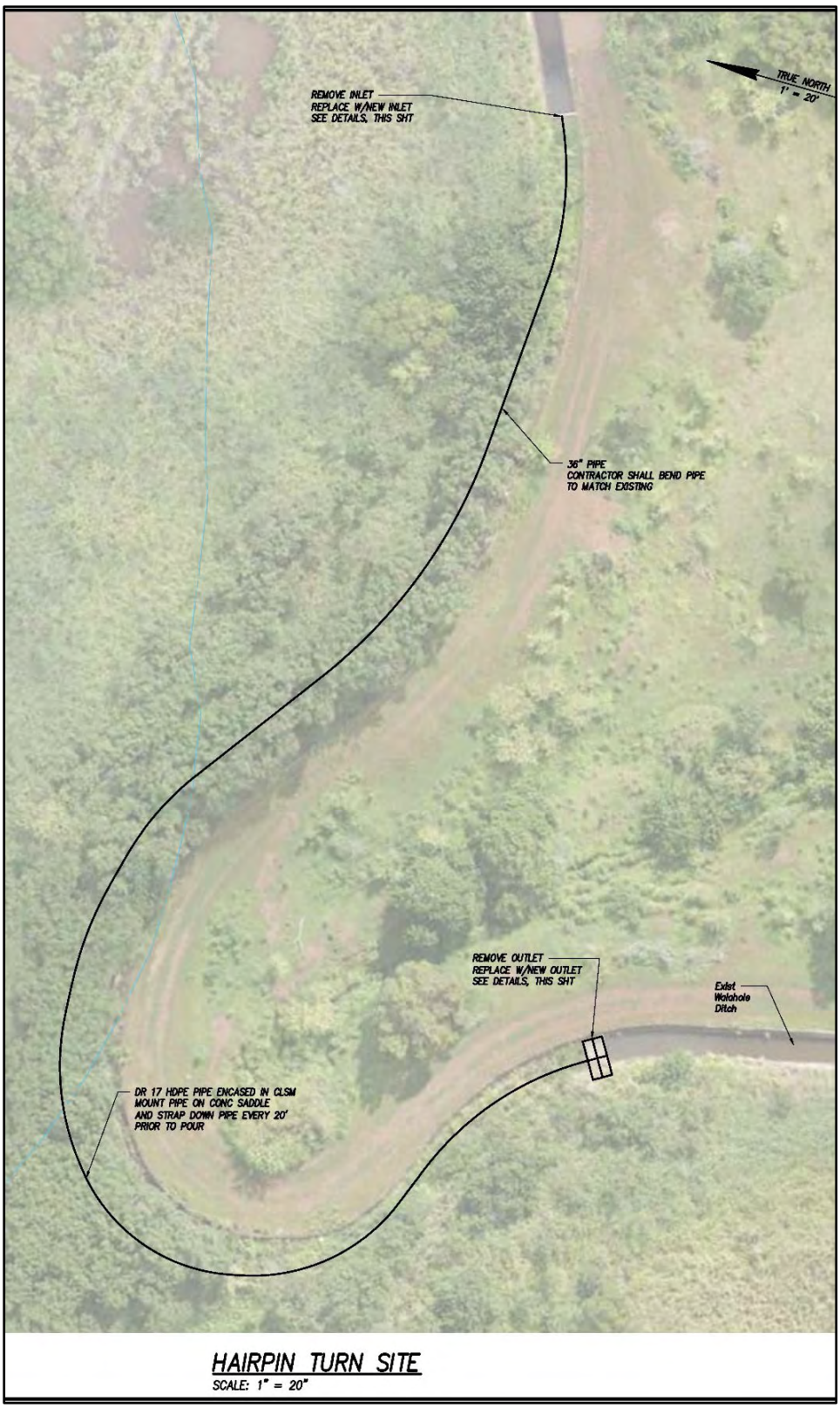

Figure 9. Hairpin turn site on the Waiahole Ditch in the west side of the project area

The project includes two relatively large areas, the proposed new 15-MG reservoir (see Figure 6) estimated at 4.6 acres and a proposed new irrigation water well enclosure (see Figure 7) estimated at 0.4 acre as well as a total of approximately 2,143 m (7,030 ft) of linear irrigation lines and amenities. These irrigation lines may well involve ground disturbance less than 3 ft wide but the precise alignment was often unclear and thus an estimated width of the study area for these lines is somewhat arbitrarily 20 ft; this yields an estimated project area for the lines of 140,600 square (sq) ft (3.23 acres) and an estimate for the total project area of 8.23 acres (3.33 hectares).

1.2 Document Purpose

This investigation was designed—through detailed historical, cultural, and archaeological background research and a field inspection of the project area—to determine the likelihood that historic properties may be affected by the project and, based on findings, consider cultural resource management recommendations. This document is intended to facilitate the project’s planning and support the project’s historic preservation and environmental review compliance and specifically to support the obtaining of a determination letter from the SHPD (in accordance with HAR §13-275-3).

1.3 Environmental Setting

1.3.1 Natural Environment

The project area lies on the southwest slope of O‘ahu’s central valley on the west side of Kunia Road, approximately 6 km northwest of the ocean at the West Loch of Pearl Harbor, with the elevation in the project area ranging from approximately 170-195 m (560 ft to 640 ft) above mean sea level (AMSL). The project area land is generally relatively flat with the exception of the significant tributary valley of Honouliuli Gulch in the central portion of the Kupehau Road/Irrigation Line “A” portion of the project area.

The project area averages about 710.6 mm (28.0 inches) of rainfall annually (Field 140 Station, Giambelluca 2013) which would be marginal at best for non-irrigated agriculture. The tributary valley of Honouliuli Gulch is understood as an intermittent stream but may have run with water more frequently in traditional Hawaiian times prior to water diversion for commercial agriculture.

In pre-Contact Hawai‘i the project area would have been mostly lowland dry shrub and grassland, dominated by species such as *wiliwili* (*Erythrina sandwicensis*), *lama* (*Diospyros ferrea*), sandalwood (*Santalum* sp.), *‘a‘ali‘i* (*Dodonea eriocarpa*), scrub *‘ōhi‘a* (*Metrosideros collina*), and *pili* grass (*Heteropogon contortus*) (Frierson 1972). The predominant vegetation within the project area consists of corn fields, *haole koa* (*Leucaena glauca*), castor bean plants (*Ricinus ommunis*), and a variety of other exotic weeds.

Four soil series, and seven soil types are found in the project area (Foote et al. 1972, Figure 10). The northeast portion of the project area is Kunia silty clay, 0 to 3% slope soils (KyA) with smaller areas of Kunia silty clay, 3 to 8% slope soils (KyB) and Kunia silty clay, 8 to 15% slope soils (KyC) in the central and west portions of the project area. The east portion of the project area is in

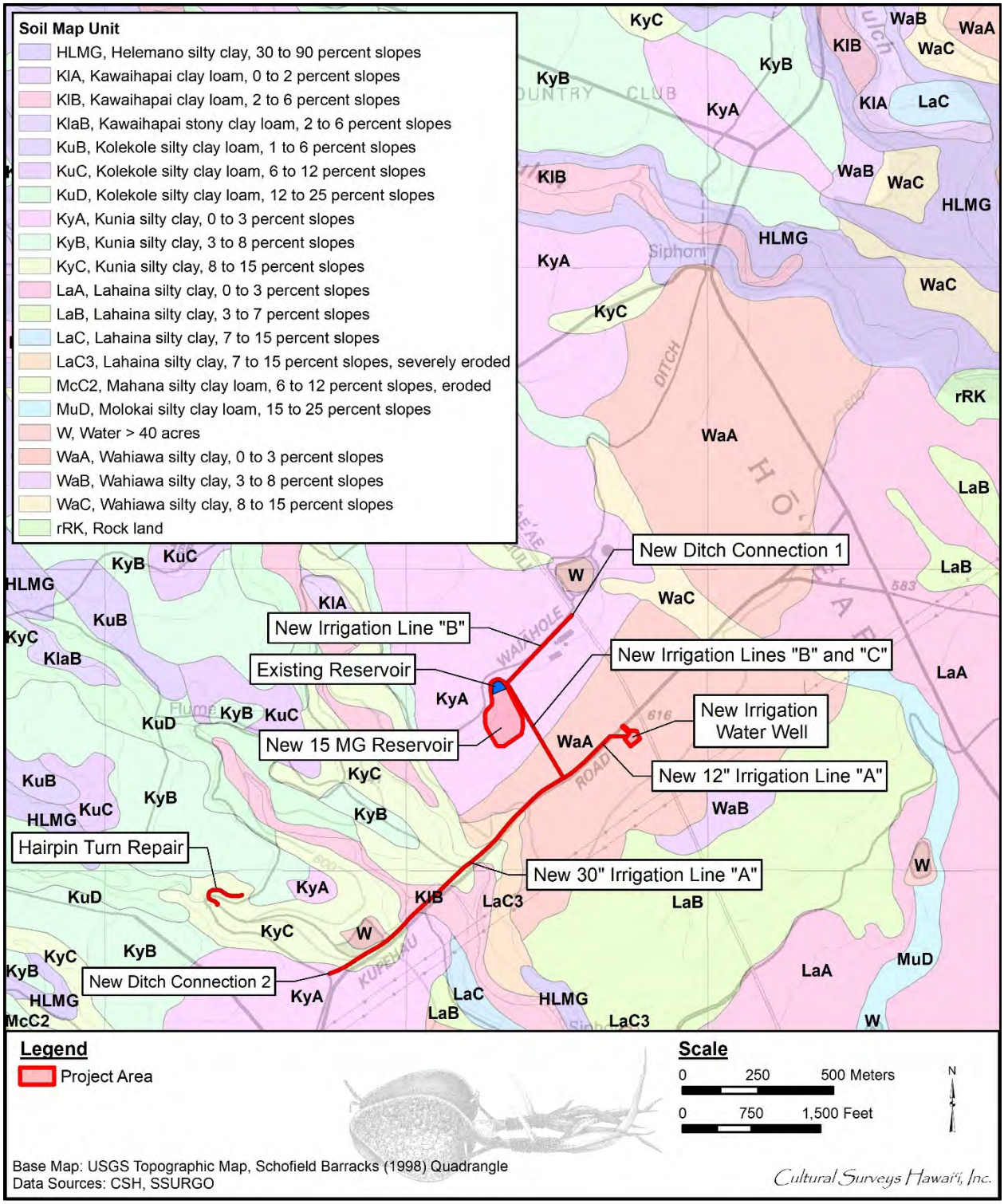

Figure 10. Overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972), indicating soil types within and surrounding the project area(s) (U.S. Department of Agriculture Soils Survey Geographic Database [USDA SSURGO] 2001)

Wahiawa silty clay, 0 to 3% slope soils (WaA). Small areas of Kawaihapai clay loam, 2 to 6% slope (KIB) soils and Lahaina silty clay, 7 to 15% slope (LaC3) soils are present in the central project area.

The Kunia Series

> consists of well-drained soils on upland terraces and fans on the island of Oahu. These soils developed in old alluvium. They are nearly level to moderately sloping. Elevations range from 700 to 1,000 feet. […] Kunia soils occur on the foot slopes of the Waianae Range, near Schofield Barracks. […] These soils are used for sugarcane, pineapple, homesites, and military reservations. Most areas are cultivated, and the natural vegetation is not significant. [Foote et al. 1972:77]

KyA soils are further described as “occurs on broad, smooth slopes. […] Permeability is moderate. Runoff is slow, and the erosion hazard is no more than slight” (Foote et al. 1972:77).

KyB soils are further described as “runoff is slow and the erosion hazard is slight” (Foote et al. 1972:78).

KyC soils are further described as “occurs on narrow side slopes, mainly along drainageways. Runoff is medium, and the erosion hazard is moderate” (Foote et al. 1972:78).

The Wahiawa series:

> […] consists of well-drained soils on uplands on the island of Oahu. These soils developed m residuum and old alluvium derived from basic igneous rock. They are nearly level to moderately steep. Elevations range from 500 to 1,200 feet. […] These soils are used for sugarcane, pineapple, pasture, and homesites. The natural vegetation consists of bermudagrass, guava, honohono, koa haole, and lantana. [Foote et al. 1972:124]

WaA soils are further described as “occurs on smooth, broad interfluves […] Permeability is moderately rapid. Runoff is slow, and the erosion hazard is no more than slight” (Foote et al. 1972:124–125).

Kawaihapai series soils are described as follows:

> consists of well-drained soils in drainageways and on alluvial fans on the coastal plains on the islands of Oahu and Molokai. These soils formed in alluvium derived from basic igneous rock in humid uplands. They are nearly level to moderately sloping. Elevations range from nearly sea level to 300 feet. […] These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of kiawe, koa haole, lantana, and bermudagrass. [Foote et al. 1972:63–64]

KIB soils are further described as “runoff is slow and the erosion· hazard is slight” (Foote et al. 1972:64).

Lahaina series soils are described as follows:

> well-drained soils on uplands on the islands of Lanai, Maui, Molokai, and Oahu. These soils developed in material weathered from basic igneous rock. They are nearly level to steep. Elevations range from 10 to 1,500 feet […] These soils are used for sugarcane and pineapple. Small acreages are used for truck crops, pasture,

> homesites, and wildlife habitat. The natural vegetation consists of bermudagrass, feather fingergrass, ilima, kiawe, lantana, oi, and uhaloa. [Foote et al. 1972:78]

LaC3 soils are further described as follows:

> most of the surface layer and, in places, part of the subsoil have been removed by erosion. Runoff is medium, and the erosion hazard is severe. Included in mapping were small blown-out spots and gullies and small, very stony areas that are eroded to weathered rock. [Foote et al. 1972:79]

1.3.2 Built Environment

Kunia Road on the northeast side of the project area is a major vehicular artery on the southwest central valley of O‘ahu. The Royal Kunia, Villas at Royal Kunia, and Village Park subdivisions are about 2 km to the southeast. Agricultural fields and dirt field roads shown in a 2017 aerial photograph (see Figure 4), surround the project area. The Waiahole Ditch is an engineering marvel that runs along the north or upslope side of portions of the project area. Kupehau Road is a significant unimproved “Haul Cane Road” that forms much of the southeast edge of the project area. A small reservoir is unlined and is retained by an earth-filled dam. This is a commonly constructed type of dam that was built to irrigate sugarcane plantation fields between 1885 and 1940 (Hibbard 2008:3) but this small reservoir appears to post-date 1977 (it is not shown on a 1977 aerial photograph, see Figure 27).

Section 2 Methods

2.1 Field Methods

CSH completed the fieldwork component of this study under archaeological fieldwork permit number 20-07, issued by the SHPD pursuant to HAR §13-282. Fieldwork was conducted on 15 July 2020 by CSH archaeologist David W. Shideler, M.A., This work required approximately 5 hours to complete.

In general, fieldwork included 100% pedestrian inspection of the project area, GPS data collection, and the taking of representative photographs.

2.2 Research Methods

Background research included a review of previous archaeological studies on file at the SHPD; review of documents at Hamilton Library of the University of Hawai‘i, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public Library, and the Bishop Museum Archives; study of historic photographs at the Hawai‘i State Archives and the Bishop Museum Archives; and study of historic maps at the Survey Office of the Department of Land and Natural Resources. Historic maps and photographs from the CSH library were also consulted. In addition, Māhele records were examined from the Waihona ‘Aina database (Waihona ‘Aina 2020).

This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources studied were used to formulate a predictive model regarding the expected types and locations of historic properties in the project area.

2.3 Consultation Methods

A companion cultural impact assessment is actively (October 2020) being undertaken for this project.

Section 3 Background Research

Hawaiians recognize several land divisions in varying scales, including the *moku* (district, larger land division consisting of several *ahupua‘a*), the *kalana* (smaller land division than a *moku*), the *ahupua‘a* (land division typically running from the mountains to the sea), and the *‘ili* (smaller land divisions within an *ahupua‘a*) (Malo 1951:16). S.K. Kuhano wrote in 1873 (cited in Kame‘eleihiwa 1992:330) that O‘ahu was divided into six *kalana* (although later scholars refer to these same divisions as *moku*)—Kona, ‘Ewa, Wai‘anae, Waialua, Ko‘olau Loa, and Ko‘olau Poko—that were further divided into 86 *ahupua‘a*. Within ‘Ewa, there were 12 *ahupua‘a* including (from west to east) Honouliuli, Hō‘ae‘ae, Waikele, Waipi‘o, Waiawa, Mānana, Waimano, Waiau, Waimalu, Kalauao, ‘Aiea, and Hālawa (Kame‘eleihiwa 1992:330). Modern maps and land divisions still generally follow the ancient system and use the same land divisions. The project area addressed in this report lies within Honouliuli Ahupua‘a of ‘Ewa District (Figure 11).

3.1 *Nā Wahi Pana* (Notable Places)

Place names or *wahi pana* (“legendary place”; Pukui and Elbert 1986:376) are an integral part of Hawaiian culture. “In Hawaiian culture, if a particular spot is given a name, it is because an event occurred there which has meaning for the people of that time” (McGuire 2000:23). The *wahi pana* were then passed on through language and the oral tradition, thus preserving the unique significance of the place. Hawaiians named all sorts of objects and places, points of interest that may have gone unnoticed by persons of other cultural backgrounds.

> Hawaiians named taro patches, rocks and trees that represented deities and ancestors, sites of houses and *heiau* (places of worship), canoe landings, fishing stations in the sea, resting places in the forests, and the tiniest spots where miraculous or interesting events are believed to have taken place. [Pukui et al. 1974:x]

Place names and their meaning in this section are compiled from a number of sources. The primary compilation source is the online database of Lloyd Soehren’s “Hawaiian Place Names.” Soehren has compiled all names from mid-nineteenth century land documents, such as Land Commission Award (LCA) and Boundary Commission (BC) reports. The database also includes place name meanings from the definitive book by Pukui, Elbert, and Mookini, *Place Names of Hawaii* (Pukui et al. 1974). In the general text, all place name meanings are from this definitive source, unless otherwise noted.

There were several pre-Contact/early historic trails across ‘Ewa and within the vicinity of the project area. A *mauka-makai* trail branched off from the coastal cross-*ahupua‘a* trail, and followed the boundary between Honouliuli and Hō‘ae‘ae from near the coast at West Loch up into the central valley of O‘ahu (Figure 11 and Figure 12). Further north this trail split with one branch ascending to the Pōhākea Pass and to Wai‘anae and another branch continuing up to the central Wahiawā plateau and on to Waialua District on O‘ahu’s north shore see (Figure 12). Hawaiian historian John Papa ‘Ī‘ī (1959:97) describes the *mauka-makai* (mountains-sea) trail: “From Kunia the trail went to the plain of Keahumoa, on to Maunauna [peak], and along Paupauwela (*‘ili*), which met with the trails from Wahiawā [District] and Waialua [District].”

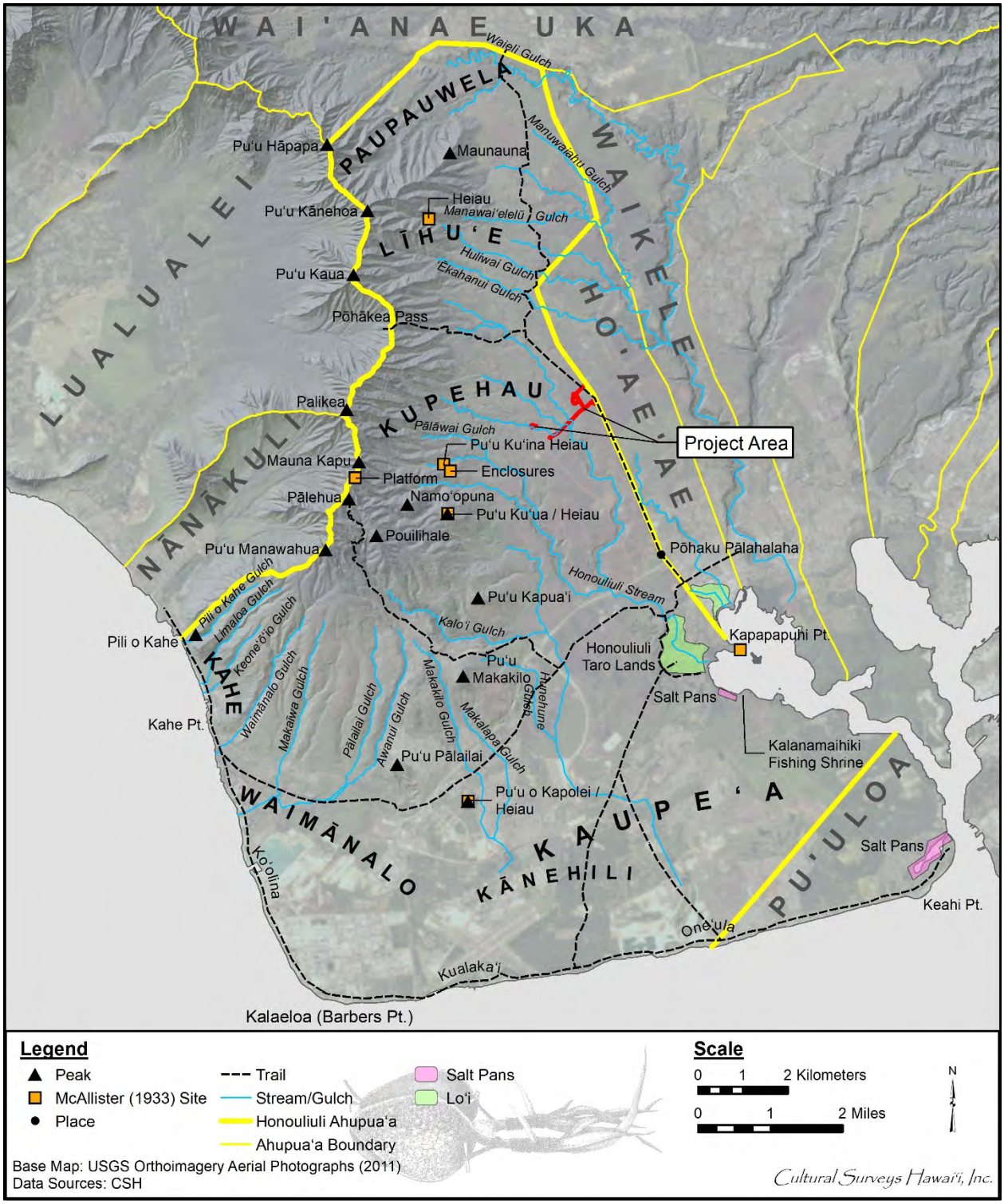

Figure 11. 2011 USGS orthoimagery aerial photograph showing place names of Honouliuli Ahupua‘a and the location of the project area

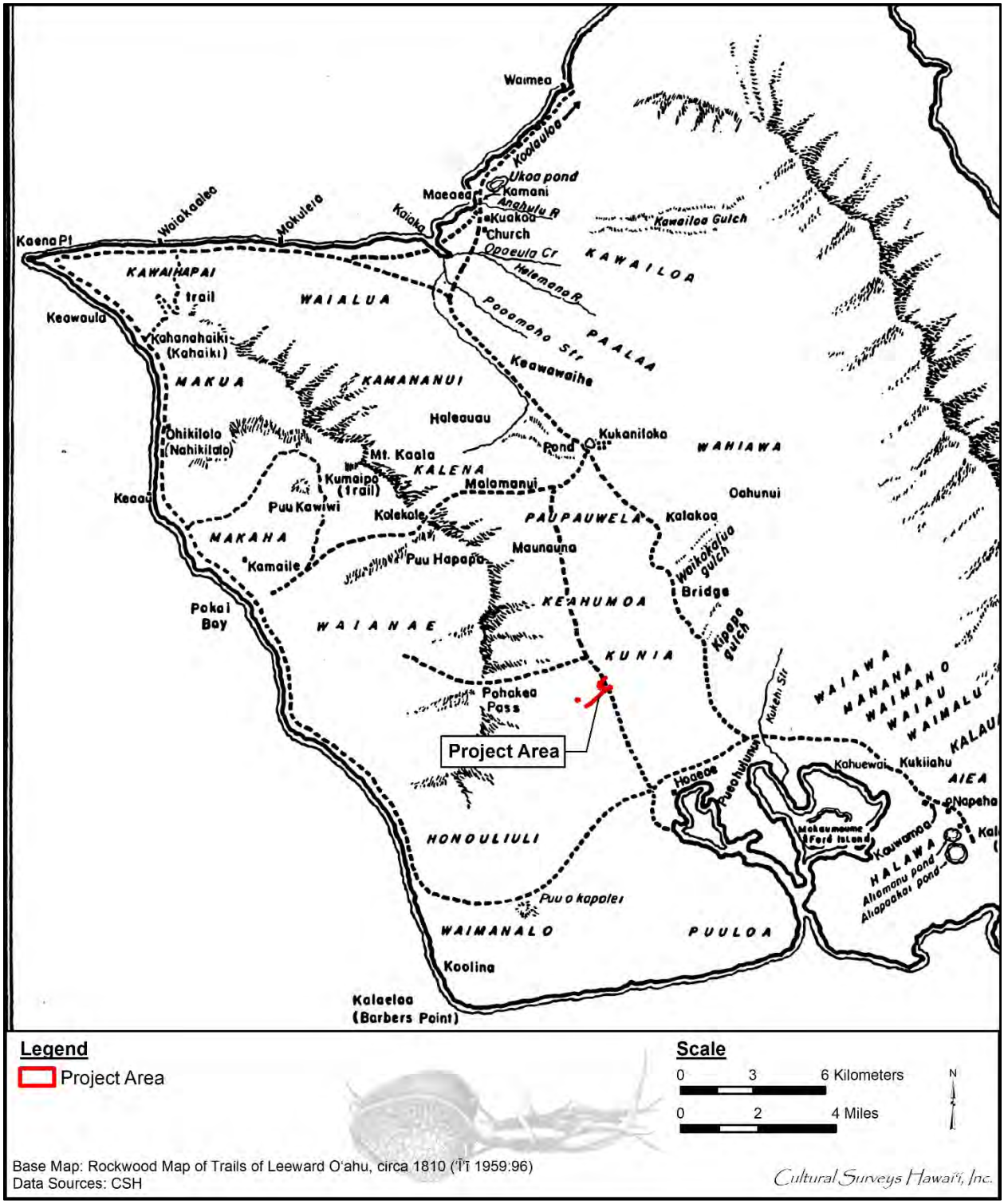

Figure 12. The Rockwood map of trails of Leeward O‘ahu ca. 1810 (from ‘Ī‘ī 1959:96) showing the location of the project area

3.2 **Honouliuli Place Names**

Honouliuli is the largest *ahupua‘a* in the *moku* of ‘Ewa. One translation of the name for this district is given as “unequal” (*Saturday Press*, 11 August 1883). Others translate the word as “strayed” and associate it with the legends of the gods, Kāne and Kanaloa.

> When Kane and Kanaloa were surveying the islands they came to Oahu and when they reached Red Hill saw below them the broad plains of what is now Ewa. To mark boundaries of the land they would throw a stone and where the stone fell would be the boundary line. When they saw the beautiful land lying below them, it was their thought to include as much of the flat level land as possible. They hurled the stone as far as the Waianae range and it landed somewhere, in the Waimanalo section. When they went to find it, they could not locate the spot where it fell. So Ewa (strayed) became known by the name. The stone that strayed. [Told to E.S. by Simeon Nawaa, 22 March 1954; cited in Sterling and Summers 1978:1]

Honouliuli means “dark water,” “dark bay,” or “blue harbor” and was named for the waters of Pearl Harbor (Jarrett 1930:22), which marks the eastern boundary of the *ahupua‘a*. The Hawaiians called Pearl Harbor, Pu‘uloa (*lit*. long hill). Another explanation for the names comes from the “Legend of Lepeamoa,” the chicken-girl of Pālama. In this legend, Honouliuli is the name of the husband of the chiefess Kapālama and grandfather of Lepeamoa. The land district Honouliuli was named for the grandfather of Lepeamoa (Westervelt 1923:164–184).

It seems likely the boundaries of the westernmost *ahupua‘a* of ‘Ewa were often contested with Wai‘anae people. The ‘Ewa people could cite divine sanction that the dividing point between Wai‘anae and ‘Ewa was between two hills at Pili o Kahe:

> The ancient Hawaiians said the hill on the ‘Ewa side was the male and the hill on the Wai‘anae side was female. The stone was found on the Waianae side hill and the place is known as Pili o Kahe (Pili=cling to, Kahe=flow). The name refers, therefore, to the female or Waianae side hill. And that is where the boundary between the two districts runs. [Told to E.S. by Simeon Nawaa, 22 March 1954; cited in Sterling and Summers 1978:1]

Honouliuli has a number of topographic features, peaks, streams, gulches, coastal points, and a number of ancient villages. The place names, the types of features, and name meanings are listed in Table 1 and are shown on Figure 11.

3.3 **Honouliuli Prehistory and Early History**

Various Hawaiian legends and early historical accounts indicate the *ahupua‘a* of Honouliuli was once widely inhabited by pre-Contact populations, including Hawaiian *ali‘i* (chiefly class). This would be attributable for the most part to the plentiful marine and estuarine resources available at the coast, along which several sites interpreted as permanent habitations and fishing shrines were located. Other attractive subsistence-related features of the *ahupua‘a* include irrigated lowlands suitable for wetland taro cultivation, as well as the lower forest area of the mountain slopes for the procurement of forest resources.

Table 1. Honouliuli place names

Place	Type	Meaning	Source
Kalo‘i	gulch	the taro patch	Pukui et al. 1974
Kapapapuhi	point, *‘ili ‘āina* (land area)	the numerous eels	Thrum 1922
Kapolei, Pu‘u o	hill	beloved Kapo, a sister of Pele	Pukui et al. 1974
Kapuai, Pu‘u	*pu‘u*	footstep	Thrum 1922
Ku‘ina, Pu‘u	*pu‘u*, *heiau* (pre-Christian place of worship)		
Ku‘ua, Pu‘u	*pu‘u*, *heiau*	relinquished hill	Pukui et al. 1974
Makakilo, Pu‘u	*pu‘u*	observing eyes	Pukui et al. 1974
Manawahua, Pu‘u	*pu‘u*	great grief hill, or nausea hill	Pukui et al. 1974
Maunakapu	peak	sacred mountain	Pukui et al. 1974
Nāmo‘opuna	gulch	the grandchildren	Pukui and Elbert 1986
Pālailai	gulch	young *lai* fish	Pukui et al. 1974
Pālehua	*pu‘u*	*lehua* flower enclosure	Pukui et al. 1974
Palikea	*pu‘u*, ridge	white cliff	Pukui et al. 1974
Poulihale	gulch	dark house	Pukui et al. 1974

Exploitation of the forest resources along the slopes of the Wai‘anae Range—as suggested by E.S. and E.G. Handy—probably acted as a viable subsistence alternative during times of famine:

> [...] The length or depth of the valleys and the gradual slope of the ridges made the inhabited lowlands much more distant from the *wao*, or upland jungle, than was the case on the windward coast. Yet the *wao* here was more extensive, giving greater opportunity to forage for wild foods during famine time. [Handy and Handy 1972:469–470]

These upper valley slopes may have also been a significant resource for sporadic quarrying of basalt for the manufacturing of stone tools. This is evidenced in part by the existence of a probable quarrying site (State Inventory of Historic Places [SIHP] # 50-80-12-4322) in Makaīwa Gulch at 152 m (500 ft) AMSL (Hammatt et al. 1991).

The Hawaiian *ali‘i* were also attracted to the region, which is steeped in myth. An extensive summary of various legends and historical accounts of Honouliuli can be found in Sterling and Summers (1978:31–44).

As previously reported, John Papa ‘Ī‘ī describes a network of Leeward O‘ahu trails (see Figure 12) which in later historic times encircled and crossed the Wai‘anae Range, allowing passage from Lualualei to Honouliuli via Pōhākea Pass (‘Ī‘ī 1973:96–98). ‘Ī‘ī’s account of the use of the trail through Pōhākea Pass and passing by the project area is described as follows:

> It was at this time that the king, chiefs, and court members left Honolulu and sailed by canoe to Waianae. Liholiho, the heir to the kingdom, went overland with Papa and others from Honolulu and spent the night at Kumelewai in Ewa. […] The travelers stopped only one night and spent the following night on the other (Wai‘anae) side of Pohakea. The elders and the children who went with them slept above Kunia, on the other side of Pohakea. [‘Ī‘ī 1959:23]

3.4 **Early History**

Early historical accounts of the general region typically refer to the more populated areas of the ‘Ewa district, where missions and schools were established and subsistence resources were perceived to be greater. However, the presence of archaeological sites along the barren coral plains and coast of southwest Honouliuli Ahupua‘a indicate prehistoric and early historic populations also adapted to less inviting areas, despite the environmental hardships.

Barbers Point is named after Captain Henry Barber who ran aground on 31 October 1796. Subsequent to Western Contact in the area, the landscape of the ‘Ewa plains and Wai‘anae slopes was adversely affected by the removal of the sandalwood forest, and the introduction of domesticated animals and new vegetation species. Domesticated animals including goats, sheep, and cattle were brought to the Hawaiian Islands by Captain George Vancouver in the early 1790s, and allowed to graze freely about the land for some time after. It is unclear when the domesticated animals were brought to O‘ahu; however, L.A. Henke reports the existence of a longhorn cattle ranch in Wai‘anae by at least 1840 (Frierson 1972:10). During this same time, perhaps as early as 1790, exotic vegetation species were introduced to the area. These typically included vegetation best suited to a terrain disturbed by the logging of sandalwood forest and eroded by animal grazing. Within the current project area, the majority of the vegetation is comprised of introduced species, mainly Christmas berry (*Schinus terebinthifolius*) and eucalyptus (*Eucalyptus* sp.), though *kukui* (*Aleurites moluccana*) appears to have withstood the major vegetative changes in the area. The following dates of specific vegetation introduced to Hawai‘i are given by R. Smith and outlined by Frierson (1972:10–11):

1. “early”, c. 1790:
   Prickly pear cactus, *Opuntia tuna*

   Haole koa, Leucaena glauca

   Guava, *Psidium guajava*
2. 1835-1840

   Burmuda [*sic*] grass, *Cynodon dactylon*

   Wire grass, *Eleusine indica*
3. 1858b
   Lantana, *Lantana camara*

The *kiawe* tree was also introduced during this period, either in 1828 or 1837 (Frierson 1972:11).

3.5 **Honouliuli Settlement Patterns**

The *ahupua‘a* of Honouliuli is the largest traditional land unit on the island of O‘ahu. Honouliuli includes all the land from the western boundary of Pearl Harbor (West Loch) westward to the ‘Ewa/Wai‘anae District Boundary with the exception of the west side of the harbor entrance which is in the *ahupua‘a* of Pu‘uloa (the ‘Ewa Beach/Iroquois Point area). This comprises approximately 12 miles of open coastline from One‘ula westward to Pili O Kahe. The *ahupua‘a* extends *mauka* (almost pie-shaped) from West Loch nearly to Schofield Barracks and the western boundary is the Wai‘anae Mountain crest running *makai* to the east ridge of Nānākuli Valley.

Not only is there a long coastline fronting the normally calm waters of leeward O‘ahu but there are 4 miles of waterfront along the west side of West Loch. The land immediately *mauka* of the coast consists of a flat karstic raised limestone reef forming a level nearly featureless “desert” plain marked in prehistoric times (previous to alluviation caused by sugar cultivation) by thin or non-existent soil mantle. The micro topography is notable in containing countless sinkholes in some areas caused by chemical weathering (dissolution) of the limestone shelf. Along the eastern flank of the Wai‘anae Mountains, numerous gulches have contributed to the alluvial deposits over the limestone shelf of the coastal zone. Honouliuli Gulch, which drains into West Loch is the largest of the gulches. The gulches are generally steep-sided in the uplands and generally of a high gradient until they emerge onto the flat ‘Ewa plain. The alluvium they have carried has spread out in delta fashion over the *mauka* portions of the plain, which comprises a dramatic depositional environment at the stream gradient change. These gulches are generally dry, but during seasonal Kona storms carry immense quantities of runoff onto the plain and into the ocean. As typical drainages in arid slopes they are either raging uncontrollably, or are dry and as such do not form stable water sources for traditional agriculture in their upper reaches. The Honouliuli gulches generally do not have valleys suitable for extensive irrigated agriculture. However, this lack is more than compensated by the rich watered lowlands near West Loch.

Honouliuli Ahupua‘a, as a traditional land unit, had tremendous and varied resources available for exploitation by early Hawaiians. The “karstic desert” and marginal characterization of the limestone plain, which is the most readably visible terrain, does not do justice to the *ahupua‘a* as a whole. The richness of this land unit is marked by the following available resources:

1. Twelve miles of coastline with continuous shallow fringing reef containing rich marine resources.
2. Four miles of frontage on the waters of West Loch which offered extensive fisheries (mullet, awa, shellfish, as well as frontage suitable for development of fishponds, for example, Laulaunui).
3. The lower portion of Honouliuli Valley in the ‘Ewa plain offered rich level alluvial soils with plentiful water for irrigation from the stream as well as abundant springs. This land would have stretched well up the valley.
4. A broad limestone plain which because of innumerable limestone sinkholes offered a nesting home for a large population of avifauna. This resource may have been one of the early attractions for human settlement.

An extensive upland forest zone extending as much as 12 miles inland from the edge ot the coastal plain. As Handy and Handy have pointed out, the forest was much more distant from the lowlands here than it was on the windward side, but on the leeward side was more extensive

(Handy and Handy 1972:469). Much of the upper reaches of the *ahupua‘a* would have had species-diverse forest with *kukui*, *‘ōhi‘a* (*Metrosideros Macropus*), sandalwood (*Santalum* spp.), *hau* (*Hibiscus titiaceus*), *ti* (*Cordyline fruticose*), banana (*Maia* sp.), etc. A network of trails gives access to Lualualei and the Wai‘anae coast reaches.

Within this natural setting archaeological and traditional sources show a general pattern of three main areas of settlement within the *ahupua‘a*: a coastal zone, the Honouliuli taro lands, and inland settlement at Pu‘u Ku‘ua.

3.5.1 The Coastal Zone – Kalaeloa (Barbers Point), Ko‘olina (West Beach)

Kalaeloa (Barbers Point)

Archaeological research at Barbers Point has focused on the areas in and around the Deep Draft Harbor (Barrera 1975; Davis and Griffin 1978; Hammatt and Folk 1981, McDermott et al. 2000). Series of small clustered shelters, enclosures, and platforms show limited but recurrent use at the shoreline zone for marine-oriented exploitation. This settlement covers much of the shoreline with more concentrated features around small marshes and wet sinks. Immediately behind the shoreline under a linear dune deposit is a buried cultural layer believed to contain some of the earliest habitation evidence in the area.

The attraction of the area to early Hawaiians was the plentiful and easily exploited bird population. Particular evidence for taking of petrel occurs at SIHP # 50-80-12-2763 (Hammatt and Folk 1981:213). Initial heavy exploitation of nesting seabirds and other species in conjunction with habitat destruction probably led to early extinction.

There is some indication of limited agriculture in mulched sinkholes and limited soil areas. Considering rainfall, this activity would have been limited, but probably involved tree crops and roots (sweet potatoes). The archaeological content of the sites indicates a major focus on marine resources.

Davis and Griffin (1978) distinguish functional classes of sites, based on surface area size and argue that the Barbers Point settlement consists of functionally integrated multi-household residence groups. Density contours of midden (by weight) and artifacts (by numbers) plotted for residence sites by Hammatt and Folk (1981) generally indicate narrowly defined spatial foci of discard, possibly indicating continuous use, or at least with no refurbishing or additions to the structures through time (Hammatt and Folk 1981). The focus is small habitation sites, typically lacking the full range of features found in large permanent residence complexes such as high platforms, complex enclosures, and ceremonial sites.

Ko‘Olina (West Beach)

Davis et al. (1986a and 1986b) and Davis and Haun (1987) document around 180 component features at 48 sites and site complexes consisting of habitation sites, gardening areas, and human burials in the Ko‘Olina vicinity. Chronologically the occupation covers the entire span of Hawaiian settlement in what Davis and Haun describe as “one of the longest local sequences in Hawaiian prehistory” (Davis and Haun 1987:37). The earliest part of the sequence relates to the discovery of an inland marsh; early dates were also obtained for the beachfront site and an inland rock shelter.

3.5.2 Honouliuli Taro Lands

Centered around the west side of Pearl Harbor at Honouliuli Stream and its broad outlet into the West Loch are the rich irrigated lands of the *‘ili* of Honouliuli which give the *ahupua‘a* its name. Dicks et al. (1987) documented remnants of a once-widespread wetland system (*lo‘i* [taro pond fields] and fishponds) as well as dryland cultivation of the adjacent slopes.

Carol Silva conducted “Historic Research Relative to the Land of Honouliuli” (Appendix A, Dicks et al. 1987) and the reader is referred to this work for an overview of the history of Honouliuli.

The area bordering West Loch was clearly a major focus of population within the Hawaiian Islands and this was a logical response to the abundance of fish and shellfish resources in close proximity to a wide expanse of well-irrigated bottomland suitable for wetland taro cultivation. Dicks et al. (1987:78–79) conclude, on the basis of 19 carbon isotope dates and three volcanic glass dates, that “Agricultural use of the area spans over 1,000 years.” Undoubtedly, Honouliuli was a locus of habitation for thousands of Hawaiians. Prehistoric population estimates are a matter of some debate but it is worth pointing out that in the earliest mission census (1831-1832; Schmitt 1973:19), the land (*‘āina*) of Honouliuli contained 1,026 men, women, and children. It is not clear whether this population relates to Honouliuli Village or *ahupua‘a,* but the village probably contained the vast majority of the district’s population. The nature of the reported population structure for Honouliuli (less than 20% children under 12 years of age) and the fact that the population decreased more than 15% in the next four years (Schmitt 1973:22) suggests the prehistoric population of Honouliuli Village may well have been significantly greater than it was in 1831-1832. A conservative estimate would be that tens of thousands of Hawaiians lived and died at Honouliuli Village.

3.5.3 Pu‘uku‘ua: Inland Settlement

Documentation of inland settlement in Honouliuli Ahupua‘a, and also Hō‘ae‘ae, is more problematic in that there are relatively few documented archaeological sources. However, it is probable that the area around Pu‘uku‘ua, on the east side of the Wai‘anae Ridge 7 miles inland of the coast and 2 km southwest of Reservoir 155, was a Hawaiian place of some importance.

In 1899, the Hawaiian language newspaper *Ka Loea Kalaiaina* relates a story of Pu‘uku‘ua as “a place where chiefs lived in ancient times,” a “battle field,” and “thickly populated.” The article summarizes as follows:

> 1) This place was entirely deserted and left uninhabited and it seems that this happened before the coming of righteousness to Hawai‘i Nei. Not an inhabitant is left.
>
> 2) The descendants of the people of this place were so mixed that they were all of one class. Here the gods became tired and returned to Kahiki. [Sterling and Summers 1978:33]

McAllister recorded three sites in this area, two *heiau* (Sites 134, 137; Pu‘u Kuina and Pu‘uku‘ua, both destroyed) and a series of enclosures in Kukuilua which he calls “*kuleana* sites” (McAllister 1933). On the opposite side of the Wai‘anae range along the trail to Pōhākea Pass Cordy (2002) states “Kākuihihewa was said to have built (or rebuilt) Nīoi‘ula, a po‘okanaka *heiau* (1,300 sq. m.) in Hālona in upper Lualualei, along the trail to Pōhākea Pass leading into ‘Ewa, ca.

A.D. 1640-1660” (Cordy 2002:36). There is no direct archaeological evidence available to the authors’ knowledge that intensive Hawaiian settlement occurred here but it is considered as a place of high probability based on the above indications. John Papa ‘Ī‘ī (1959) described a journey that Liholiho took which led him and an entourage through inland Honouliuli and over Pōhākea Pass. Geographically, the area receives sufficient quantities of water and would have had abundant locally available forest resources.

3.6 **Honouliuli in the Māhele**

The Organic Acts of 1845 and 1846 initiated the process of the Māhele, the division of Hawaiian lands, which introduced private property into Hawaiian society. In 1848, the crown, the Hawaiian government, and the *ali‘i* received their land titles. The common people (*maka‘āinana*) began to receive their *kuleana* awards (individual land parcels) in 1850.

During the Māhele of 1848, 72 individual land claims in the *ahupua‘a* of Honouliuli were registered and awarded by King Kamehameha III (Tuggle and Tomonari-Tuggle 1997:34). The 72 *kuleana* awards, awards given to commoners, were located in the lower portions of Honouliuli Ahupua‘a near Pearl Harbor with its fishponds and irrigated taro fields (Maly 1997). No *kuleana* claims were awarded within the project area.

Miriam Ke‘ahikuni Kekau‘ōnohi acquired a deed (Royal Patent #6971) to all unclaimed land within the *ahupua‘a* (including the present project area), which totaled 43,250 acres.

Kekau‘onohi was one of Liholiho’s (Kamehameha II) wives, and after his death, she lived with her half-brother, Luanu‘u Kahala‘ia, who was governor of Kaua‘i (Hammatt and Shideler, 1990:19–20). Subsequently, Kekau‘onohi ran away with Queen Ka‘ahumanu’s stepson, Keli‘i-ahonui, and then became the wife of Chief Levi Ha‘alelea. Upon her death on 2 June 1851, all her property was passed on to her husband and his heirs. When Levi Ha‘alelea died the property (including the current project area) passed to his surviving wife, who in turn leased it to James Dowsett and John Meek in 1871 for stock running and grazing.

3.7 **Late Nineteenth Century**

In 1877 James Campbell purchased most of Honouliuli Ahupua‘a, including the present project area, for a total of $95,000. Campbell drove off 32,347 head of cattle owned by Dowsett, Meek, and James Robinson and constructed a fence around the outer boundary of his property (Bordner and Silva 1983:C-12). He reintroduced cattle to the lands and by 1881 Campbell’s Honouliuli property was a prosperous cattle ranch with “abundant pasturage of various kinds” (Briggs in Haun and Kelly 1984:45).

In 1880-81 Campbell’s property, called Honouliuli Ranch, was described as follows:

> […] Acreage, 43,250, all in pasture, but possessing fertile soils suitable for agriculture; affords grazing for such valuable stock. The length of this estate is no less than 18 miles. It extends to within less than a mile of the sea coast, to the westward of the Pearl River inlet […] There are valuable fisheries attached to this estate. [Bowser 1880:489]

In 1889 Campbell leased his property to Benjamin Dillingham, who subsequently formed the Oahu Railway & Land Company (OR&L) in 1890. The first 15 miles of the rail line reached Hō‘ae‘ae on 1 July 1890 (Yardley 1981:158). To attract business to his new railroad system,

Dillingham subleased all land below 200 ft to William Castle who in turn sublet the area to the Ewa Plantation Company for sugarcane cultivation (Frierson 1972:15).

Just north of Ewa Plantation was the equally sprawling Oahu Sugar Company which “covered some 20 square miles [...] ranging in elevation from 10 ft at the Waipio Peninsula [...] to 700 ft at the Waiahole Ditch” (Condé and Best 1973:313).

The 1873 Alexander map of Honouliuli (Figure 13) and the 1894 Kanakanui map of Honouliuli (Figure 14) show the vicinity of the project area in the last days of ranching of the nineteenth century before the beginning of the intensive sugarcane agriculture of the twentieth century. The “Road to Honolulu” connecting the Wai‘anae Coast to Honolulu skirting around West Loch and the connecting trail up the central valley near the boundary of Honouliuli and Hō‘ae‘ae are prominent on both maps. Both maps show the Robinson Ranch headquarters near the confluence of these two major trails. Both maps show Colonel John Meek’s ranch headquarters about 4 km northwest of the present project area in the uplands of the Līhu‘e Plain. The tributary gulch of Honouliuli gulch that crosses the project area is also prominent on both maps cutting northwest/southeast across the project area. The greater vicinity of the project area is notably lacking in evidence of human development (other than the traditional trail along Hō‘ae‘ae Ahupua‘a).

3.8 **History of Oahu Sugar Company**

In 1897, B.F. Dillingham established the Oahu Sugar Company on 12,000 acres leased from the estates of John Papa ‘Ī‘ī, Bishop, and Robinson. Prior to commercial sugar cultivation, these lands were described as being “of near desert proportion until water was supplied from drilled artesian wells and the Waiahole Water project” (Condé and Best 1973:313). Dillingham had successfully promoted the Ewa Plantation Company in 1890; the sprawling sugar company was just south of and adjacent to the Oahu Sugar Company. Artesian wells had converted those arid ‘Ewa lands into a thriving plantation, and Dillingham recognized the same potential in the northern area. During land clearing rock and stone “some as large as houses [...] were encountered” and later used as building materials (Yamamoto et al. 2005:20).

The OR&L was another Dillingham development. Established in 1886, the railway was the means to transport sugar from both the Oahu Sugar Company and the Ewa Plantation Company to Honolulu’s docks. The Oahu Sugar Company, located near the spur line of the OR&L, had approximately 64 miles of railroad tracks for transporting sugarcane to the plantation’s mill in Waipahu. The plantation owned locomotives and used both permanent and portable tracks for harvesting (Smith 1924; Condé and Best 1973).

Water to irrigate the upper cane fields was initially pumped to levels of 150 m (500 ft) by some of the “largest steam pumps ever manufactured” (Dorrance and Morgan 2000:49). Oahu Sugar Company’s innovations to utilize the arid ‘Ewa Plains and increase production within the plantation were so successful that the improvements were incorporated throughout the sugarcane industry. The Oahu Sugar Company constructed Hawai‘i’s first 12-roller mill in 1907, and P.A. Messchaert, the plantation’s chemist, invented a mechanized grooving method in 1913 that maintained pressure on the processing cane while allowing the cane juice to flow (Dorrance and Morgan 2000:49).

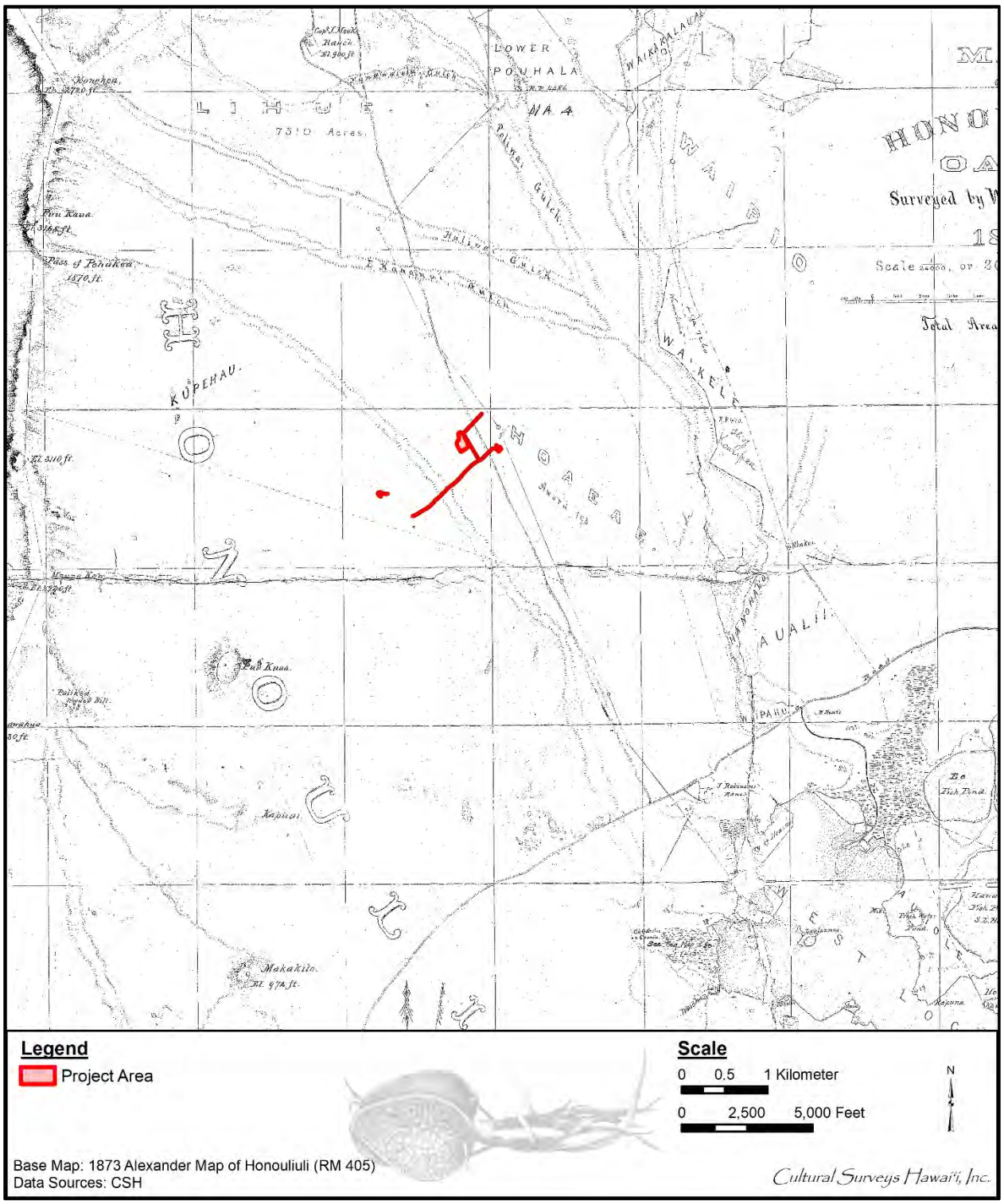

Figure 13. Portion of 1873 Alexander map of Honouliuli (RM 405) showing project area(s)

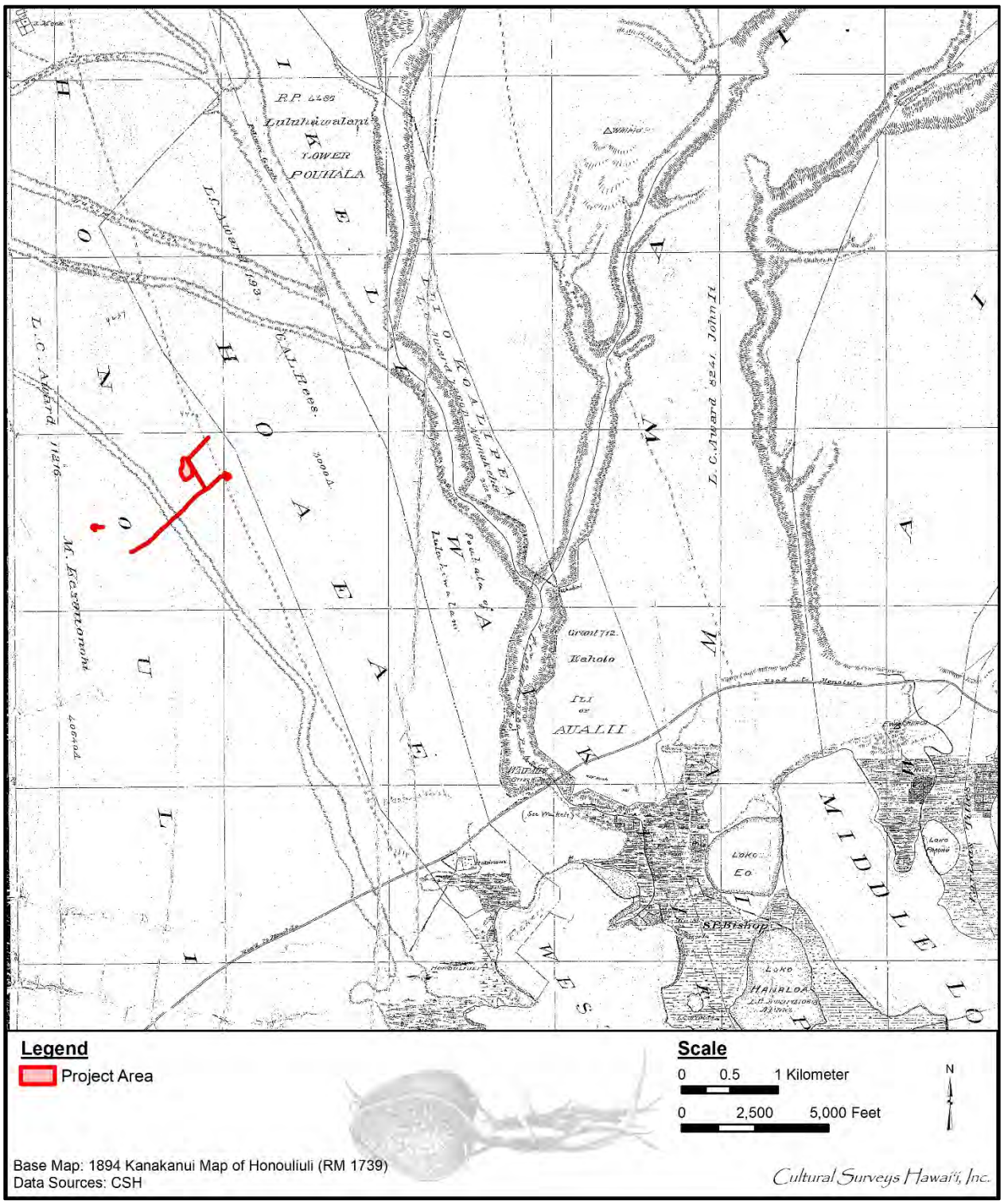

Figure 14. Portion of 1894 Kanakanui map of Honouliuli (RM 1739) showing project area(s)

The Ewa Plantation Company and Oahu Sugar Company exploded onto the lands of ‘Ewa. The Donn map of 1906 (Figure 15) shows how these two plantations quickly overran the lower slopes of ‘Ewa with the Oahu Sugar Company seemingly already including almost all of the present project area by that date. Only the hairpin turn portion of the present project area was outside the area of sugar plantations and is shown as still in grazing lands at that time.

The expense of pumping water to the high elevations of the plantation led to the proposal to transport water from the windward side of the Ko‘olau Mountains, which led to the establishment of the Waiahole Water Company (see Section 0). Completed in 1916, the Waiahole Ditch provided sufficient water to allow for sugar cultivation in the arid lands above 175 m, or 575 ft.

Annual sugar production increased to over 50,000 tons in 1918 and exceeded 40,000 tons annually for decades. Mechanical harvesting innovations within the industry continued to develop and further increased production. They included mechanically loading cane in 1924, and in 1928 the Oahu Sugar Company broke a world’s record by averaging more than 12 tons of sugar per acre. Other improvements included the removal of impurities during processing with an Oliver filter in 1926.

Lands throughout the Oahu Sugar Company were plowed and planted every eight to ten years since multiple crops, called ratoon crops, grew after the first crop was cut. Ground preparation required plowing to a depth of 50.8 to 63.5 cm, or 20 to 24 inches, with very heavy machinery since it was necessary to crumple the soil sufficiently so that it would hold more water. A length of cane stalk was then planted in furrows laid out either in the contour system or the long line system; both systems were likely used within the project area due to the configuration of flat and steep land. Concrete flumes and connecting ditches were used for irrigation and the concrete segments were formed at the plantation’s cement plant. Coulter (1933:66) refers to the system as the “Hawaiian Furrow System” with the water flowing from the Waiahole Ditch to the concrete canals and in smaller channels and then to the furrows. Nitrogen fertilizer was also added to the irrigation water for the ratoon crops. Each field was cultivated and irrigated as a separate entity with small villages of the workers and their families living adjacent to the fields. Workers overseeing the cultivation, irrigation, and general care of the fields were paid on the crop yield. Those plowing and planting the fields were paid by the acre, and cutting and piling the sugarcane was paid by the ton. There were 32 small villages within the 12,000-acre plantation in 1933, and 79 fields ranging from approximately 10 to 100 ha, or 25 to 250 acres. The plantation villages were generally located near crossroads or the juncture of several roads. By 1948, the plantation contained 131 fields, still ranging from 25 to 250 acres (Coulter 1933:66; Greene 1933:5; Smith 1924:126–127, 131).

Mechanical improvements continued and during World War II, all cane was mechanically harvested. In 1950, the Oahu Sugar Company railroad was replaced with trucks due to efficiency and ease of carrying cane to the mill as well as the ability to provide supplies throughout the plantation. The Oahu Sugar Company had 178 miles of road by that time.

By 1960, the Oahu Sugar Company was the largest sugar producer on O‘ahu with 75,000 tons annually. The company took control of the Ewa Plantation lands, south of and adjacent to the Oahu Sugar Company, in 1970 and continued operations until 1995, when sugarcane production in the combined plantation area ended (Dorrance and Morgan 2000:45, 50).

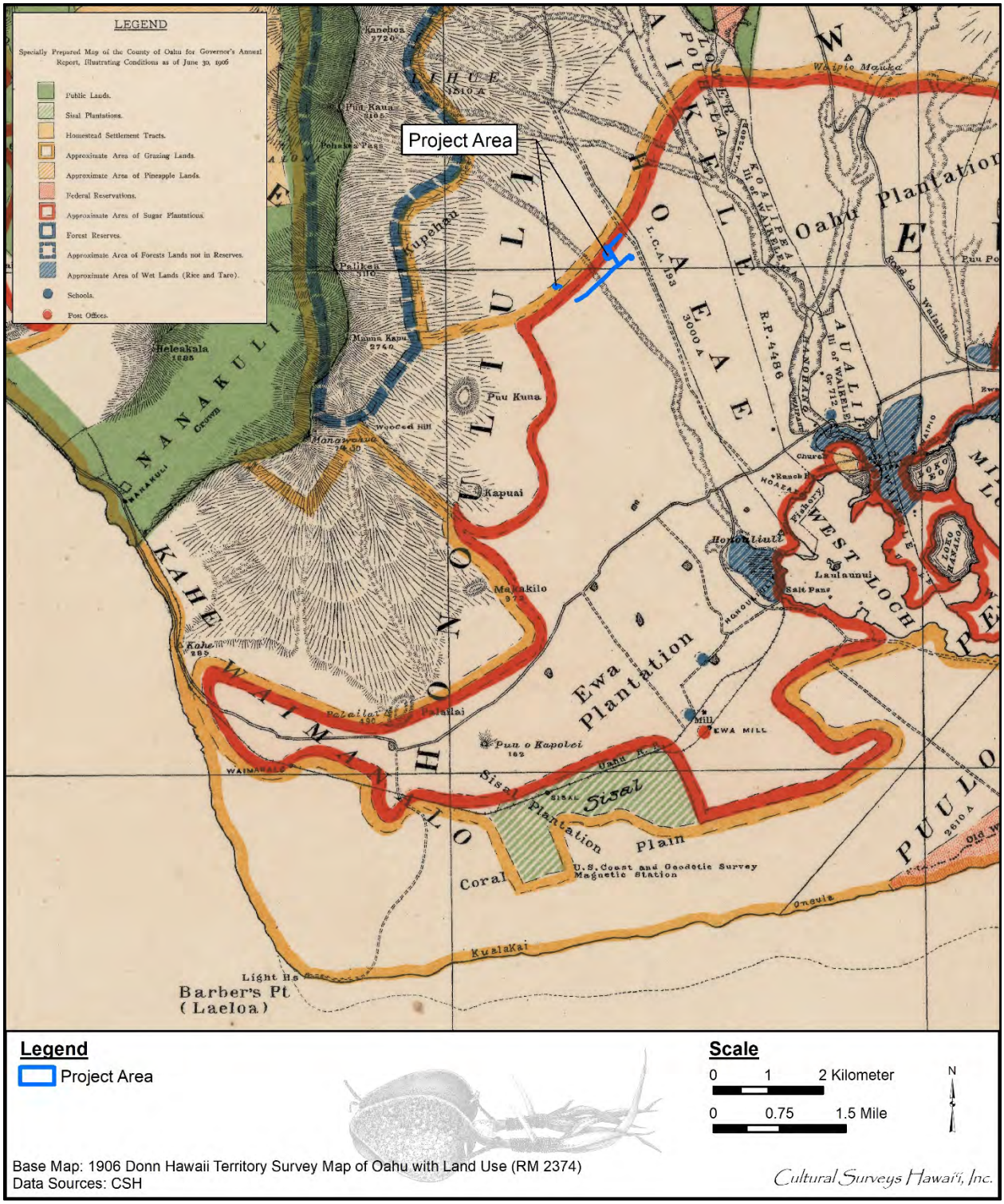

Figure 15. Portion of 1906 Donn Hawaii Territory Survey map of Oahu with land use (RM 2374) showing the location of the project area

3.9 **History of the Waiahole Ditch**

The Waiahole Water Company was formally incorporated in 1913 and was originally a subsidiary of the Oahu Sugar Company. The Waiahole Ditch was designed by engineer Jorgen Jorgensen, with recommendations by engineer J.B. Lippencott and assisted by W.A. Wall. The ditch began in Kahana Valley at an elevation of 240 m (790 ft), and ran almost entirely through tunnels in the Waikāne and Waiāhole valleys, the Ko‘olau Mountains, to central O‘ahu where the water ran through “concrete-lined ditches and across gulches by inverted siphons to Reservoir 155” (ADC 2009:2) at 600 ft. Siphons could be inverted to move water uphill; the exit grade had to be below the grade of the intake (Wilcox 1996:59). Both wood and metal siphons were used starting in the late 1800s and are throughout the Waiahole Ditch (Wilcox 1996).

Upon its completion in 1916, the Waiahole Ditch was 35 km (21.9 miles) long and cost $2.3 million. The 32 million gallons of daily water enabled the Oahu Sugar Company to grow to “some 20 square miles […] ranging in elevation from 10 feet at the Waipio Peninsula […] to 700 feet at the Waiahole Ditch” (Condé and Best 1973:313).

> Begun in February 1913, construction was completed within a little over three years and the first water was delivered to Oahu Sugar Company on May 27, 1916 [...] A series of tunnels, siphons and lined ditches on the leeward side then convey the water to reservoirs and to ditches of Oahu Sugar Company. [Herschler 1966:1–2]

A 1917 report on the “Waiahole Water Project” engineering features states, “The water is also delivered into numerous reservoirs, especially at night, when irrigating the cane fields is inconvenient” (Kluegel 1917:95).

Completion of the Waiahole Ditch provided sufficient water to allow for sugar cultivation in the arid lands above 175 m, or 575 ft. The ditch formed the *mauka* boundary of the Oahu Sugar Company plantation, and its waters were utilized throughout the uplands higher than 575 ft.

This ditch complex passed through Hō‘ae‘ae, bringing much needed water to the area.

> West of Waikakalaua Gulch, through Hoaeae and to the upper boundary of Oahu Plantation in Honouliuli, the conduit consists of 12,650 feet of cement-lined ditches, and three redwood pipes 5 feet in diameter, having an aggregate length of 2,830 feet. [Kluegel 1917:96]

> The Waiahole Water Co. has taken over from the Oahu Sugar Co. the Ahrens Ditch in Waiawa, the Kipapa Ditch, the Waikakalaua Ditch in Waipio, and the Hoaeae Ditch. Two redwood pipes having a total length of 1,223 feet have been laid across two gulches on the line of Hoaeae Ditch, cutting out 2¼ miles of ditch. The water delivered by the Waiahole System is chiefly used on newly planted cane on land above the lift of the pumps. [Kluegel 1917:107]

The Waiahole Water Company changed its name in 1970 to the Waiahole Ditch Irrigation Company. The Oahu Sugar Company and Waiahole Ditch Irrigation Company later became a wholly owned subsidiaries of Amfac/JMB Hawaii. When the Oahu Sugar Company’s sugarcane production ceased in 1995, discussions—as well as law suits—with regard to how best to use the Waiahole Ditch waters ensued. In 1999, the Waiahole Ditch system was purchased by the State of Hawai‘i, under management by the ADC (ADC 2009:2).

An economic impact study of the system provides the following summary of its operation:

> The 25.3 mile long water delivery system begins at an elevation of 790 ft. in Kahana Valley and ends at a reservoir on the leeward side of Oahu in Honouliuli. The irrigation system is made up of a series of natural dikes and tunnels, which channel impounded ground water. The water from these dikes also feeds three Windward streams in the vicinity, Waiahole, Waikane and Kahana, through seeps and springs. The system uses gravity to transport water through the central plain, and Leeward users of the system pump out the water. A redwood board determines the flow direction and amount. Depending on which marker the board is raised or lowered to, more or less water flows to leeward or windward areas. If the board is raised, more water flows to the leeward side. Conversely, the more the board is lowered, the greater the amount of water that flows to Waiahole stream. From the time the irrigation system was built up until the early 1990s, the leeward side of Oahu was receiving an average of 27 million gallons of water a day. [ADC 2002:6]

The Office of Planning Department of Business Economic Development and Tourism (DBEDT 2012:53) reports the Waiahole Ditch is used by approximately 15,000 people who receive 10 mdg delivered to 6,000 acres of land. Agriculture supported by the system includes “corn seed, mixed vegetables, watermelons, bananas, papaya, pumpkin, tomato, cucumbers, onions, taro, bell peppers, cabbage, bok choy, soybeans, squash, bitter-melon, melons, corn, pineapple, herbs and broccoli” (DBEDT 2012:53).

Repairs to the ditch system by the ADC are routinely undertaken to prevent water losses due to seepage, including replacing three siphon sections constructed with redwood that “were recently replaced” (Water Resource Associates 2003:78). While a bit dated, the following list of alterations from the DBEDT (2012:22) gives a feeling for the frequency of minor alterations and repairs:

Relatively Recent (2004-2009) Activity for the Waiahole Ditch Irrigation System

2009 December 2008 heavy rains collapsed two wooden flumes. High water volumes led to the installment of two new culvert pipes.

2009 Easement acquired for land on Kahana and Waiahole land parcels.

2009 Delay of Reservoir 255 and 155 lining project due to new dam safety rules and dam safety issues.

2008 Completed installation of a pump-back system at Reservoir 225.

2008 As part of the Waiahole Combined Contested Case Decision and Order III, developed plans to line Reservoirs 225 and 155 with an impermeable material and ADC’s reduce system loss permit would be reduced from 2.03 mgd to 1.42 mgd by June 2008.

2007 Del Monte ceased its Kunia pineapple operation in 2006. Diversified agriculture picked up resulting loss in water sales.

2007 ADC initiated work on the installation of a pump-back system at Reservoir 225.

2007 Kunia Water Users Cooperative agreed to turn over the farmers’ water meters to the ADC.

2006 Closure of Del Monte plantation. Del Monte consumed 25-30 percent of water. Closure has created the potential for overflow, as well as lost resources.

2006 ADC board approved the installation of a pump-back system at Reservoir 225.

2006 Elimination of unnecessary 800 ft stretch of unlined wing ditch.

2006 ADC initiated contract to obtain easement over land owned by Campbell Estate.

2005 Design Phase Waiahole Irrigation System Reservoir Improvements.

2005 ADC began design portion of project with US Army Corps of Engineers to improve system and reduce water loss by lining reservoirs. To better monitor system loss, two Partial flumes have been installed.

2005 Dredged by-pass ditch at Reservoir 155 and soil erosion control measures taken near Del Monte fields.

2004 Design Phase of Waiahole Irrigation System Reservoir [Office of Planning Department of Business Economic Development and Tourism 2012:22]

3.10 The Project Area as Depicted on Twentieth Century Maps and Aerial Photographs

A series of historic maps and aerial photographs shows the land use and gradual development of the project area and its vicinity. The 1919 U.S. War Department map (Figure 16) shows the (approximate) alignment of the Waiahole Ditch (understood as completed in 1916) as already in place with most of the project area indicated as under sugarcane cultivation. A separate ditch system appears to descend from two small reservoirs to the northeast, arcing through the proposed 15-MG reservoir location and crossing the proposed new 30-inch Irrigation Line “A.” The depicted fences in the vicinity are understood to reflect the former history of livestock grazing that was being phased out as sugar cultivation intensified. A short segment of a plantation railroad line running along Kupehau Road east of Kunia Road (that would come to be designated SIHP # 50-80-08-7671: Feature 3 in Wong and Spear 2015) crosses into the project area near the proposed new backup irrigation and water well enclosure. A small reservoir is indicated just west of the gulch and just north of the west end of the proposed new 30-inch Irrigation Line “A.” No buildings are indicated near the project area (other than a water tank on the east side of Kunia Road).

The 1922 Wall map (Figure 17) is curious in that it does not depict either Kunia Road at the east edge of the project area which ran along the boundary of Honouliuli and Hō‘ae‘ae *ahupua‘a* nor the Waiahole Ditch. It does show an “upside down” T-intersection of unimproved road alignments just to the north of the project area and provides a wealth of detail regarding developments on the lower Kunia slope of the southern Wai‘anae Range including small “camps,” pineapple fields, ploughed fields, and the “Kupihau Ranch Station” located approximately 1.0 km southwest of the present project area. No information was obtained regarding this ranch, assumed to have been a small livestock ranch, and understood as related to the name “Kupehau Road.” Other than unimproved roads, no other development is indicated near the present project area on this 1922 map. The 1925 Evans map (Figure 18) shows the same configuration of unimproved roads near the present project area but nothing else (and similarly shows neither Kunia Road nor the Waiahole Ditch).

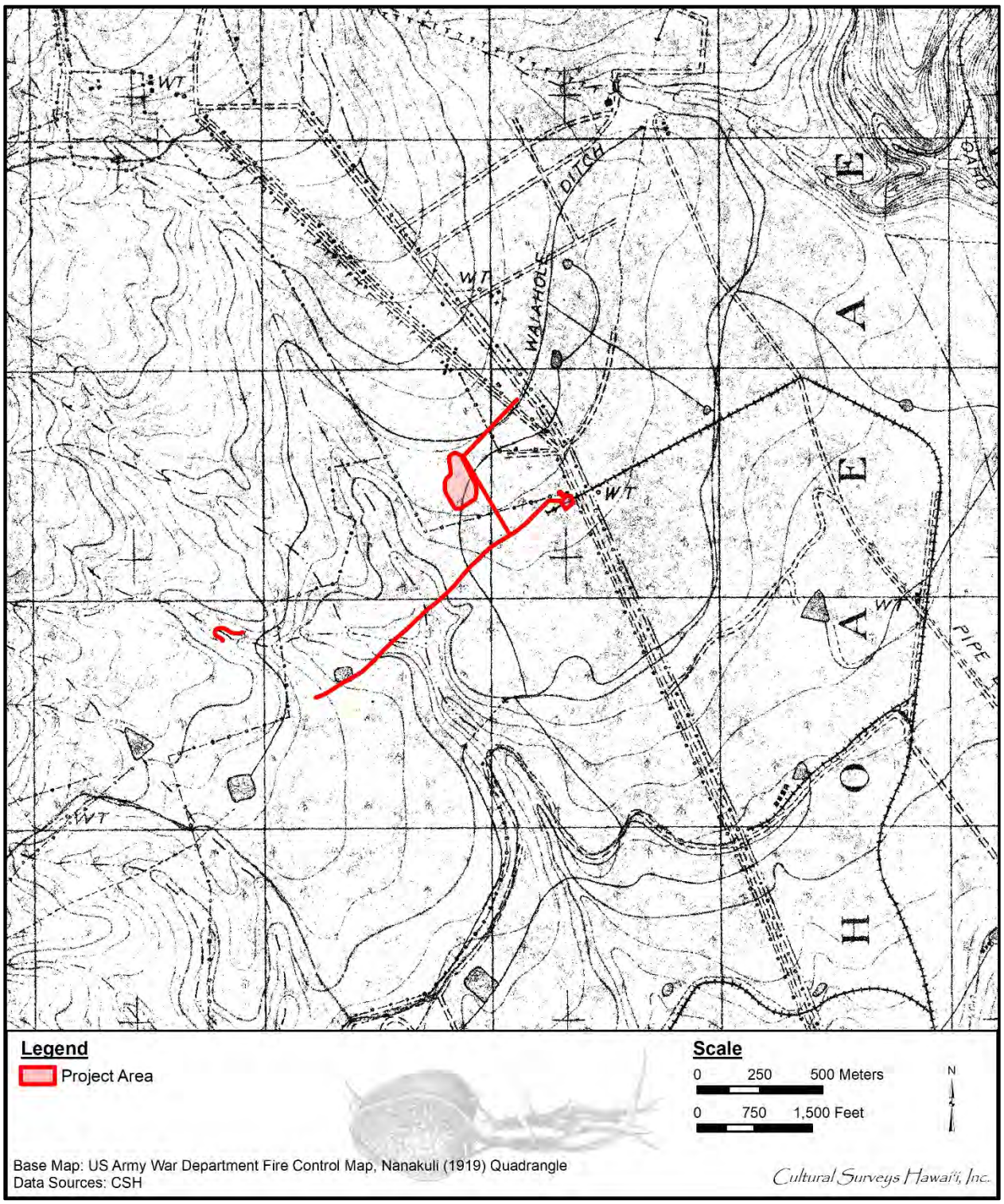

Figure 16. Portion of 1919 U.S. Army War Department fire control map, Nanakuli quadrangle showing project area(s)

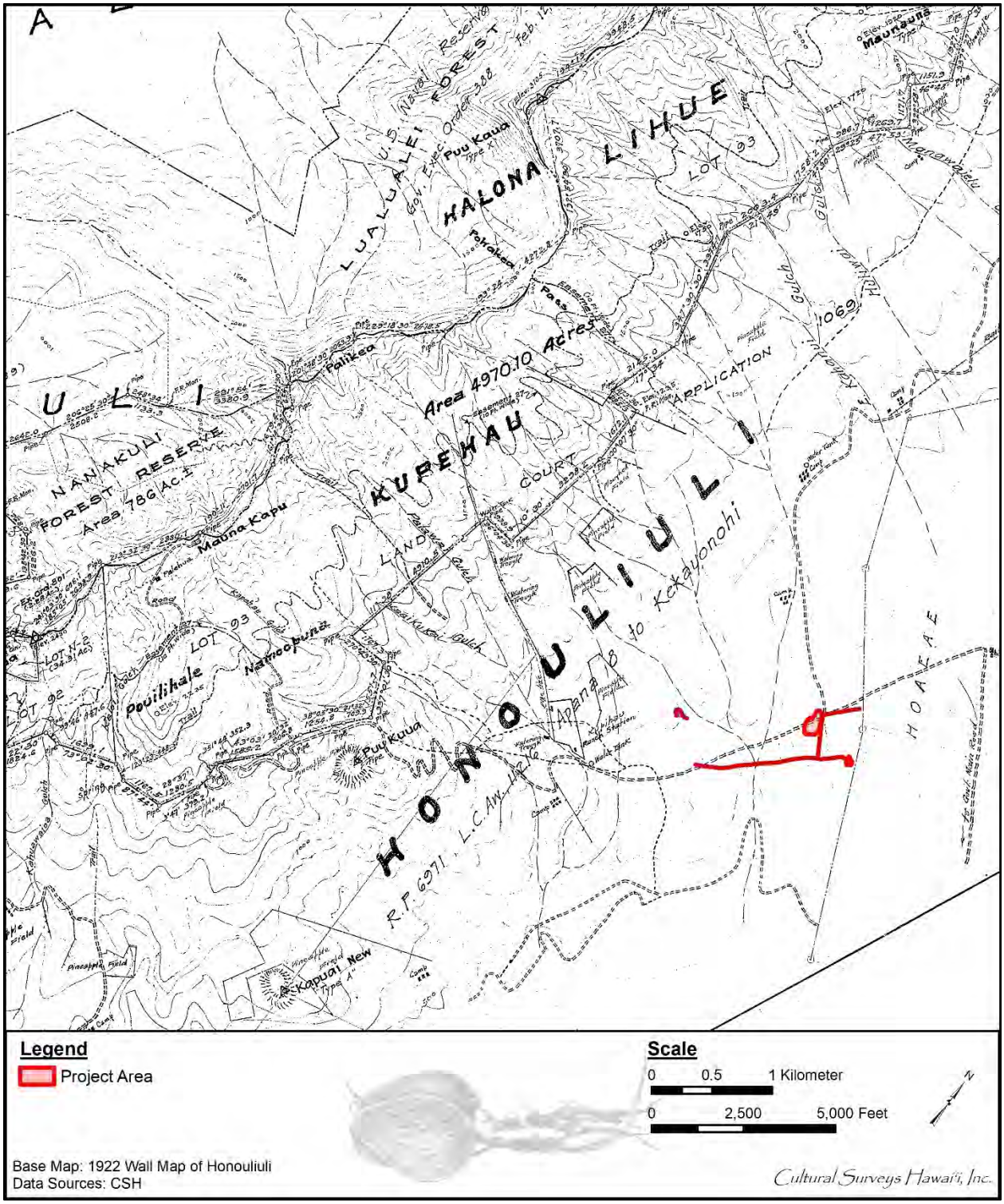

Figure 17. Portion of 1922 Wall map of Honouliuli showing the project area(s)

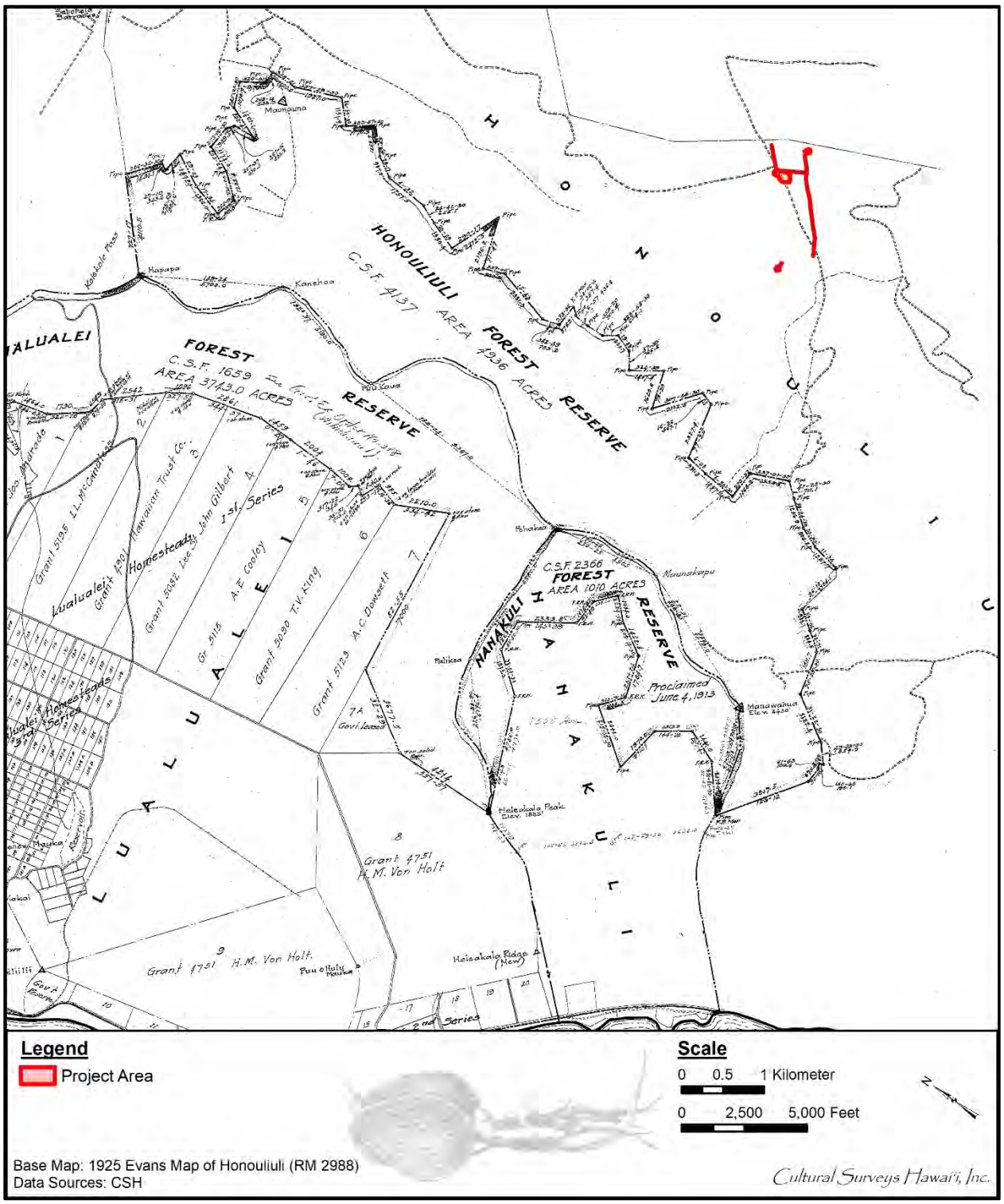

Figure 18. Portion of 1925 Evans map of Honouliuli (RM 2988) showing the project area(s)

The 1928/1929 USGS map (Figure 19) shows an extensive grid of new, unimproved roads to the north and west of the project area understood as supporting pineapple cultivation. Two plantation railroad lines of the Oahu Sugar Company are indicated in the present project area. It appears that a railroad line crossed Kunia Road on the Kupehau Road alignment along the proposed new 12-inch Irrigation Line “A” alignment for a distance of approximately 300 m before curving *mauka* as it approached the central gulch south of the proposed new reservoir. A separate railroad line is indicated heading *mauka* up the floor of the gulch until approximately where the proposed new 30-inch Irrigation Line “A” crosses the gulch. A relatively straight ditch is depicted heading *makai* (southeast) from the Waiahole Ditch near the northwest end of the project area near Kunia Road. No buildings are indicated near the project area.

The 1933 Land Court Application map (Figure 20) provides details of the Waiahole Ditch alignment in the vicinity of the project area but little else.

The 1935/1936 U.S. War Department map (Figure 21) and the 1943 U.S. War Department map (Figure 22) show very much the same scene with the relationship of the two adjacent railroad lines to the present project area depicted with greater clarity but show no other development within the project area. A line of houses just to the east, on the east side of Kunia Road, suggests a small plantation camp was located there at that time. The Wahiawā/‘Ewa boundary line is shown as at the Waiahole Ditch.

Following World War II, plantation railroad transportation was quickly replaced by trucking and the 1953 USGS map (Figure 23) depicts no railroads but Kupehau Road within the project area is named and indicated as improved.

The 1962 USDA aerial photograph (Figure 24) shows the project area in a sea of sugarcane (including in the central gulch area) although there is large-scale pineapple cultivation indicated immediately to the northwest in the darker green narrow rectangular fields. The 1968 USGS aerial (Figure 25) shows much the same scene but there is an indication that the nearest pineapple fields have been converted to sugarcane cultivation. The former small plantation camp on the east side of Kunia Road and just south of Kupehau Road (outside the project area) depicted on maps from 1935 to 1953 appears to be gone by 1962.

The 1969 USGS map (Figure 26) shows the Waiahole Ditch alignment quite clearly and shows a new “Landing Strip” a kilometer north of the project area but no other new development.

The 1977 USGS aerial (Figure 27) shows most of the sugarcane fields in the eastern project area as fallow and perhaps already out of production forever (Oahu Sugar Company went out of business in 1994; Dorrance and Morgan 2000:41). The small reservoir now present in the north portion of the proposed new 15-MG reservoir is not indicated and is understood as having been built after 1977.

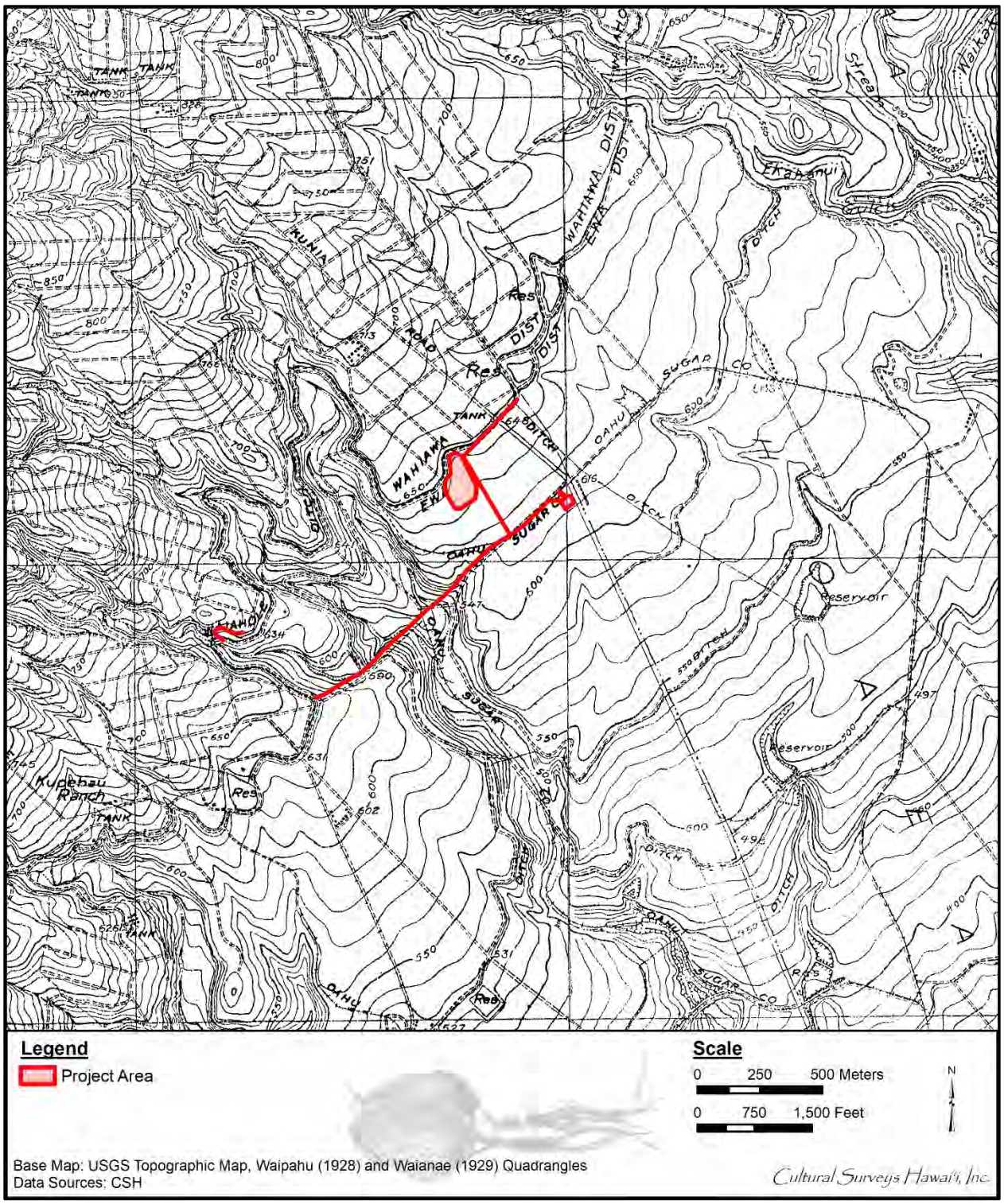

Figure 19. Portion of 1928 Waipahu and 1929 Waianae USGS topographic quadrangle map showing the project area(s)

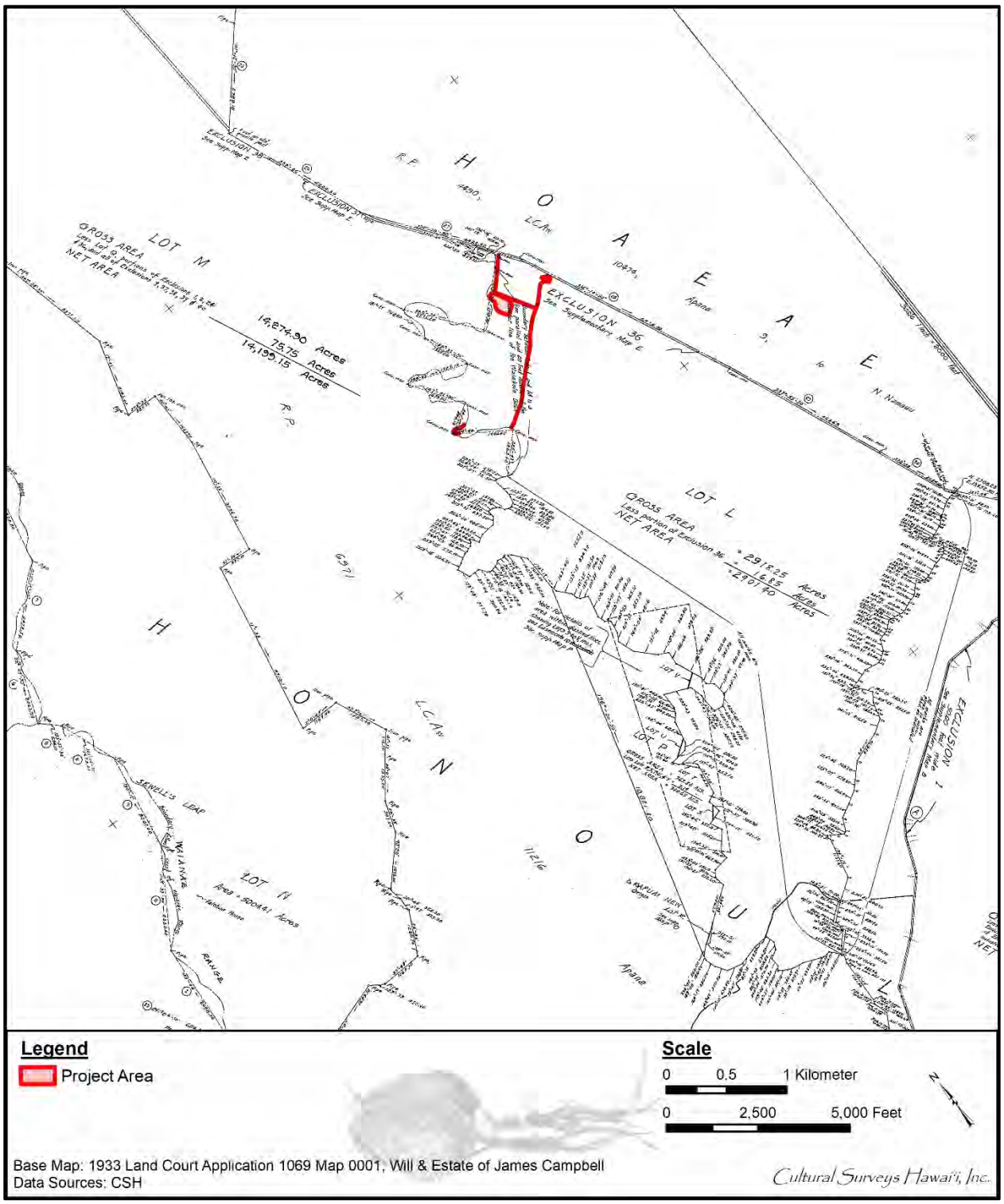

Figure 20. Portion of 1933 Land Court Application 1069 Map 0001, Will & Estate of James Campbell showing the project area(s)

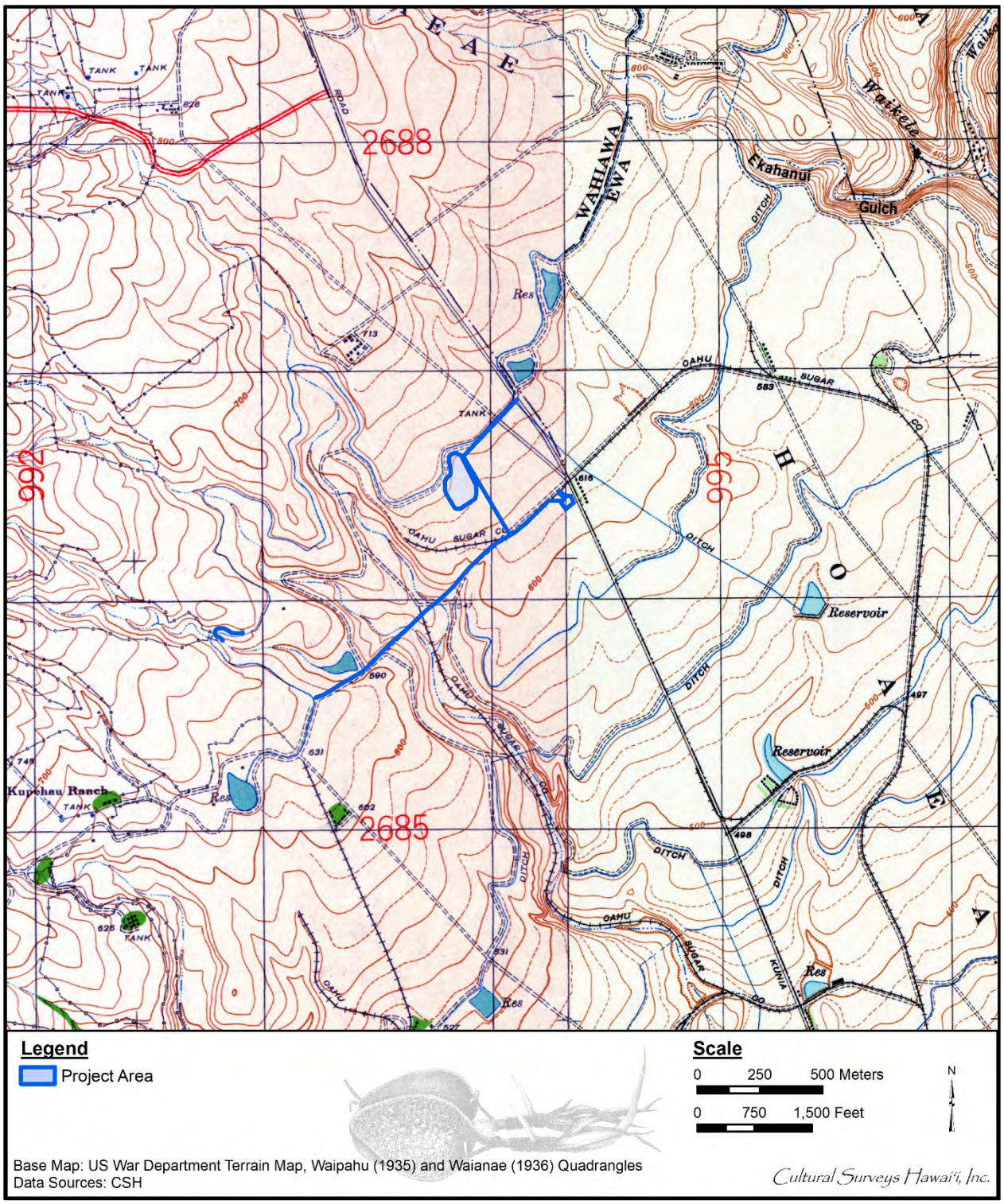

Figure 21. Portion of 1935 Waipahu and 1936 Waianae U.S. War Department terrain quadrangle map showing the project area(s)

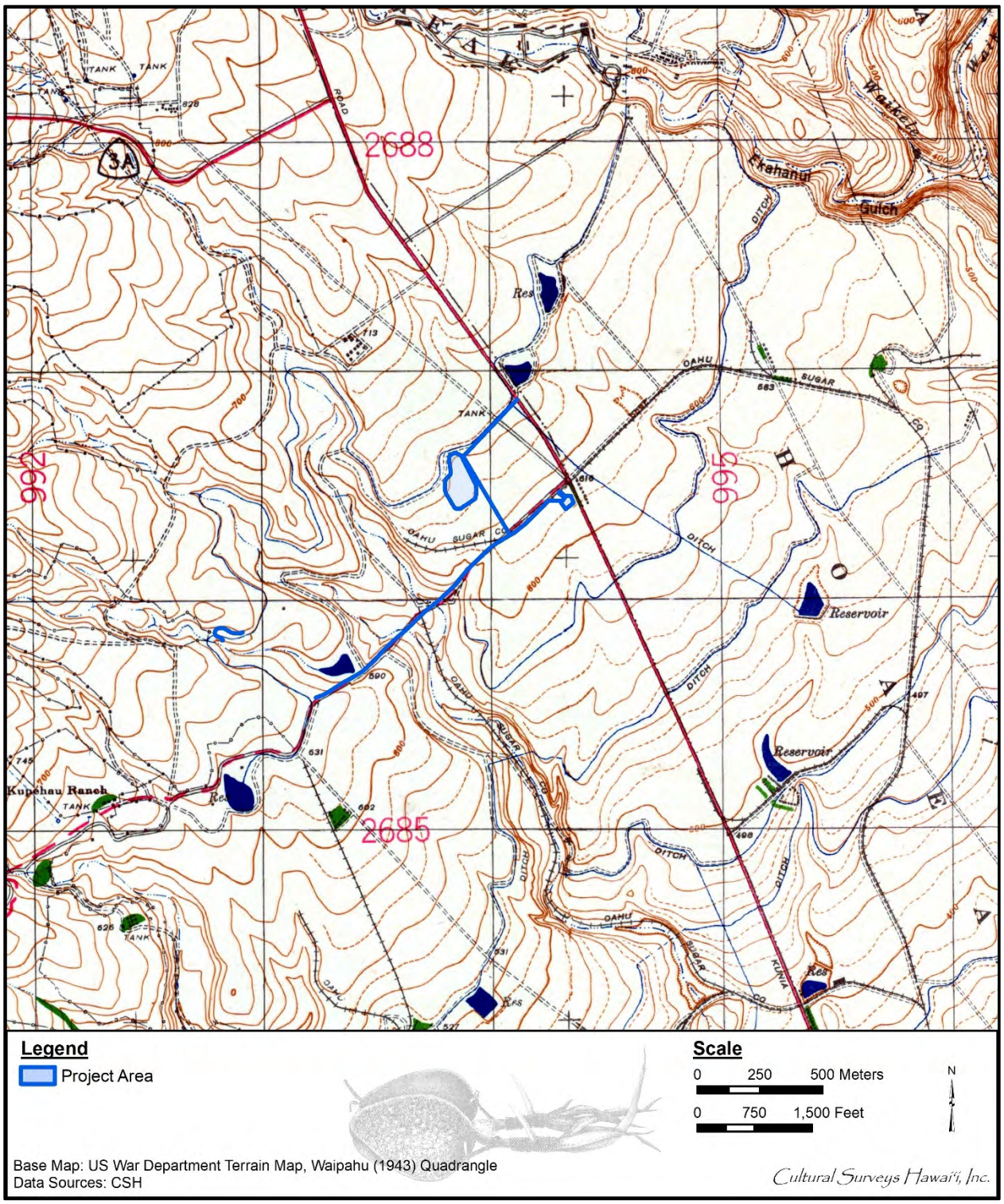

Figure 22. Portion of 1943 Waipahu U.S. War Department terrain quadrangle map showing the project area(s)

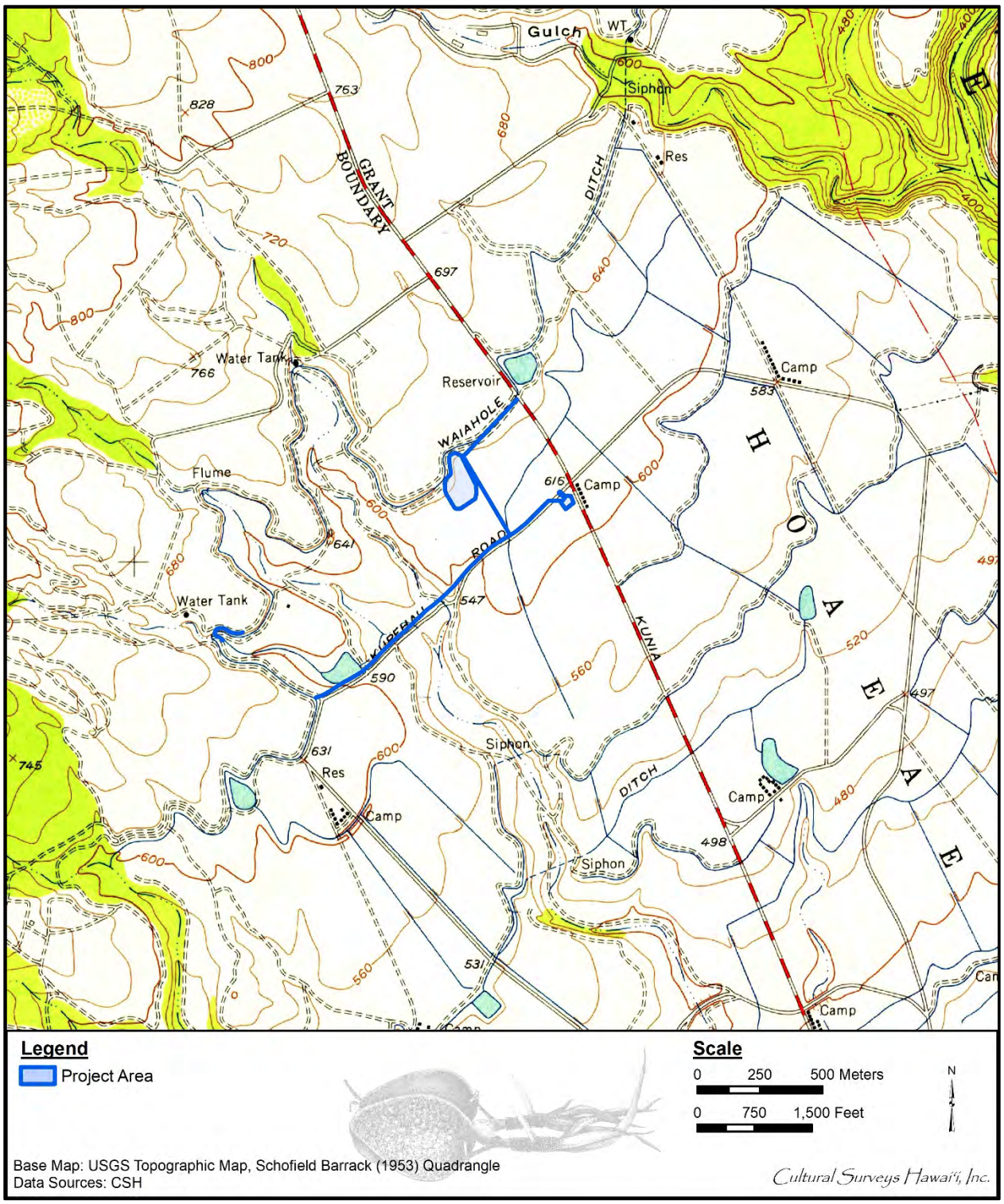

Figure 23. Portion of 1953 Schofield Barracks USGS topographic quadrangle showing the project area(s)

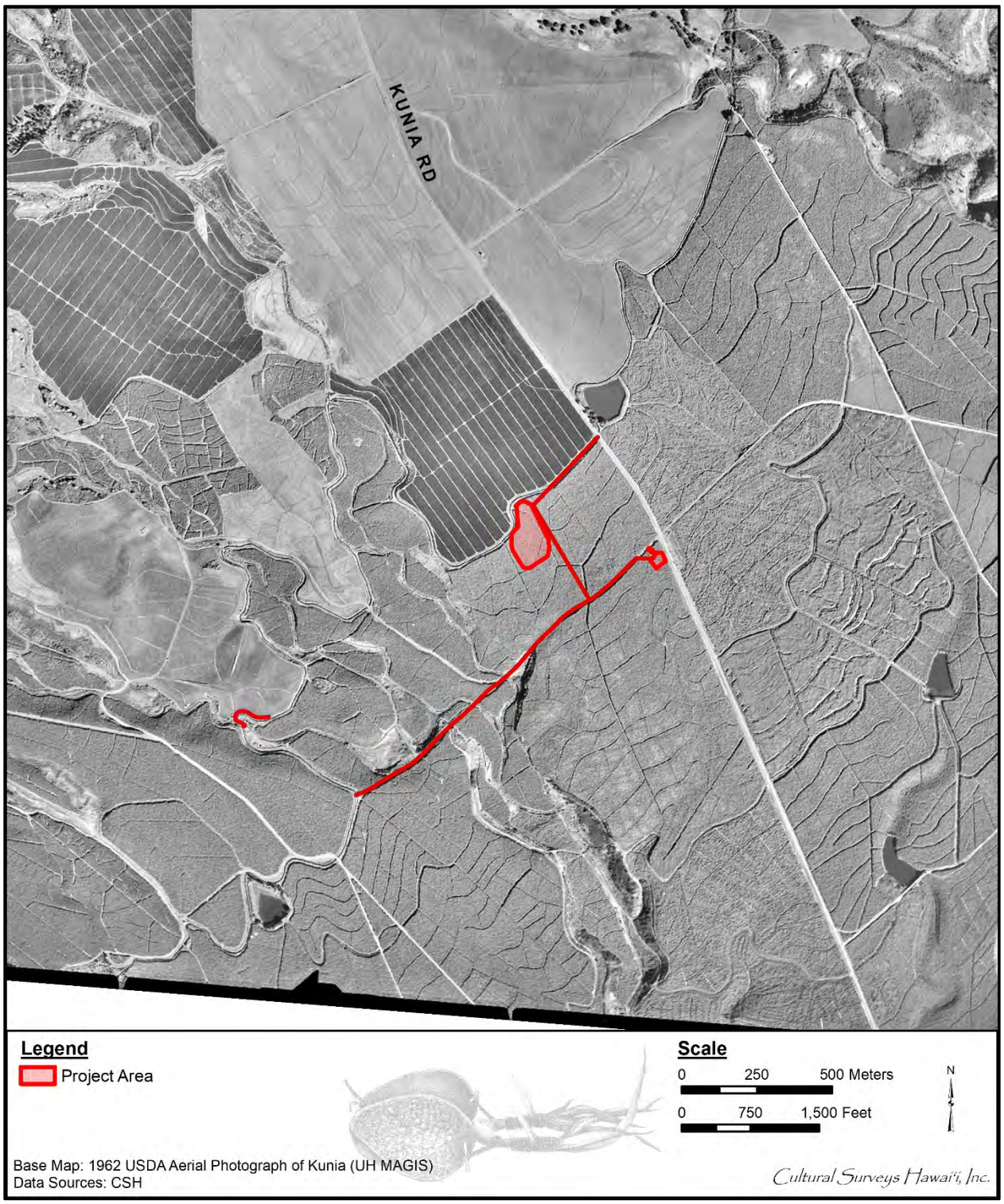

Figure 24. 1962 USDA aerial photograph of Kunia (UH MAGIS) showing the project area(s)

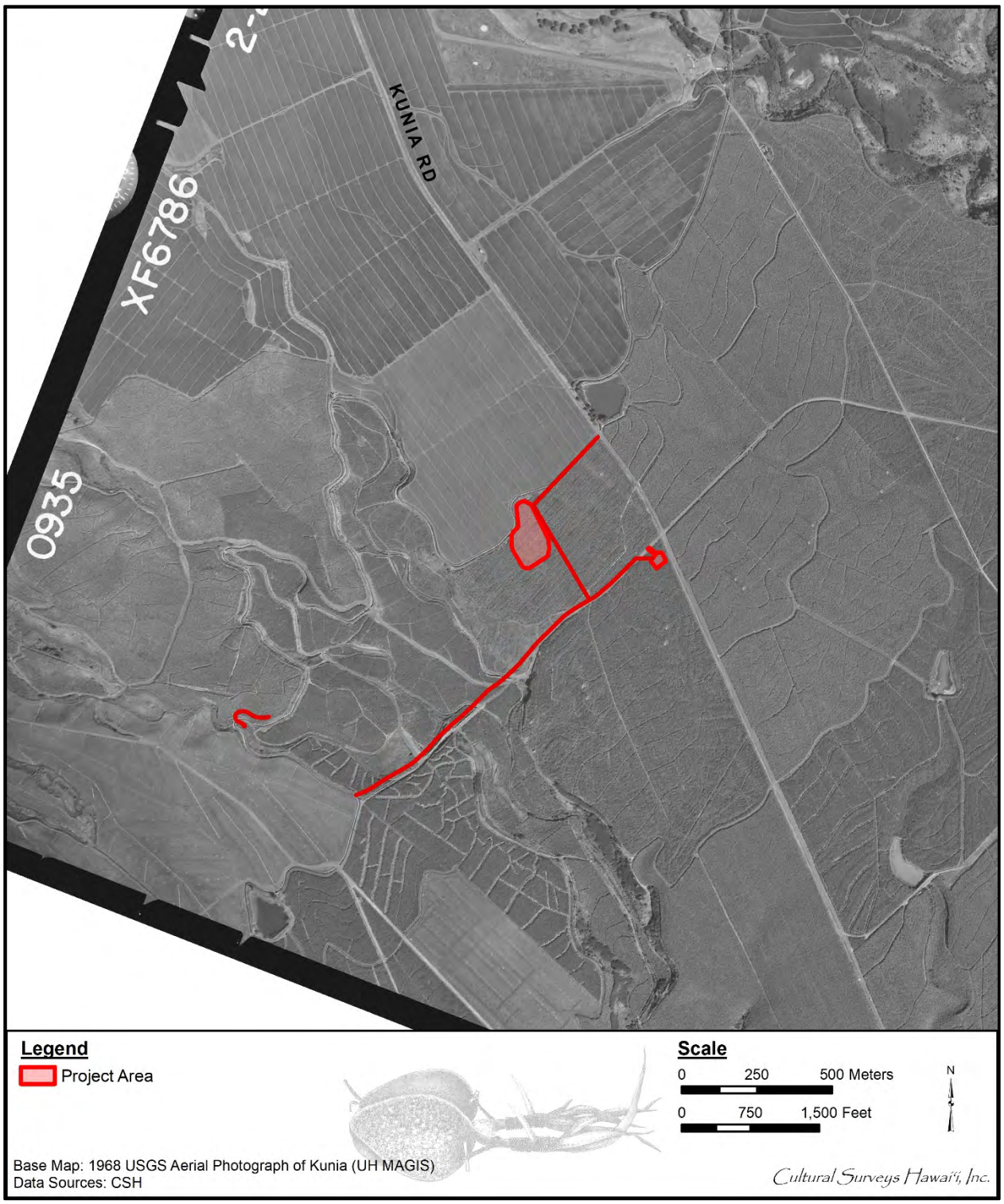

Figure 25. 1968 USGS aerial photograph of Kunia (UH MAGIS) showing the project area(s)

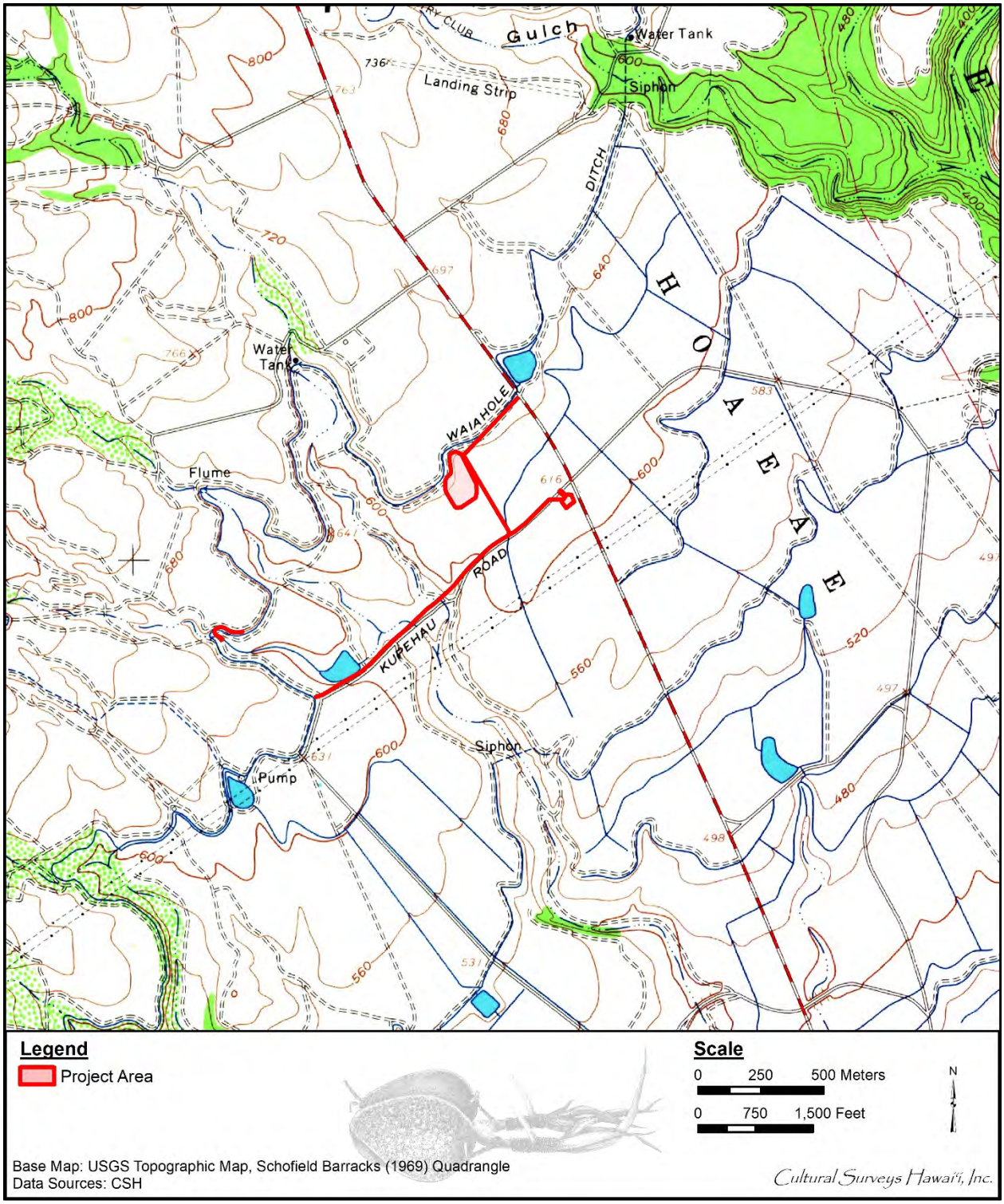

Figure 26. 1969 Schofield Barracks USGS topographic quadrangle showing the project area(s)

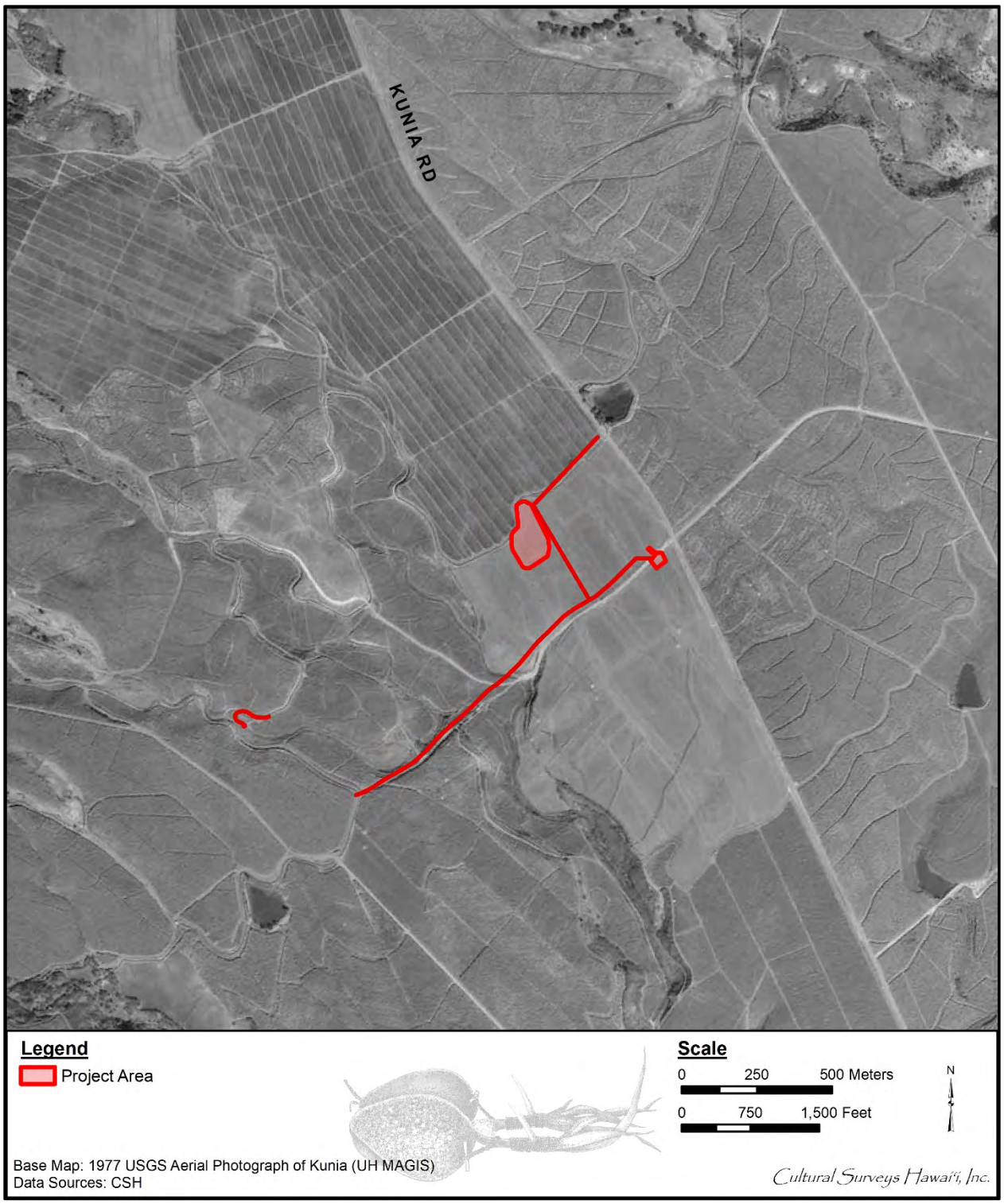

Figure 27. 1977 USGS aerial photograph of Kunia (UH MAGIS) showing the project area(s)

Section 4 Previous Archaeological Research

Figure 28 and Table 2 summarize the previous archaeological studies conducted near the project area (within approximately 1 km), and Figure 29 and Table 3 summarize the previously identified historic properties in the vicinity (within approximately 1 km). No historic properties are indicated in the vicinity of the project area in McAllister's (1933) survey of the archaeology of O‘ahu. Two previously identified historic properties (SIHP # 50-80-08-7671:3 relating to Kupehau Road and SIHP # 50-80-09-2268, the Waiahole Ditch) have a particular bearing on the present project area and are discussed further in Section 4.2 below.

4.1 Previous Archaeological Studies in the Vicinity

A brief discussion of prior archaeological studies in the vicinity (within approximately 1 km) of the project area (presented in chronological order) follows.

4.1.1 Barrera 1985

William M. Barrera, Jr. (1985) reported on an archaeological reconnaissance on approximately 692 acres at Village Park, Waipahu (TMK: [1] 9-4-002:por. 001) bounded on the west by Kunia Road, on the south by the Village Park subdivision, on the east by Waikele Gulch, and on the north by sugarcane fields. Barrera (1985:3) reports, "No evidence of past utilization of any kind were observed either in the open fields or in the exposed earthen faces of the irrigation ditches."

4.1.2 Kennedy 1987

Kennedy (1987:2) reports that "no above ground archaeological features (with) little chance of subsurface recovery" for a 20-acre parcel approximately 1 km northeast of the project area. The survey coincided with the cultivation of a sugarcane field that overlaid the project area, thus there was no ground vegetation to inhibit the archaeological survey.

4.1.3 Kennedy 1988

In 1988, Kennedy conducted a 670-acre archaeological walk-through survey of the proposed Royal Kunia, Phase II. This survey was conducted by "a two man survey team covered(ing) the area by automobile along the network of cane haul roads and by foot in the few areas where this was necessary. Visibility was limited by the dense stands of sugarcane"; no archaeological sites were recorded (Kennedy 1988).

4.1.4 Perzinski et al. 2003

In 2003, CSH conducted an archaeological inventory survey (AIS) on approximately 250 acres for a proposed landfill project in Kunia (Perzinski et al. 2003). The project was located in western O‘ahu on the southeastern flank of the Wai‘anae Range, including the ridges and gulches from 800-1,200 ft elevation in the vicinity of Pōhākea Pass. The archaeological inventory survey included a complete surface survey, site identification, mapping, and limited subsurface testing of select archaeological sites. Six archaeological sites were discovered in this area as a result of the survey. Of the six, two were recommended to undergo a process for data recovery, SIHP #s 50-80-09-6458 and -6461. SIHP # -6458 consisted of filled crevices, and SIHP # -6461 consisted of a series of historic roads and, bunkers. SIHP # -6456 is a terrace, mound, and trail; SIHP # -6459

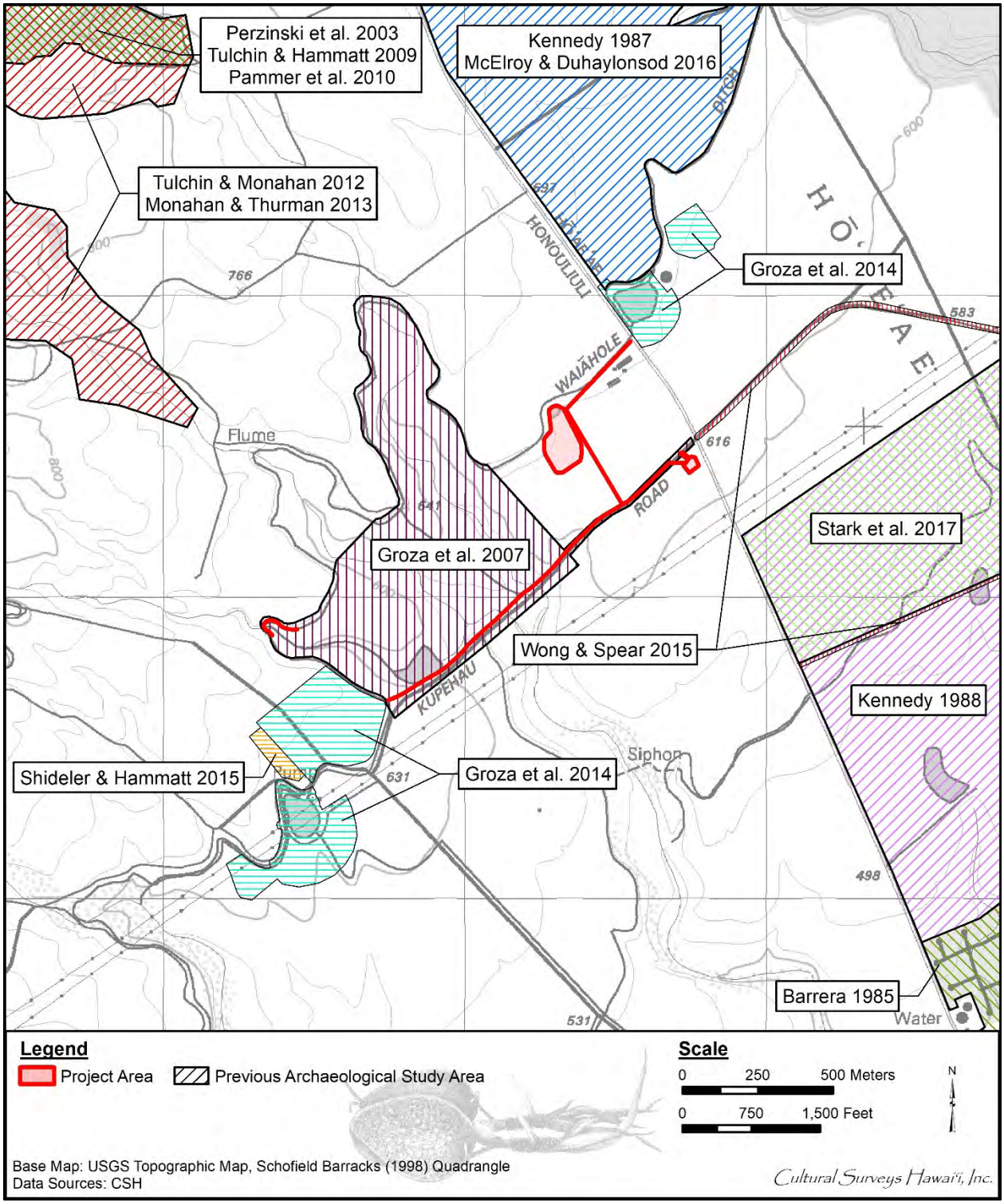

Figure 28. Previous archaeological studies in the vicinity of the project area (base map: 1998 Schofield Barracks USGS topographic quadrangle)

Table 2. Previous archaeological studies in the vicinity of the project area

Reference	Type of Study	Location	Results
Barrera 1985	Archaeological reconnaissance	692 acres at Village Park, Waipahu, bounded on west by Kunia Rd, on south by Village Park subdivision, on east by Waikele Gulch, and on north by sugarcane fields, TMK: [1] 9-4-002:001 por.	Barrera (1985:3) reports, “No evidence of past utilization of any kind were observed either in the open fields or in the exposed earthen faces of the irrigation ditches.”
Kennedy 1987	Archaeological reconnaissance	Hō‘ae‘ae Ahupua‘a; TMK: [1] 9-4-004	No findings
Kennedy 1988	Archaeological pedestrian survey	Royal Kunia, Phase II, TMK: [1] 9-4-002:001	No historic properties identified
Perzinski et al. 2003	Archaeological inventory survey	Kunia Landfill, Honouliuli, TMK: [1] 9-2-004:5 por.	Archaeological sites identified: SIHP #s 50-80-12-6456, -6457, -6458, -6459, -6460, -6461
Groza et al. 2007	Archaeological inventory survey	TMK: [1] 9-2-001:001 por.	Three new plantation infrastructure sites (SIHP #s 50-80-06-6892, -6893, -6894), and Waiahole Ditch (SIHP # 50-80-09-2268)
Tulchin and Hammatt 2009	Site relocation	Proposed Kunia Loa Ridge Farmlands project, TMK: [1] 9- 2-004:005 por.	No new historic properties identified; SIHP #s 50-80-12-6457, -6458, and -6461 identified; new features associated with -6461 documented
Pammer et al. 2010	Archaeological inventory survey	TMK: [1] 9-2-004:005 por.	Eight sites including five traditional Hawaiian sites (SIHP #s 50-80-12-6456, -6457, -6458, -7125, -7126) and three historic sites (SIHP #s -6459, -6460, -6461)

Reference	Type of Study	Location	Results
Tulchin and Monahan 2012	Archaeological reconnaissance survey	162-acre project area on eastern side of Wai‘anae Mountain Range, approx. 1.5 km east Hawai‘i Country Club, TMK: [1] 9-2-004:013 por.	Documented 29 new historic properties and identified two additional features at previously-identified SIHP # 50-80-08-6459; identified archaeological features representing distinct periods of land use, including pre-Contact traditional Hawaiian habitation and agriculture as well as post-Contact agriculture, ranching, and military activities; observed site types: stacked-stone walls, platforms, terraces, enclosures, and mounds, modified outcrops, petroglyphs, sugarcane infrastructure (i.e., siphon, earthen ditches, etc.), and a military road with stone and mortar culverts and cut earthen storage bays; interpreted site functions included possible burial, ceremonial, habitation, agriculture, transportation, water control, animal husbandry, and land division boundary
Monahan and Thurman 2013	Archaeological inventory survey	Approx. 854-acre Kunia Mauka Loa Ridge C&C Farmlands project area east of Honouliuli Forest Reserve	Identified 60 historic properties including 14 sites loosely categorized as plantation infrastructure, 11 related to ranching activities, and 16 sites interpreted as either pre-Contact or “pre-Contact to early Historic” in nature

Reference	Type of Study	Location	Results
Groza et al. 2014	Archaeological inventory survey	Waiahole Reservoir System - Reservoirs 155 and 225	Waiahole Ditch Irrigation System previously designated as SIHP # 50-80-09-2268 (Goodman and Nees 1991); Reservoirs 155 and 225 addressed as features of Waiahole Ditch Irrigation System; 25 sub-features of Waiahole Ditch identified within project area; 15 sub-features associated with Reservoir 155 and eight sub-features associated with Reservoir 225
Shideler and Hammatt 2015	Archaeological inventory survey (addendum)	Additional 2.8-acre adjacent to Groza et al. 2014 study area, TMK: [1] 9-2-001:001 por.	Addendum to Groza et al. 2014 addressed additional 2.8 acres; identified no additional historic properties
Wong and Spear 2015	Archaeological inventory survey	161-acre Ho‘ohana Solar Farm Project in Kunia, Waikele Ahupua‘a, TMK: [1] 9-4-002:052	Identified one new historic property, SIHP # 50-80-08-7671, a historic road complex comprised of three features: a basalt rock alignment, a basalt block and mortar wall, and paved segments of coral; reported three pre-Contact artifacts (a basalt adze preform and two basalt flakes with polished facets)
McElroy and Duhaylonsod 2016	Archaeological inventory survey (recorded as archaeological assessment in the absence of finds)	New Hope Network Development on 203-acres in Kunia, Hō‘ae‘ae Ahupua‘a, TMK: [1] 9-4-004:009	No historic properties identified; eight test excavations conducted

Reference	Type of Study	Location	Results
Stark et al. 2017	Archaeological inventory survey	150-acre Kunia Agricultural Park project area located immediately east of Kunia Rd, surrounded by large agricultural lots managed by Waikele Farms, with Royal Kunia residential community to south and Kupehau Rd to north	Identified one historic property, SIHP # 50-80-08-7758 consisting of seven features of one remnant site pertaining to former agricultural activity, specifically related to Oahu Sugar Co.; each feature (1–7) represents an activity area relating to contemporaneous agricultural activity; Feature 1 is a retaining wall (linear); Features 2 and 3 are portions of a historic irrigation ditch (linear); Feature 4 is the structural remnant of a headworks feature connecting Features 2 and 3; Feature 5 is a historic lithic workshop relating to production of faced basalt boulders observed in Features 1–4; Features 6 and 7 are former plantation cane haul roads

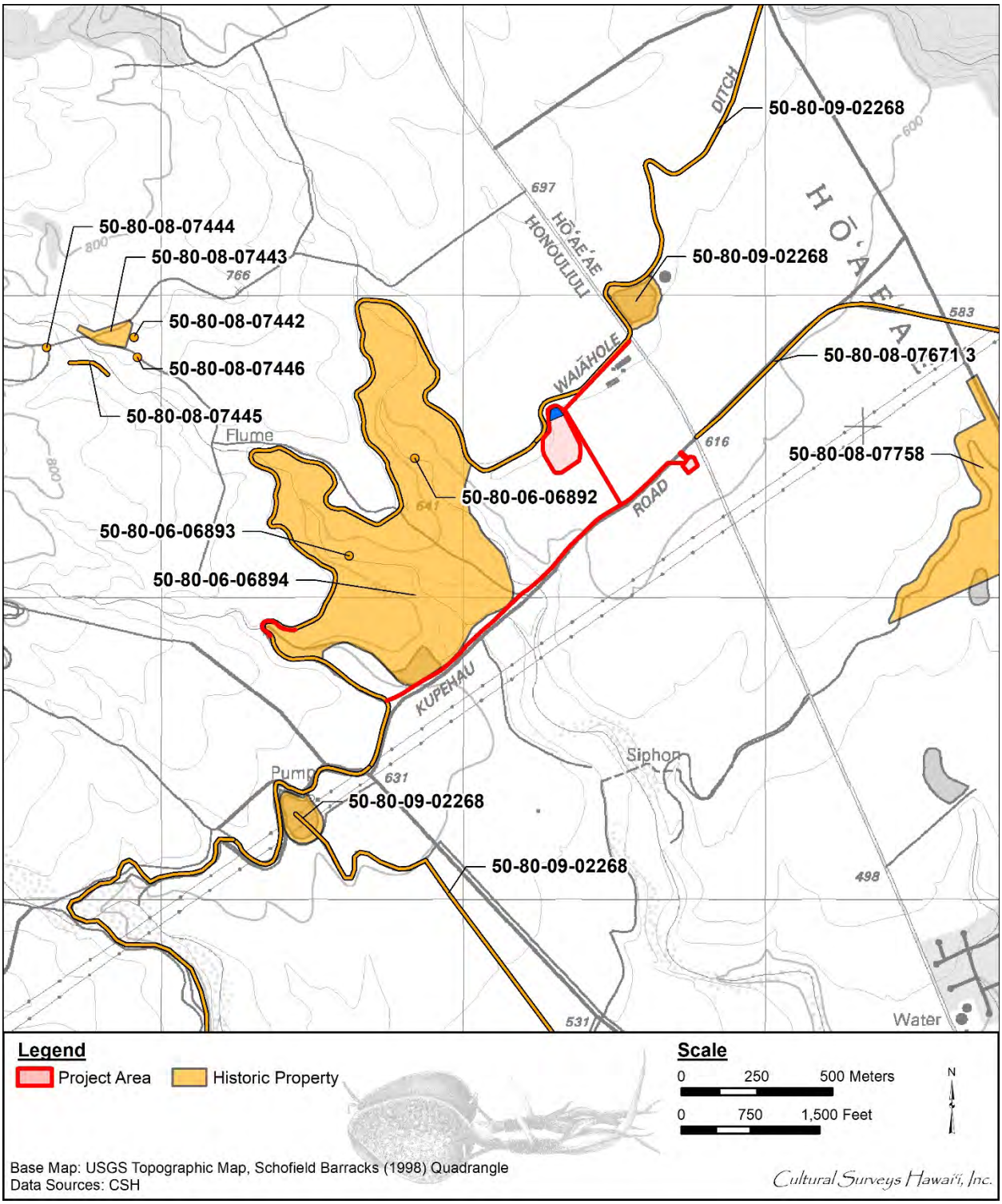

Figure 29. Previously identified historic properties in the vicinity of the project area (base map: 1998 Schofield Barracks USGS topographic quadrangle)

Table 3. Previously identified historic properties in the vicinity of the project area

SIHP # (50-80-)	Description	Comment	Source
06-6892	Rectangular bridge with wall	The date 9.27.1929 is inscribed on the top of the eastern slab wall of the bridge.	Groza et al. 2007
06-6893	Rectangular bridge with wall	No construction date was found on the bridge although it is very similar in appearance and construction to SIHP # -6892.	Groza et al. 2007
06-6894	Oahu Sugar Co. plantation infrastructure	Features A–D are Oahu Sugar Company plantation infrastructure, most of which appear to be related to the Waiahole Ditch. The features include: a U-shaped rock and mortar wall; wooden chutes that extend over the Waiahole Ditch; concrete slab bridges that extend over the Waiahole Ditch; and U-shaped concrete molded flumes and multiple remnants of the flumes.	Groza et al. 2007
08-7442	Concrete flume section	A short concrete flume section dating from the 1960s and functioning to irrigate large, gently sloping areas previously under commercial sugar cane agriculture.	Monahan and Thurman 2013
08-7443	Irrigation complex	An irrigation complex of six designated features built by plantation workers to manage what would have been an extensive irrigation system dating to the 1930s if not a bit earlier.	Monahan and Thurman 2013
08-7444	Concrete and mortared rock sluice gate complex	A heavy-duty water retention and diversion feature built by plantation workers to manage what would have been an extensive irrigation system likely dating to at least the 1930s if not a bit earlier.	Monahan and Thurman 2013
08-7445	Concrete flume section	Dating from the 1960s and functioning to irrigate large, gently sloping areas previously under commercial sugar cane agriculture.	Monahan and Thurman 2013
08-7446	Mortared rock sluice gate	A water retention and diversion feature built by plantation workers to manage what would have been an extensive irrigation system dating to the 1930s if not a bit earlier.	Monahan and Thurman 2013
08-7671:3	Historic road complex	Comprised of three features: 1: a basalt rock alignment, 2: a basalt block and mortar wall, and 3: paved segments of coral	Wong and Spear 2015

SIHP # (50-80-)	Description	Comment	Source
08-7758	Remnant site pertaining to former agricultural activity specifically related to Oahu Sugar Co.	Consisting of seven designated features; each feature (1–7) represents an activity area relating to contemporaneous agricultural activity. Feature 1 is a retaining wall (linear). Feature 2 and Feature 3 are portions of a historic irrigation ditch (linear). Feature 4 is the structural remnant of a headworks feature connecting Feature 2 and Feature 3. Feature 5 is a historic lithic workshop relating to the production of faced basalt boulders observed in Features 1–4 and Feature 6 and Feature 7 are former plantation cane haul roads.	Stark et al. 2017
09-2268	Irrigation Ditch (Waiahole Ditch)	Waiahole Ditch system	Goodman and Nees 1991, Groza et al. 2007, Groza et al. 2014

a U-shaped structure and alignment; and SIHP # -6460 a leveled cobble pavement. One site was recommended for preservation, SIHP # -6457, a possible *heiau* located in the central gulch directly downslope from Pōhākea Pass. The site consisted of an enclosure with a three-tiered retaining terrace and ramp leading into the interior of the enclosure. The walls of the structure were documented to have been up to 2 m in thickness and were well built with chinking, facing, and core filling. Such thick walls are not typical construction for traditionally built houses and a ritual function was suggested.

4.1.5 Groza et al. 2007

In 2007, at the request of PBR Hawai‘i, Inc., CSH (Groza et al. 2007) completed an inventory survey for the Ho‘opili project, Mauka Detention Basin, Honouliuli Ahupua‘a, TMK: [1] 9-2-001:001. The project area is bordered on the north and west by the Waiahole Ditch, on the south by Kupehau Road, and is west of Kunia Road. During the project, the entirety of the 143-acre Mauka Detention Basin was surveyed on foot. The pedestrian survey revealed several sites, one of which consisted of 31 features. All sites identified were associated with water control, the Waiahole Ditch, and the Oahu Sugar Company (Groza et al. 2007): SIHP #s 50-80-06-2268, -6892, -6893, and -6894. Two concrete slab bridges with four to six courses of dressed, faced, rectangular stone were also found. One of the bridges was inscribed with the date 9.27.1929 and the other bridge was similar in appearance. The other sites are identified with the Waihole Ditch and consisted of scattered plantation infrastructure features.

4.1.6 Tulchin and Hammatt 2009

Following on the findings of Perzinski et al. (2003), in 2009, Tulchin and Hammatt conducted a GPS relocation project at the Kunia Loa Ridge Farmlands project to further document SIHP #s 50-80-12-6457, -6458, and -6461. No new historic properties were identified, while SIHP #s

-6457, -6458, and -6461 were located and new features associated with SIHP # -6461 were documented.

4.1.7 Pammer et al. 2010

In 2010, an archaeological inventory survey was conducted on an approximately 294-acre parcel for a proposed agricultural subdivision including the ridges and gulches from 800-1,200 ft elevation in the vicinity of Pōhākea Pass, approximately 3 km southwest of the project area (Pammer et al. 2010). Several historic properties were identified, with functional types including temporary habitation, agriculture, and transportation: SIHP #s 50-80-12-6456 terrace, mound, and trail; -6457 *heiau* enclosure and associated terraces; -6458 cobble filled crevices; -6459 U-shaped structure and alignment; -6460 leveled cobbles; -6461 historic road improvements; -7125 petroglyph; -7126 mound, and -7351. Radiocarbon dating from samples recovered from the site yielded date ranges of AD 1290-1420 and AD 1510-1810. It was also noted that, with the exception of SIHP #s -6459, -7125 and -7126, all sites were within the gulches in the upslope portion of the study area (Pammer et al. 2010).

4.1.8 Tulchin and Monahan 2012

In 2012, at the request of C&C Farmlands, LLC, Tulchin and Monahan of CSH conducted an archaeological reconnaissance survey for the Kunia Mauka Loa Ridge Farmlands project. The project area was on the eastern side of the Wai‘anae Mountain Range and abutted the eastern edge of the Honouliuli Forest Reserve. Kunia Road is roughly parallel to the project area’s eastern boundary. Most of the identified archaeological sites were in the northern portion of the project area within and between ‘Ēkaha Nui and Huliwai gulches. The relative absence of sites south of ‘Ēkaha Nui Gulch was attributed to pineapple cultivation which involved extensive grading of ridge tops. A majority of the historic properties identified within ‘Ēkaha Nui Gulch were of historic ranching origin. Archaeological sites identified included SIHP #s 50-80-12-7125, -7126, -7323, -7324, -7325, -7326, -7327, -7328, -7335, -7336, -7337, -7338, -7339, -7340, -7341, -7343, -7344, -7345, -7446, -7347, -7448, -7349, -7350, and -7351:

> Identified archaeological features representing distinct periods of land use were observed, including: pre-Contact traditional Hawaiian habitation and agriculture, as well as post-Contact agriculture, ranching, and military activities. Observed site types were stacked-stone walls, platforms, terraces, enclosures, and mounds, modified outcrops, petroglyphs, sugarcane infrastructure (i.e., siphon, earthen ditches, etc.), and a military road with stone and mortar culverts and cut earthen storage bays. Interpreted site functions included the following: possible burial, ceremonial, habitation, agriculture, transportation, water control, animal husbandry, and land division boundary. [Tulchin and Monahan 2012:ii]

4.1.9 Monahan and Thurman 2013

TCP Hawaii, LLC (Monahan and Thurman 2013) reported on an archaeological inventory survey for an approximately 854-acre Kunia Mauka Loa Ridge C&C Farmlands project area east of the Honouliuli Forest Reserve (TMK: [1] 9-2-004). Most of the archival research in the current report is based on the two previous CSH reports on the project area (AIS by Pammer et al. 2010 and archaeological reconnaissance survey by Tulchin and Monahan 2011). It was noted that nearly all the ridges within the project area had been leveled and graded due to historic and modern

agriculture, including large-scale pineapple and sugarcane cultivation. An extensive network of dirt roads connecting these agricultural fields had been constructed throughout the project area. Additionally, areas not impacted by agricultural activities have been utilized for ranching or historic military storage. Sixty historic properties were identified including 14 sites that can be loosely categorized as plantation infrastructure, 11 sites that appeared to be related to ranching activities, and 16 sites interpreted as either pre-Contact or "pre-Contact to early Historic" in nature. The latter included two *heiau* complexes (SIHP #s 50-80-08-6457 and -7447), one formal enclosure complex within which a burial was documented (SIHP # -7331), a very large and impressive terraced agricultural and habitation complex with a petroglyph in ‘Ēkaha Nui Gulch (SIHP # -7326), habitations and possible habitations (SIHP #s -6456, -6458, -7325, -7340 and -7454) and several possible burial sites.

4.1.10 Groza et al. 2014

CSH (Groza et al. 2014) carried out an archaeological inventory survey addressing an approximately 61.3-acre (24.8-ha) project area adjacent to the southwest of the present project area. The study notes that the Waiahole Ditch Irrigation System was previously designated as SIHP # 50-80-09-2268 (Goodman and Nees 1991). The primary foci of the project were Reservoir 155 (southwest of the present project area) and Reservoir 225 on the east side of Kunia Road that are both addressed as features of the Waiahole Ditch Irrigation System. Twenty-five water control sub-features of the Waiahole Ditch (SIHP # 50-80-09-2268) were identified within their project area. Fifteen of the sub-features are associated with Reservoir 155 and eight of the sub-features are associated with Reservoir 225. These included walls, pipes, spillways, inlets, siphons, water sluices and the two reservoir excavations and retaining walls.

4.1.11 Shideler and Hammatt 2015

This CSH (Shideler and Hammatt 2015) addendum to the Groza et al. 2014 AIS addressed an additional 2.8 acres immediately north of Reservoir 155 but identified no additional historic properties.

4.1.12 Wong and Spear 2015

Scientific Consultant Services, Inc. (Wong and Spear 2015) carried out an archaeological inventory survey for a 161-acre Ho‘ohana Solar Farm project in Kunia, Waikele Ahupua‘a (TMK: [1] 9-4-002:052). The project area included the alignments of two long roads (Kupehau Road and a roughly parallel road to the south) extending west of the main project area and connecting with Kunia Road. One new historic property was identified, SIHP # 50-80-08-7671, a historic road complex comprised of three features: a basalt rock alignment, a basalt block and mortar wall, and paved segments of coral and modern crushed basalt gravel. With the exception of three pre-Contact artifacts (a basalt adze preform and two basalt flakes with polished facets) collected during the surface survey, the materials from the subsurface testing are comprised of both historic and modern cultural materials. The study noted that much of the project area had been mechanically impacted and subjected to modern modifications due to agricultural activity as evidenced through mechanical scarring on basalt cobbles and basalt boulders in a large push pile, pieces of mortared ditch sections, agricultural irrigation systems, and active, wooden telephone posts along the north/northwest side of the project area.

4.1.13 McElroy and Duhaylonsod 2016

Keala Pono Archaeological Consulting LLC (McElroy and Duhaylonsod 2016) carried out an archaeological inventory survey (recorded as an archaeological assessment in the absence of finds) for the New Hope Network Development on 203-acres in Kunia, adjacent to the east side of Kunia Road, in Hō‘ae‘ae Ahupua‘a (TMK: [1] 9-4-004:009). Eight test excavations were conducted. No historic properties were identified. It was concluded that the entire property had been disturbed by previous and current agricultural use.

4.1.14 Stark et al. 2017

CSH (Stark et al. 2017) prepared an AIS report for a 150-acre Kunia Agricultural Park project in Hō‘ae‘ae Ahupua‘a (TMK: [1] 9-4-002:080). The study identified one historic property, SIHP # 50-80-08-7758 consisting of seven features of one remnant site pertaining to former agricultural activity, specifically related to the Oahu Sugar Company. Each feature (1–7) represents an activity area relating to contemporaneous agricultural activity. Feature 1 is a retaining wall (linear). Features 2 and 3 are portions of a historic irrigation ditch (linear). Feature 4 is the structural remnant of a headworks feature connecting Features 2 and 3. Feature 5 is a historic lithic workshop relating to the production of faced basalt boulders observed in Features 1–4 and Features 6 and 7 are former plantation cane haul roads.

4.2 Previously Identified Historic Properties

4.2.1 SIHP # 50-80-08-7671, a historic road complex including Kupehau Road

Wong and Spear (2015) identified SIHP # 50-80-08-7671 as a historic road complex comprised of three features, including Feature 1, a concrete and basalt rock alignment; Feature 2, a concrete pipe bordered by a mortar and basalt block wall to the northwest and angular basalt cobbles and boulders to the southeast; and Feature 3, portions of a historic plantation road and former railway route. Their designated SIHP # -7671: Feature 3 corresponds to Kupehau Road within their project area (east of Kunia Road). They note that their designated SIHP # -7671 Feature 3 road alignment is depicted on a 1927 USGS map that appears to show a plantation railroad spur extending along this alignment. They document ferrous spikes along the portion of designated Feature 3 commensurate with former use as a railroad line. They assess SIHP # -7671 as significant under Criterion d (only) as outlined in HAR §13-275-6 for having yielded information about prior historic land use, particularly in association with former plantation agriculture in the area (Wong and Spear 2015:54) but recommended no further archaeological work on the basis that “what remains are remnant plantation features that have been adequately documented, and that little potential exists to encounter intact subsurface cultural deposits.”

The Wong and Spear (2015) designated SIHP # -7671:3 is clearly that portion of Kupehau Road within their project area (east of Kunia Road). However, the 1928/1929 USGS topographic map (see Figure 19) indicates that at that time the road and railroad crossed Kunia Road along the Kupehau Road alignment within the present project area. By logical extension, that portion of the Kupehau Road alignment within the present project area may be regarded as part of SIHP # -7671:3.

4.2.2 SIHP # 50-80-09-2268, Waiahole Ditch

The Waiahole Ditch, designated SIHP # 50-80-09-2268, has been the subject of several archaeological studies along portions of its approximately 22-mile length (Figure 30). The present project area connects with the Waiahole Ditch at: 1) “Ditch Connection Site 1” (see Figure 1, Figure 4, and Figure 5), “Ditch Connection Site 2” (see Figure 1, Figure 4, and Figure 8), and at the hairpin turn site (see Figure 1, Figure 4, and Figure 9). While these are understood to involve very minor changes to the Waiahole Ditch, they would arguably have a small effect on SIHP # -2268.

SIHP # 50-80-09-2268, the Waiahole Ditch System, has a long history of significance evaluation (Table 4).

- The Bishop Museum Public Archaeology Section Applied Research Group (Goodman and Nees 1991) conducted archaeological reconnaissance and inventory surveys of 3,600 acres in the uplands of Waiawa Ahupua‘a, and touched on the Waiahole Ditch (SIHP # 50-80-09-2268) as it crossed their project area (Goodman and Nees 1991:64). The only discussion of significance is in their statement: “The significance of the following sites has been realized through field and archival research and no further work is recommended: State Sites […] 2268; B4-15 (the Waiahole Ditch)” (Goodman and Nees 1991:137). Thus, while the Waiahole Ditch is assigned with an SIHP #, there is really no discussion of significance of the Waiahole Ditch in the Goodman and Nees (1991) study.
- A Hammatt et al. (1996) archaeological inventory survey of 1,339 acres of Castle & Cooke lands within portions of Waipio and Waiawa Ahupua‘a discusses that portion of the Waiahole Ditch within the Koa Ridge area west of the H-2 Freeway. At the time of that study, it was anticipated that a portion of the ditch (which conveyed large volumes of water of significant import) would not be impacted. While the significance of the Waiahole Ditch was noted, the significance was not formally evaluated. It was simply asserted that “If the portion of the Waiahole Ditch which crosses the two parcels of the project area is ever to be impacted by future development, the State Historic Preservation Division should be notified beforehand, so that appropriate mitigative measures, if necessary, can be established” (Hammatt et al. 1996:55).
- The Dega et al. study (1998:22) asserts, “The Waiahole Ditch System has previously been assessed as significant (see Goodman and Nees 1991).” The Dega et al. study offers no further discussion of the significance of the Waiahole Ditch System (and avoids any substantive comment regarding the conclusion of the referenced Goodman and Nees 1991 study).
- A Tulchin and Hammatt 2004 AIS of an approximately 86-acre proposed Pālehua Community Association project identified a portion of the Waiahole Ditch System. SIHP # 50-80-09-2268 was evaluated as significant under National Register of Historic Places (NRHP) and Hawai‘i Register of Historic Places (HRHP) Criteria A and D (Tulchin and Hammatt 2004:65).
- The Tulchin et al. (2009:66–68) archaeological inventory survey addresses that portion of the Waiahole Ditch within the Koa Ridge project area east of the H-2 Freeway crossing a small northern tributary gulch of Pānakauahi Gulch. Two features have been designated

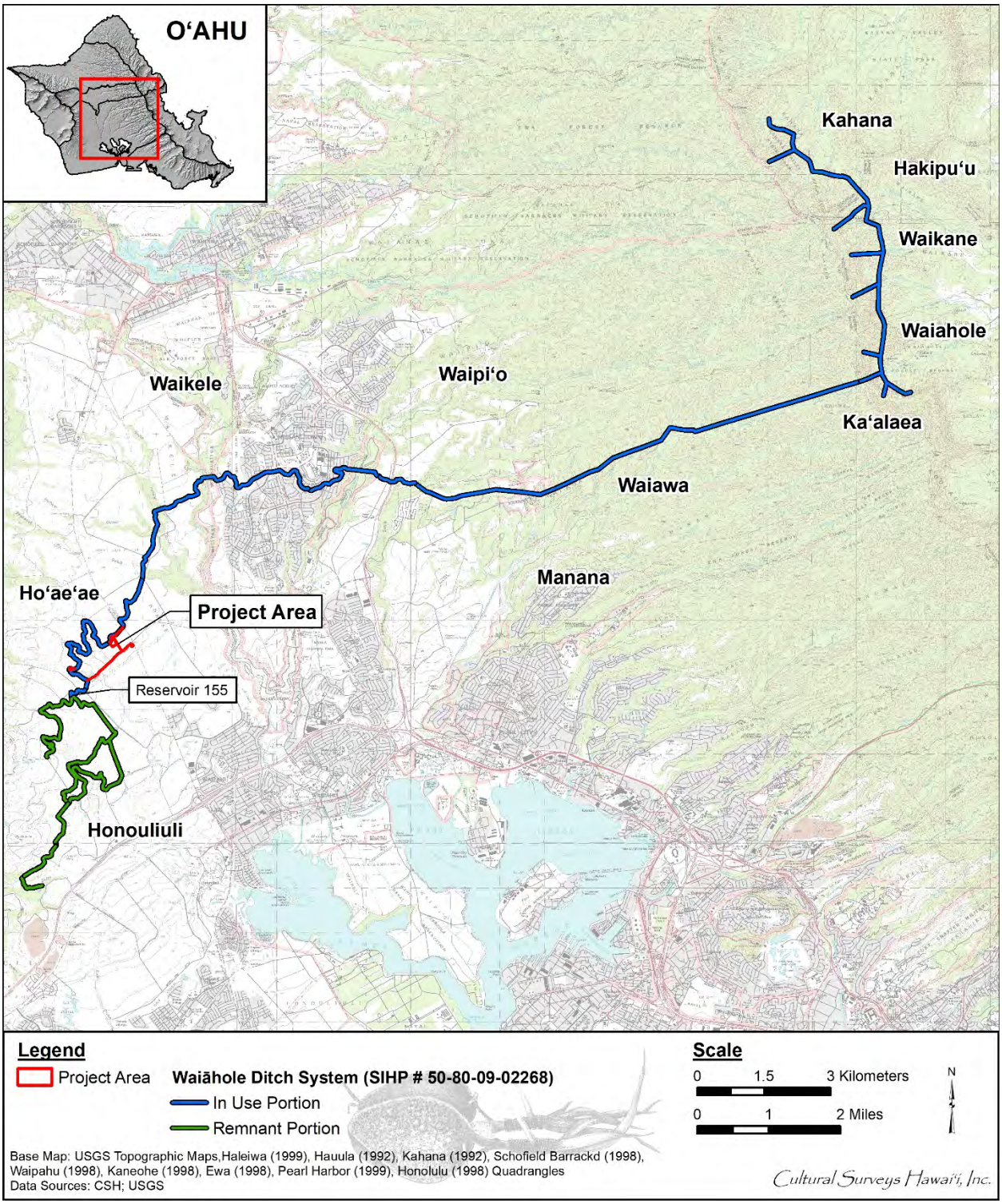

Figure 30. Figure showing the relationship of the Waiahole Ditch (SIHP # 50-80-09-2268) to the present project area (base map: portions of the 1999 Haleiwa, 1992 Hauula, 1992 Kahana, 1998 Schofield Barracks, 1998 Waipahu, 1998 Kaneohe, 1998 Ewa, 1999 Pearl Harbor, and 1998 Honolulu USGS quadrangle maps)

Table 4. Significance evaluations for portions of the Waiahole Ditch

Study or Review*	General Location	Evaluation in terms of HAR criteria	Evaluation in terms of NRHP/HRHP criteria
Goodman and Nees 1991	3,600 acres in uplands of Waiawa Ahupua‘a	Significance not evaluated: “significance […] has been realized through field and archival research and no further work is recommended”	
Hammatt et al. 1996	1,339 acres within portions of Waipio and Waiawa Ahupua‘a	Significance not evaluated: “If the portion of the Waiahole Ditch which crosses the two parcels of the project area is ever to be impacted by future development, the State Historic Preservation Division should be notified beforehand, so that appropriate mitigative measures, if necessary, can be established.”	
Dega et al. 1998	Proposed University of Hawai‘i West O‘ahu Campus project	Significance not evaluated: “The Waiahole Ditch System has previously been assessed as significant” (refers to Goodman and Nees 1991)	
Tulchin and Hammatt 2004	86-acres at Pālehua in Makakilo	Not evaluated under HAR criteria	Significant under NRHP and HRHP Criteria A and D
Tulchin et al. 2009	Koa Ridge project	HAR significance not evaluated	Significant under NRHP and HRHP Criteria A, C, and D
SHPD acceptance letter for Tulchin et al. 2009	Koa Ridge project	SHPD acceptance letter for this study makes no reference to site significance.	
Hunkin and Hammatt 2009	Makakilo Dr Extension project	HAR significance not evaluated	Significant under NRHP and HRHP Criteria A, C, and D
SHPD review letter for Hunkin and Hammatt 2009	Makakilo Dr Extension project	HAR significance not evaluated	Significant under NRHP and HRHP Criteria A, B, and D
Shideler and Hammatt 2018	Koa Ridge project	HAR significance not evaluated	Evaluated integrity; supports significance assessment made in Tulchin et al. 2009 as significant under NRHP and HRHP Criteria A, C, and D

Study or Review*	General Location	Evaluation in terms of HAR criteria	Evaluation in terms of NRHP/HRHP criteria
SHPD review letter for Shideler and Hammatt 2018	Koa Ridge project	Assessed as significant pursuant to HAR §13-284-6 Criteria a, c, and d	NRHP and HRHP significance not addressed
Zapor et al. 2018	Makakilo Dr Extension project	Assessed as significant pursuant to HAR §13-275-6, under Criteria a, c, and d	Evaluated for listing on the NRHP and HRHP pursuant to 36 CFR 60.4 and HAR §13-198-8

*These studies were quite far afield from the present project area and thus are not depicted on Figure 28

for the Waiahole Ditch during the Koa Ridge project (but without any letter or numeric designations): one for the main ditch including both the open ditch and Pānakauahi siphon and one feature designation including two 1-m long basalt boulder support walls.

The 2009 archaeological inventory survey provides the following assessment of significance:

SIHP # 50-80-09-2268 is assessed as significant under Criterion A (associated with events that have made an important contribution to the broad patterns of our history), Criterion C (embody the distinctive characteristics of a type period or method of construction), and Criterion D (have yielded, or may be likely to yield information important in prehistory or history) of the National and Hawai‘i Registers of Historic Places evaluation criteria. [Tulchin et al. 2009:66]

The integrity of SIHP # 50-80-09-2268, Waiahole Ditch was not assessed at the time of identification (Hammatt et al. 1996:47–50; Tulchin et al. 2009:89–91). The SHPD acceptance letter for this study dated 10 February 2009 (LOG NO. 2009.0605, DOC. NO. 0902WT21) makes no reference to historic property significance.

- An archaeological inventory survey for a Makakilo Drive Extension project (Hunkin and Hammatt 2009) discusses a portion of the Waiahole Ditch and concludes, “The SIHP # 50-80-09-2268 alignment continues to be significant under criteria A, C, and D” with reference to the criteria established for the NRHP and HRHP (Hunkin and Hammatt 2009:65).

  The SHPD acceptance letter for this AIS dated 18 August 2009 (LOG NO. 2008.3209, DOC. NO. 0908NM28) asserts that SIHP # 50-80-09-2268, the Waiahole Ditch System is eligible for listing on the NRHP and HRHP under Criteria A, B, and D (the AIS declares significance under Criteria A, C, and D and the acceptance letter specifies A, B, and D).

- A preservation plan for the Koa Ridge project (Shideler and Hammatt 2018) addressed a portion of the SIHP # 50-80-09-2268, Waiahole Ditch System. The report evaluated the significance of the Waiahole Ditch System as follows:

  > SIHP # -7046 is evaluated as possessing integrity of location, design, materials, and workmanship. The setting is evaluated as lacking integrity as the character of the place as a locus of agriculture has been lost and the vegetation is much different. The feeling of agricultural life of the historic property has been lost. The historic property has lost its association with the events and activities of agriculture.
  >
  > The relationship of the historic property to the local history of agriculture and the integrity of location, design, materials, and workmanship is evaluated as supporting the site significance assessment made in 2009. [Shideler and Hammatt 2018:20]

  So while not spelled out per se in the 2018 preservation plan, the preservation plan supports the significance assessment made in 2009 “assessed as significant under Criterion A […] Criterion C […] and Criterion D of the NRHP and HRHP evaluation criteria.”

  The SHPD acceptance letter for this preservation plan dated 28 February 2018 (Log No. 2018.00220, Doc. No. 1802JA04) asserts slightly differently that “Site 2268 retains

integrity of location, design, materials, and workmanship and is assessed as significant under HAR §13-284-6 Criteria a, c, and d."

- A supplemental archaeological inventory survey for the Makakilo Drive Extension project (Zapor et al. 2018) further documented previously identified components of the Waiahole Ditch and documented one newly identified feature. Zapor et al. (2018) assess the ditch as significant pursuant to HAR §13-275-6, under Criteria a, c, and d.

Based on the findings of this study, SIHP # 50-80-09-2268 is assessed as significant under HAR §13-284-6 Criteria a, c, and d. The historic property has yielded information on the agricultural history of the area and contributed greatly to the development and evolution of the ‘Ewa Plain throughout its history. The portions of the Waiahole Ditch within the present project area retain integrity of location, design, materials, and workmanship.

The proposed project is regarded as routine maintenance, will have minimal impact on the Waiahole Ditch, and is not anticipated to diminish the appearance, integrity or significance of this historic property.

4.3 **Background Summary and Predictive Model**

The historical background research summarized in this study and the review of previous archaeological studies indicates a low probability of traditional Hawaiian or early historic sites. Two historic properties are present in the present project area: a westward extension of SIHP # 50-80-08-7671:3 Kupehau Road which was a plantation road (and at one time, for part of the stretch in the project area, a plantation railway alignment; see the 1928/1929 USGS topographic map, Figure 19) and small portions of the Waiahole Ditch, designated SIHP # 50-80-09-2268.

Section 5 Results of Fieldwork

A field inspection of the project area was undertaken by David W. Shideler, M.A., on 15 July 2020 and took approximately 5 hours to complete. An overall archaeologist's track log is presented in Figure 31 with close-ups of the track log in the proposed 15-MG reservoir portion of the project area in Figure 40 and in the proposed well area in Figure 59 .

Most of the project area was along existing roads or fallow fields and ground visibility was generally very good. The field inspection focused on attempting to identify any remnants of traditional Hawaiian land use (boulder alignments, midden, worked lithics), early habitation (glass and ceramic shards), or plantation infrastructure. No archaeological evidence of activity predating the plantation era was observed. Observed plantation infrastructure was largely associated with the Waiahole Ditch and former cane haul roads.

The photographic coverage begins at the northeast end of the project area adjacent to Kunia Road near the main entrance gate in an area proposed for "New Ditch Connection 1" on the Waiahole Ditch (see Figure 5 for project plans and Photo A/Figure 33 through Photo D/Figure 36 for views of this immediate area). It is understood that a "new 24-inch by 24-inch sluice gate with operator" is proposed for the south side of the ditch between Kunia Road and the entry gate and a small cement slab pedestrian bridge (Photo A/Figure 33 and Photo B/Figure 34). A close-up of the cut basalt block stonework in the immediate vicinity of the proposed grate is shown in Photo C/Figure 35. It is understood that this existing connection feature ties into an existing, short, underground culvert in the area shown in Photo D/Figure 36 where a new access port is proposed. (see plan map in Figure 5). This new access port would seemingly not have an impact on the Waiahole Ditch as a historic property. Modification of the ditch for "New Ditch Connection 1" with a "new 24-inch by 24-inch sluice gate with operator" would appear to involve minimal modification and to be part of routine repair and maintenance of the ditch system.

The proposed new Irrigation Line "B" corridor was then traversed along the south side of an existing unimproved road effectively extending from Kunia Road to the east corner of the existing small reservoir. Views are provided looking southeast (Photo E/Figure 37) and northwest (Photo F/Figure 38) along this corridor. The open trench excavation for new Irrigation Line "B" along this existing cane haul road was assessed as having no adverse effect on historic resources.

The proposed new Irrigation Line "B" corridor leads up to the east side of an existing small reservoir which would be included with a substantial adjacent area to the southeast (downslope) proposed for the creation of a new 15-MG reservoir. A close-up of the tracklog and key to photos is provided in Figure 40. It may be noted that there are two rectangular areas on the southwest side of the proposed new 15-MG reservoir that were not traversed. These were in active maize cultivation and it was made quite clear that these areas were not to be traversed. Visibility of the ground surface from the perimeter of these two maize plots was good and it was felt that nothing was missed.

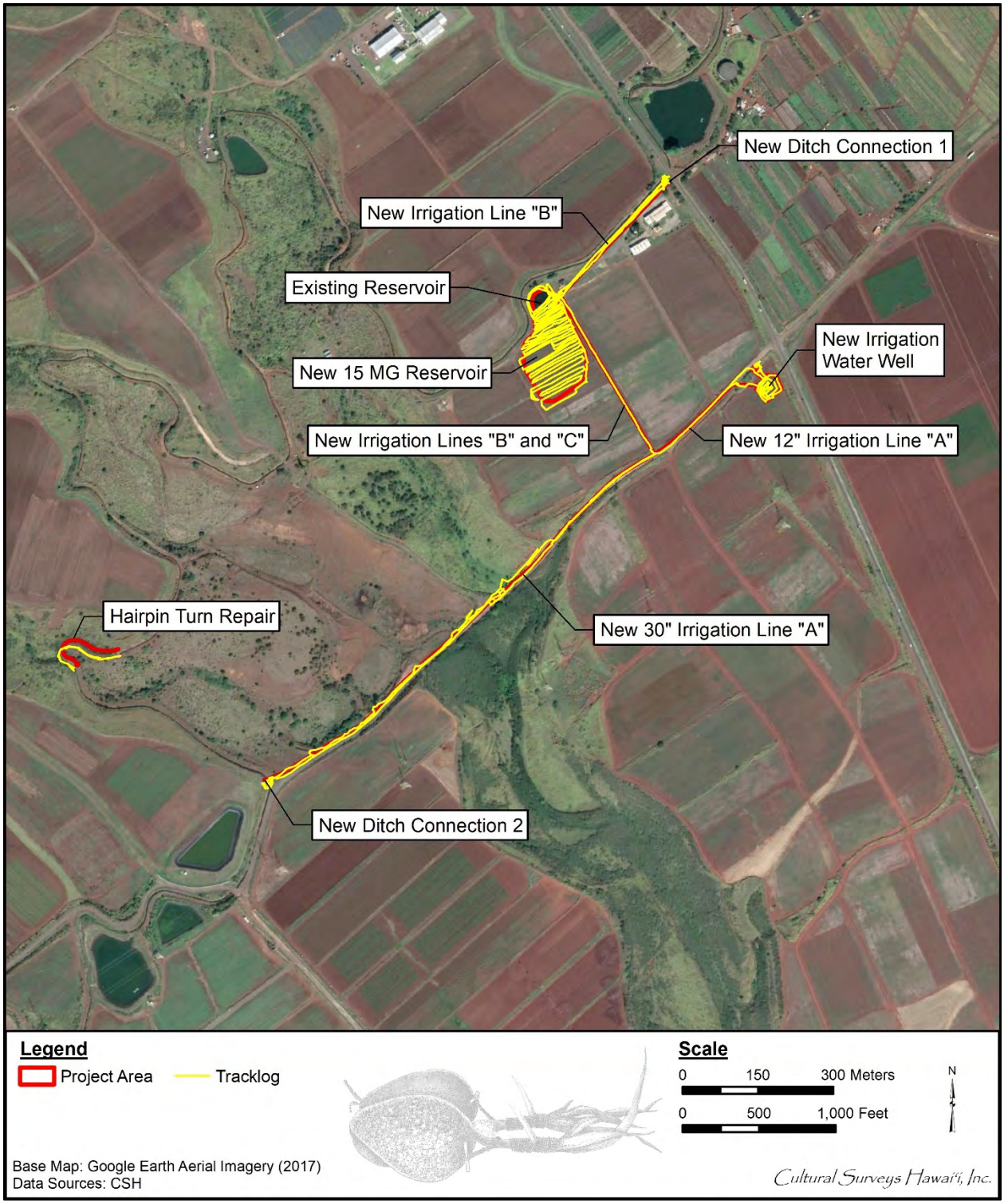

Figure 31. Overall archaeologist’s tracklog for the field inspection of the project area(s) (base map: Google Earth Aerial Imagery 2017)

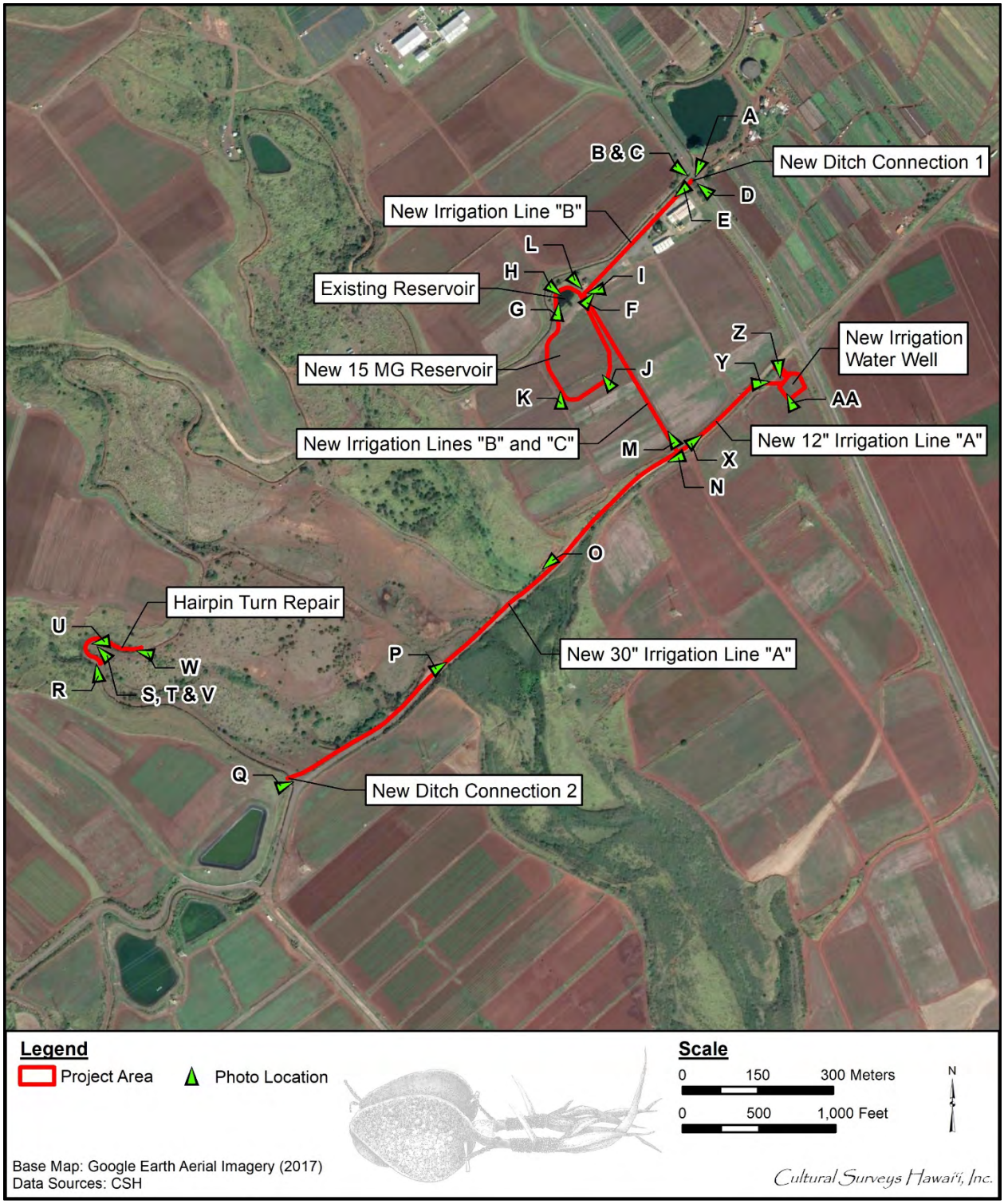

Figure 32. Overall key to general location and direction for field inspection photographs (Google Earth Aerial Imagery 2017)

Figure 33. Photo A: View of “Ditch Connection Site 1” area on south (left) side of the Waiahole Ditch, view from Kunia Road (in foreground), view to southwest

Figure 34. Photo B: View of “Ditch Connection Site 1” area (locus of proposed new 24-inch by 24-inch sluice gate with operator) on south side of the Waiahole Ditch, Kunia Road at upper left, view to southeast

Figure 35. Photo C: Close-up of “Ditch Connection Site 1” area (locus of proposed new 24-inch by 24-inch sluice gate with operator) showing cut basalt block stonework on south side of the Waiahole Ditch, view to southeast

Figure 36. Photo D: View of “Ditch Connection Site 1” area (locus of proposed special manhole-1, 5.5 ft deep to connect with existing culvert to Waiahole Ditch) on south side of the Waiahole Ditch, Kunia Road at upper right, view to north

Figure 37. Photo E: View of the northeast end (near Kunia Road) of the new Irrigation Line “B” corridor, view to southwest

Figure 38. Photo F: View of the southwest end (near the west side of the existing reservoir) of the new Irrigation Line “B” corridor, view to northeast (toward Kunia Road)

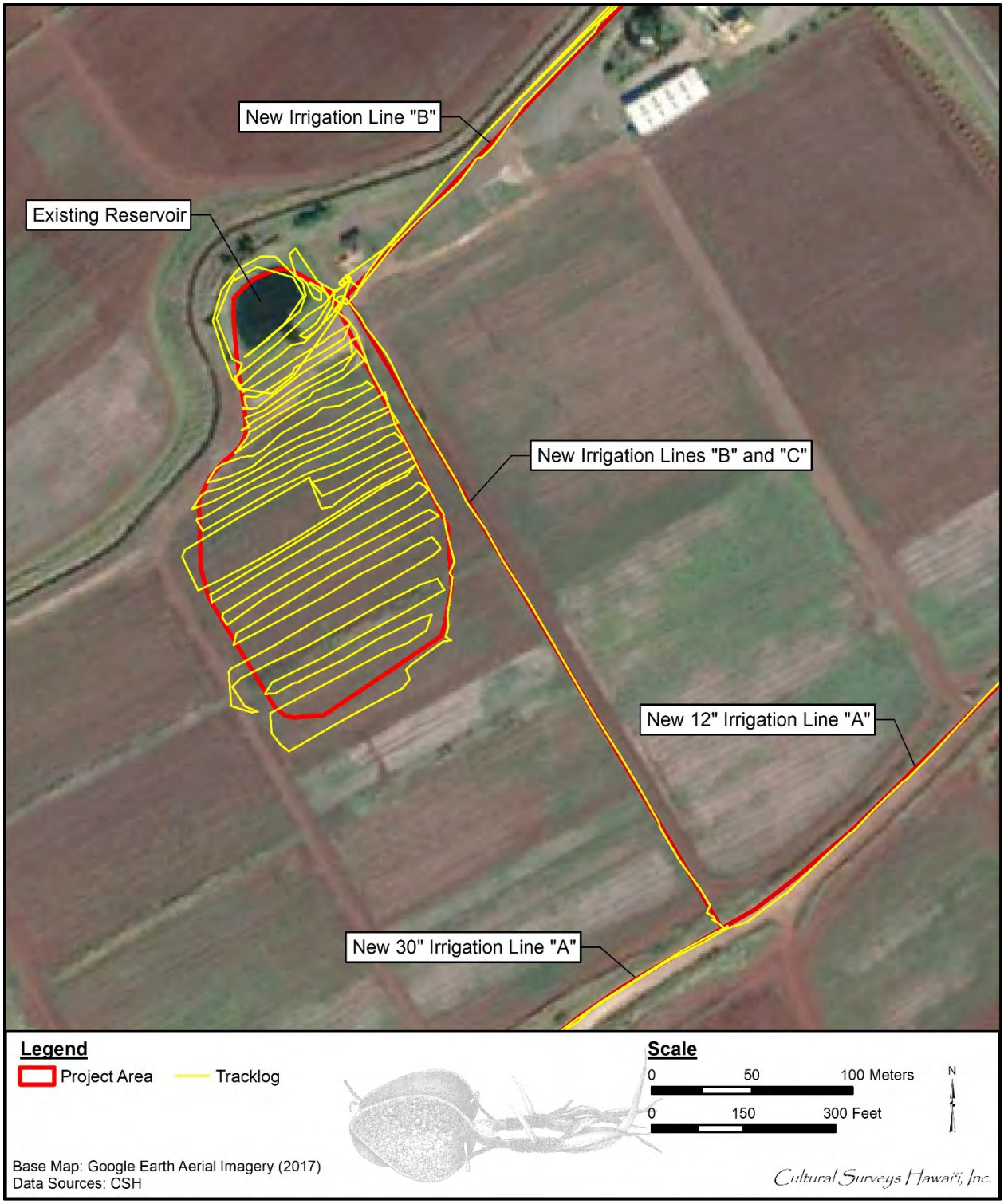

Figure 39. Archaeologist’s tracklog for the field inspection of the proposed new 15-MG reservoir area (base map: Google Earth Aerial Imagery 2017)

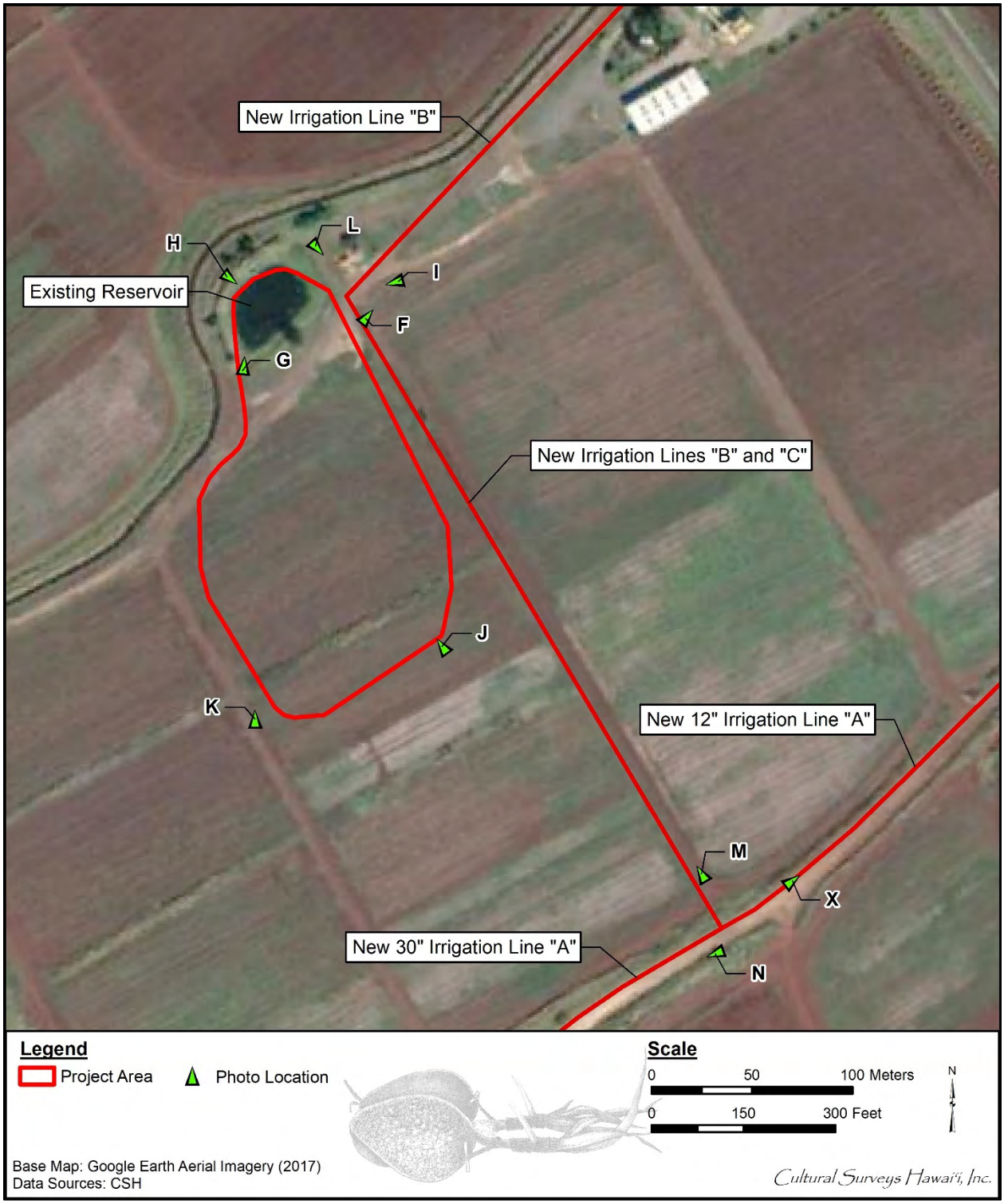

Figure 40. Key to general location and direction for field inspection photographs of the proposed new 15-MG reservoir area (Google Earth Aerial Imagery 2017)

Two general views are provided of the wide, flat top of the existing reservoir in Photo G/Figure 41 and Photo H/Figure 42. The southeast retaining wall appears to be entirely of earth (Photo I/Figure 43). Views from the southeast corners of the proposed 15-MG reservoir area are provided in Photo J/Figure 44 and Photo K/Figure 45. The majority of this area was in freshly tilled fields.

The field inspection proceeded southeast down the alignment of new Irrigation Lines “B” and “C” along the southwest side of an existing cane haul road from near the existing reservoir (Photo L/Figure 46) to the T-intersection with Irrigation Line “A” (Photo M/Figure 47). The project area was then followed to the southwest along a proposed 30-inch Irrigation Line “A,” along the *mauka* side of Kupehau Road which crosses a wide and shallow tributary gulch (Photo N/Figure 48 through Photo Q/Figure 51). As the Waiahole Ditch extends west from the upslope side of the existing small reservoir, it arcs well to the north closely following the contour around the *mauka* edge of two shallow tributary gulches. The Waiahole Ditch then continues southeast connecting with the southwest end of the project’s new 30-inch Irrigation Line “A” (on Kupehau Road) at the location of a proposed “Ditch Connection Site 2” New Headwall area. (Photo Q/Figure 51; see Figure 8 for “Ditch Connection Site 2” plans). Certain modest Waiahole Ditch infrastructure (slots in concrete to hold diversion boards) was observed in the vicinity of the proposed new headwall and sluice gate.

The field inspection then traversed a haul cane road that parallels the northeast side of the Waiahole Ditch (an effective gap in the project area) northwest up to the south end of the “Hairpin Turn Repair” area on the Waiahole Ditch (Photo R/Figure 52). At this point a large concrete box-like structure spans the Waiahole Ditch securing the downstream ends of two large diameter (18-inch) pipes through which the Waiahole Ditch water flows. From this point upstream within the Waiahole Ditch to the end of the “Hairpin Turn Repair” area the ditch water flows through two pipes set in the floor of the ditch. Following the ditch “upstream” in this “Hairpin Turn Repair” area, an inscribed date was observed in cement on the edge of the Waiahole Ditch in the central portion of the “Hairpin Turn Repair” area (Photo S/Figure 53). The date was obscure, but was read as “10-1-19” interpreted as relating to construction (or repair) on 1 October 1919. The Waiahole Ditch was completed in 1916 (Condé and Best 1973:313) so this date (if read correctly) may relate to some “fine-tuning” of the water distribution system. In this immediate portion of the central “Hairpin Turn Repair” area there was a hole adjacent to the Waiahole Ditch (understood as caused by erosion) that allowed for a view of the downslope ditch wall construction (Photo T/Figure 54). The vast majority of the Waiahole Ditch observed within the project area has the appearance of sloping concrete side walls with a concrete-lined bottom (the views in Photo R/Figure 52 and Photo W/Figure 57 are very representative). Only occasional exposures show the distinctive stacking of roughly dressed basalt blocks. Four courses of basalt blocks were visible in the hole shown in Photo T/Figure 54. In this immediate area was a segment of train track rail (Photo T/ Figure 54 and Photo U/Figure 55). Several historic maps from the 1920s through the 1940s (see Figure 19, Figure 21, and Figure 22) depict the extensive Oahu Sugar Company railroad system in the general vicinity—although seemingly not in this specific location. It seems likely that this section of rail was relocated and repurposed for reasons unknown. The track section did not appear to be in situ. While in general the portions of the Waiahole Ditch observed appear to have held up very well, a portion of the upslope side of the Waiahole Ditch in the “Hairpin

Figure 41. Photo G: General view of the existing (post-1977) small reservoir, view to northeast

Figure 42. Photo H: General view of the existing (post-1977) small reservoir, view to east (Diamond Head in background)

Figure 43. Photo I: General view of outer east side of existing (post-1977) small reservoir, view to west

Figure 44. Photo J: View of the proposed 15-MG reservoir area from the southeast corner, view to northwest

Figure 45. Photo K: View of the proposed 15-MG reservoir area from near the southwest corner, view to north

Figure 46. Photo L: View of the alignment of new Irrigation Lines “B” and “C” from near the existing reservoir, view to southeast

Figure 47. Photo M: View of the alignment of new Irrigation Lines “B” and “C” from the southeast end (T-intersection with Irrigation Line “A,” view to northwest

Figure 48. Photo N: View of the alignment of new 30-inch Irrigation Line “A” along the *mauka* side of Kupehau Road from near the intersection with new Irrigation Lines “B” and “C,” view to southwest

Figure 49. Photo O: View of the southwest portion of the alignment of new 30-inch Irrigation Line “A” along the northwest (right) side of Kupehau Road, view to southwest

Figure 50. Photo P: View of the northeast portion of the alignment of new 30-inch Irrigation Line “A,” along the northwest (left) side of Kupehau Road, view to northeast

Figure 51. Photo Q: View of “Ditch Connection Site 2” New Headwall area on the northeast side of the Waiahole Ditch at the southwest end of Irrigation Line “A” along the *mauka* side of Kupehau Road (at upper right), view to northeast

Figure 52. Photo R: View of the south end of the “Hairpin Turn Repair” area on the Waiahole Ditch, view to northwest

Figure 53. Photo S: Close-up of inscribed date (obscure, read as “10-1-19”) in the central portion of the “Hairpin Turn Repair” area on the Waiahole Ditch

Figure 54. Photo T: View of a portion of the downslope side of the Waiahole Ditch in the “Hairpin Turn Repair” area showing four courses of roughly dressed rectangular basalt blocks (and an adjacent railroad rail)

Figure 55. Photo U: View of a section of train track rail (adjacent and parallel to the downslope side of the Waiahole Ditch) in the “Hairpin Turn Repair” area

Figure 56. Photo V: View of a portion of the upslope side of the Waiahole Ditch in the “Hairpin Turn Repair” area showing damage, prior repair efforts, and the two pipes laid in this portion of the ditch

Turn Repair” area showed damage and prior repair efforts (see Photo V/Figure 56). It was unclear whether the damage in this hairpin turn area related to the subsequent placement of two parallel PVC-type pipes in the ditch to convey the water but it was thought likely that this damage relates to present repair plans. The upstream, east end of the “Hairpin Turn Repair” area on the Waiahole Ditch has a similar large concrete box-like structure spanning the Waiahole Ditch that effectively funnels ditch water into the two modern pipes (Photo W/Figure 57).

The field inspection then effectively retraced the traversed route back to the intersection of new 30-inch Irrigation Line “A” with new Irrigation Line “B” and “C” (the location of Photo M/Figure 47). The traverse then continued northeast along Kupehau Road toward Kunia Road following Irrigation Line “A” (Figure 58). The new Irrigation Line “A” angles east off the Kupehau Road alignment, across a road berm and fallow fields toward the new irrigation water well location (Figure 59, Figure 60, and Photo Y/Figure 61). There is also a driveway connection off Kupehau Road connecting with the new irrigation water well location (Figure 59 and Photo Z/Figure 62). The new irrigation water well location was traversed (Figure 59 and Photo AA/Figure 63) with no evidence of any historic property in this fallow field.

The only historic properties observed in the course of the fieldwork were the Waiahole Ditch system and possibly some of the haul cane road alignments. The existing small reservoir is understood to post-date 1977 (and hence to not be a historic property) as it does not appear on an aerial photograph of that date (see Figure 27). It was thought that the laying of a new irrigation pipeline would not have an effect on the historic integrity of the system of haul cane roads. It was noted that some of the proposed improvements will be close to certain attributes of the Waiahole Ditch (sluice grate slots, a date inscription) but that impact could be minimized through avoidance. At a number of locations it was clear that the Waiahole Ditch has been previously modified in the course of routine repair and maintenance as with the creation of the small post-1977 reservoir and the large concrete box-like structures spanning the Waiahole Ditch on the upstream and downstream ends of the “Hairpin Turn Repair” area.

Figure 57. Photo W: View of the east end of the “Hairpin Turn Repair” area on the Waiahole Ditch, view to west

Figure 58. Photo X: New 12-inch Irrigation Line “A,” view from the T-intersection with new Irrigation Lines “B” and “C” toward Kunia Road (along Kupehau Road), view to northeast

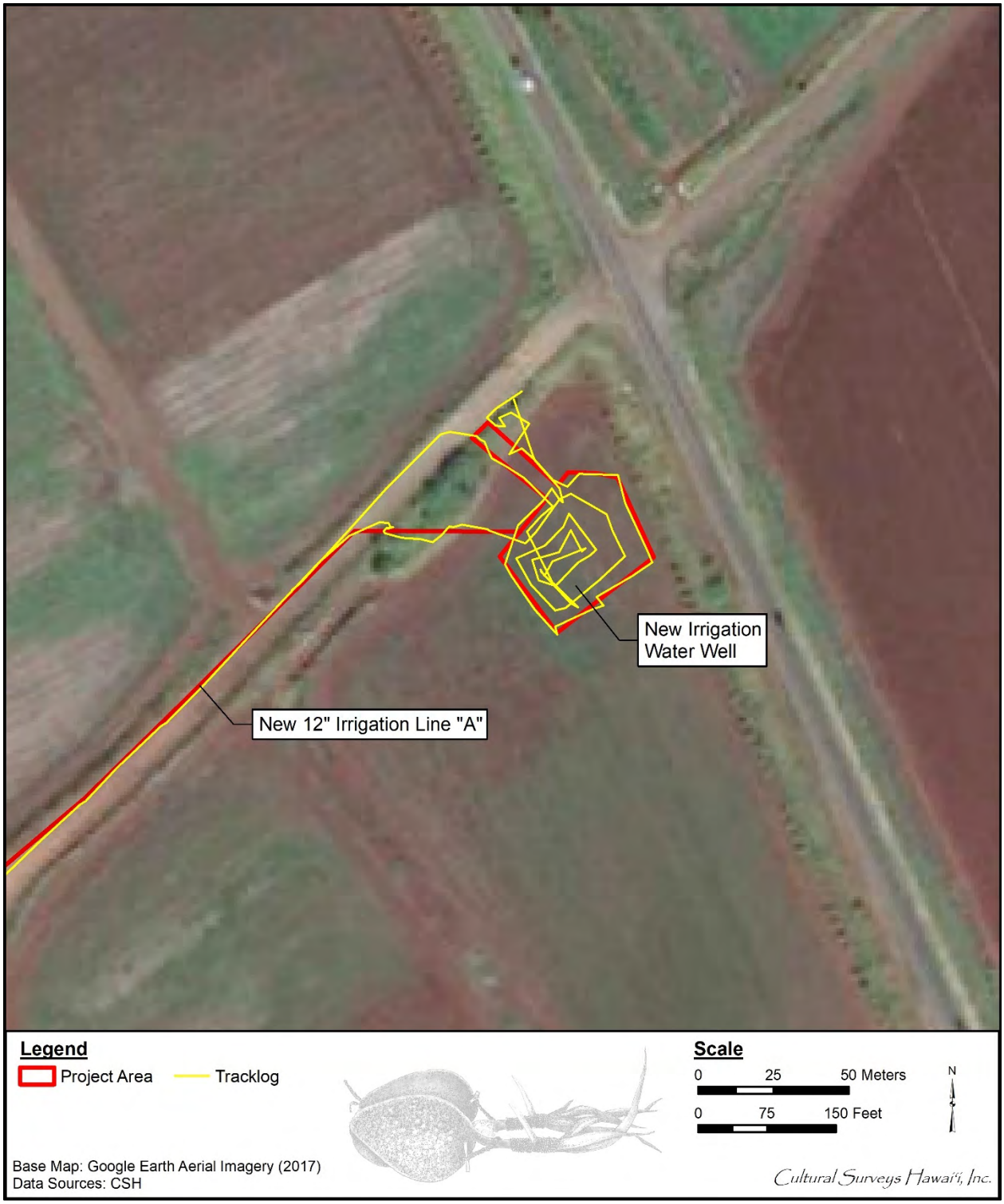

Figure 59. Archaeologist’s tracklog for the field inspection of the new well site portion of the project area (base map: Google Earth Aerial Imagery 2017)

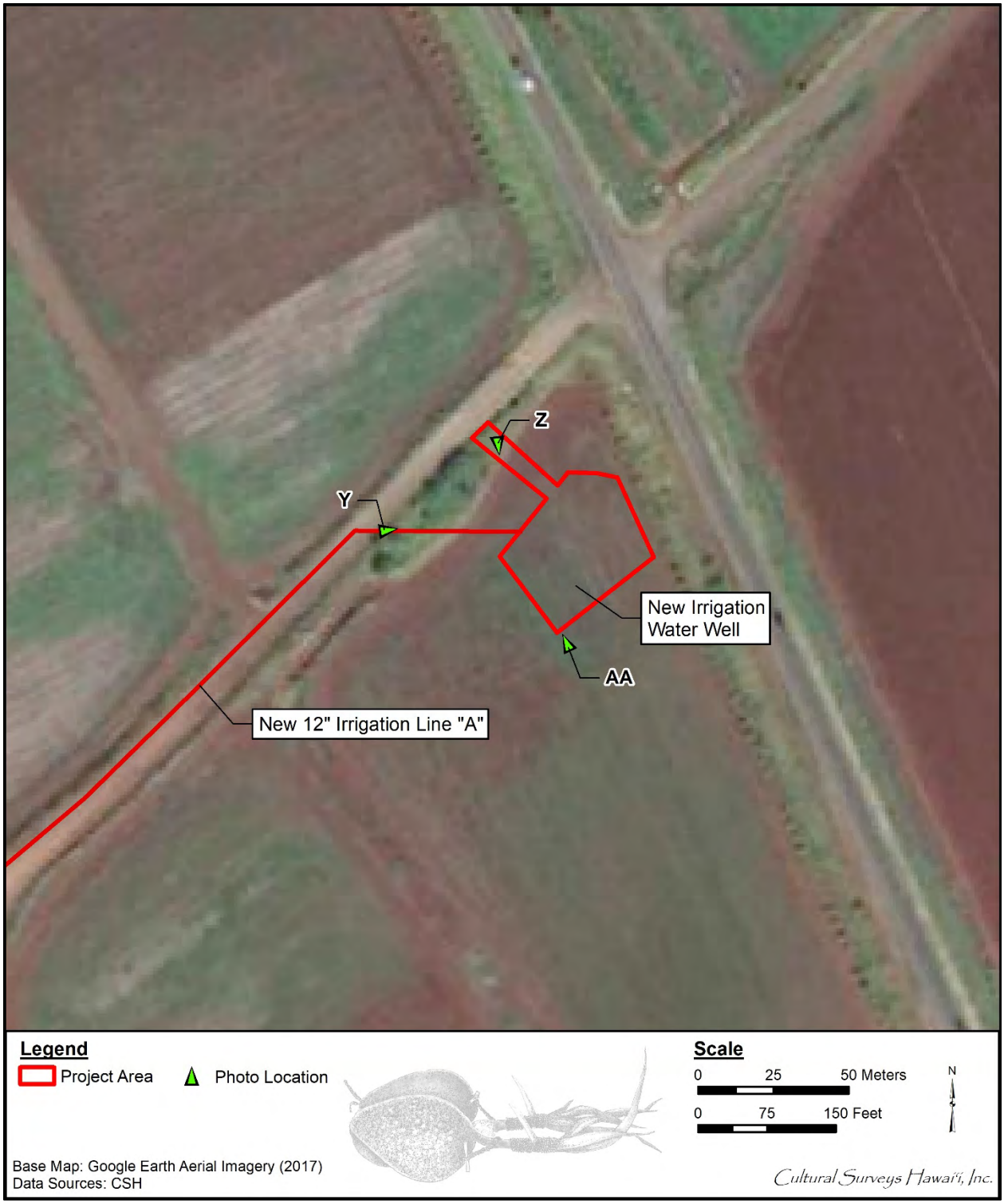

Figure 60. Key to general location and direction for field inspection photographs of the proposed new 15-MG reservoir area (Google Earth Aerial Imagery 2017)

Figure 61. Photo Y: Route of new 12-inch Irrigation Line “A” from near Kupehau Road toward the well site (in background), view toward Kunia Road to east

Figure 62. Photo Z: View of proposed driveway alignment to the proposed well site, Kunia Road at upper left, view to southeast

Figure 63. Photo AA: View of proposed well site, from the southeast edge of the well site area toward the proposed driveway, Kunia Road at upper right, view to northwest

Section 6 Consultation

A companion cultural impact assessment is actively being undertaken for this Waiāhole water system improvements project. A preliminary list of parties with whom consultation has been attempted is provided in Table 5.

Table 5. Preliminary list of parties with whom consultation has been attempted (consultation actively ongoing in October 2020)

Name	Affiliation
Abrigo, Scott	President, Kapolei Community Development Corporation
Aila, William	Interim Chair of Hawaiian Homes Commission / Director of Department of Hawaiian Homelands
Akau, Randal H.	-
Alaka‘i, Robert	Cultural practitioner
Barbieto, Leda	Raised in Ewa Plantation (Banana / Varona Camp)
Barbieto, Pio	Raised in Ewa Plantation (Banana / Varona Camp)
Basham, Leilani	Associate Professor of Hawaiian-Pacific Studies, University of Hawai‘i (UHMA)
Berg, Tom	Former Councilman, District 1
Bond, John	‘Ewa Historian, Kanehili Cultural Hui
Caceras, Mana Kaleilani	OIBC Representative for ‘Ewa
Cayan, Phyllis	Intake Specialist SHPD
Cordy, Ross	Professor of Hawaiian-Pacific Studies, University of Hawai‘i (UHWO)
Cullen, Ty J.K.	Representative, House District 39
DaMate, Leimana	Executive Director, DLNR-Aha Moku
Daniels, Sheri-Ann	Executive Director Papa Ola Lokahi
De Santos, Kahulu	Cultural Advisor, Aulani, A Disney Resort and Spa
Eaton, Ku‘uwainani	Hoakalei Cultural Foundation
Farden, Hailama	President, Association of Hawaiian Civic Clubs
Faulkner, Kirsten	Executive Director, Historic Hawai‘i Foundation
Feiteira, Blossom	President
Friends of Honouliuli	-
Hanohano, Anolani	Kānehili Hawaiian Homestead
Holt Takamine, Victoria	Executive Director, PA‘I Foundation
Hussey, Sylvia	Ka Pouhana of Office of Hawaiian Affairs (OHA)
Gabbard, Mike	Senatorial District 20
Kai, G. Umi	President, ‘Aha Kāne
Kaleikini, Ali‘ikaua	Cultural descendant

Name	Affiliation
Kaleikini, Hāloa	Cultural descendant
Kaleikini, Kala	Cultural descendant
Kaleikini, Mahi‘aimoku	Cultural descendant
Kaleikini, Moehonua	Cultural descendant
Kaleikini, No‘eau	Cultural descendant
Kaleikini, Paulette Ka‘anohi	Cultural descendant
Kaleikini, Tuahine	Cultural descendant
Kane, Shad	‘Ewa Moku Representative, Aha Moku; Kalaeloa Heritage and Legacy Foundation
Kauahi, R. Kaiulani Vincent	Culture and Arts Coordinator, Department Parks and Recreation
Kauhane, Michelle	President, Kaupe‘a Homestead Association
Keala, Jalna	Association of Hawaiian Civic Clubs
Keaulana, Ha‘a	Cultural Advisor at Four Seasons Resort at Ko‘olina
Keli‘inoi, Kalahikiola	Cultural descendant
Keli‘inoi, Kilinahe	Cultural descendant
Kruse, Kehaulani	Outrigger Enterprises, Cultural Advisor
Legal, Jack	Chair, Makakilo/Kapolei/Honokai Hale Neighborhood Board No. 34
Lewis, Joe Kūhiō	Chief Executive Officer Council of Native Hawaiian Advancement
Lidstone, Miki‘ala	Executive Director, Ulu A‘e Learning Center Hālau ‘o Kaululaua‘e
Lilomaiva-Doktor, Sa‘iliemanu	Professor of Humanities/Hawaiian-Pacific Studies, University of Hawai‘i West O‘ahu
Lyman, Melissa	President Kalaeloa Heritage and Legacy Foundation
McKeague, Kawika	Director of Cultural Planning G70 International
Medeiros, Pōhai	PIKO Program Advisor, University of Hawai‘i West O‘ahu
Nahulu-Mahelona, Moani	Social Studies Department, Kapolei HS
National Park Service Honouliuli National Monument	-
O’Connell, Eugene	Project Coordinator The Makua Group
Paglinawan, Lynette	Kumu Hula at UHWO
Paik, Linda Kaleo	Cultural practitioner/ Secretary/Treasurer for Koa Ike

Name	Affiliation
	Cultural Specialist; Former History and Culture, SHPD ‘Aha Wahine Aha Moku Committee, Kona District, O‘ahu
Paishon, Jr., Frank	Raised in Tenney Village
Patterson, Kaleo	Native Hawaiian Church; Pacific Justice & Reconciliation Center
Puahala, Roth	Past-President, Ke One O Kakuhihewa
Ramos, Rodolfo	President, Ewa Villages Community Association; Chair of ‘Ewa Task Force
Saul, Melissa	Associate Specialist, Title III PIKO Project Director, University of Hawai‘i West O‘ahu
Schaedel, Homelani	President, Malu‘ōhai Residents Association
Serrao, Marleen Kau‘i	Pelekikena, ‘Ewa-Pu‘uloa Hawaiian Civic Club
Shibuya, Barbara	Kama‘āina of ‘Ewa, member of the Shibuya Dayanan Family
Silva, Adrian Nakea	Chairman, Hui Huliau, Inc.
Soong, Melvin	President The I Mua Group
Suganuma, La‘akea	President, Royal Hawaiian Academy of Traditional Arts and Nā Lei Ali‘i Kawananakoa
Swinney, Shirley S.	Founder, Kapolei Community Development Corporation; Hawaii Community Development Authority
Tiffany, Nettie	Kahu for Lanikohonua
Williams-Solomon, Leilani	President Native Hawaiian Chamber of Commerce
Wong-Kalu, Hinaleimoana	OIBC Chair
Woode, Napali	Native Hawaiian Economic Alliance
Wond, Kanani	Vice President, Kaupe‘a Homestead Association
Yee, Christian	*Kama‘āina*, familiar with *wahi pana* and *mo‘olelo*

Section 7 Summary and Recommendations

The project area lies far from the coast, approximately 6 km northeast of the West Loch of Pearl Harbor on a relatively featureless south slope of the central valley of O‘ahu. There is a significant tributary valley of Honouliuli Gulch in the central portion of the project area which would have carried flowing water intermittently but this is believed to have been dry most of the time. The project area averages about 710.6 mm (28.0 inches) of rainfall annually (Field 140 Station) which would be marginal at best for non-irrigated agriculture. The generally dry nature of the project area and distance from the coast would have discouraged traditional Hawaiian land use. There was a major traditional Hawaiian trail that would become contemporary Kunia Road on the east end of the project area but it is suggested that most travelers on this trail would have just been passing through.

During the Māhele land division of 1848, Miriam Ke‘ahikuni Kekau‘ōnohi acquired a deed (Royal Patent #6971) to all unclaimed land within the *ahupua‘a* (including the present project area), which totaled 43,250 acres. The 72 *kuleana* awards, awards given to commoners, were located in the lower portions of Honouliuli Ahupua‘a near Pearl Harbor with its fishponds and irrigated taro fields (Maly 1997). No *kuleana* claims were awarded within the project area.

There were no “storied places” (*wahi pana*) in the immediate vicinity as would have attracted early visitation and land use (see Figure 11 and Figure 12).

Nineteenth century maps such as the 1873 Alexander map (see Figure 13) and the 1894 Kanakanui map (see Figure 14) indicate no development in the vicinity of the project area (other than the trail extending up the central valley at the east end that would become Kunia Road) and are consistent with this area having been used solely as grazing land as indicated in the 1906 Donn map (see Figure 15).

The project area and the ‘Ewa slope and plain in general was transformed by the Waiahole Ditch completed in 1916 (see Figure 16). Sugarcane cultivation by the Oahu Sugar Company dominated the project area until Oahu Sugar Company went out of business in 1994.

The only historic properties identified within the project area relate to twentieth century commercial sugarcane cultivation which included a westward extension of SIHP # 50-80-08-7671:3 Kupehau Road, which was a plantation road (and at one time, for part of the stretch in the project area, a plantation railway alignment; see the 1928/1929 USGS topographic map, Figure 19), and small portions of the Waiahole Ditch, designated SIHP # 50-80-09-2268. This study supports the conclusion of Wong and Spear (2015:54) that SIHP # 50-80-08-7671 is significant under Criterion d (only) as outlined in HAR §13-275-6 for having yielded information about prior historic land use, particularly in association with former plantation agriculture in the area; no further archaeological work is indicated on the basis that “what remains are remnant plantation features that have been adequately documented, and that little potential exists to encounter intact subsurface cultural deposits.”

The case of the Waiahole Ditch (SIHP # 50-80-09-2268) is more complicated in that the ditch has been determined to be quite significant and the present study supports significance under HAR §13-284-6 Criteria a, c, and d. The historic property has yielded information on the agricultural history of the area and contributed greatly to the development and evolution of the ‘Ewa Plain

throughout its history. The portions of the Waiahole Ditch within the present project area retain integrity of location, design, materials, and workmanship.

The proposed project is regarded as part of on-going routine maintenance, will have minimal impact on the Waiahole Ditch (SIHP # 50-80-09-2268), and is not anticipated to diminish the appearance, integrity or significance of this historic property. Impacts to the Waiahole Ditch are understood to be limited to: 1) a new sluice gate with operator at Ditch Connection Site 1 (see Figure 5), a new headwall at Ditch Connection Site 2 (see Figure 8), and 3) a re-working of the previous re-working of the ditch at the Hairpin Turn (see Figure 9). It is suggested that documentation of these areas within the present study is appropriate and enough but early consultation with the SHPD archaeology and architecture branch is recommended regarding impacts to the Waiahole Ditch and possible mitigation.

Given the nature of the proposed project’s impacts and the present documentation, the present study supports a determination of “no historic properties affected” and no further historic preservation work.

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Cultural Impact Assessment for the Waiahole Water Systems Improvement Project, Honouliuli Ahupuaʻa, ʻEwa District, Oʻahu TMKs: [1] 9-2-001:001 and 9-2-004:006 por.

Prepared for
R.M. Towill Corporation
on behalf of the
State of Hawaiʻi Agribusiness Development Corporation (ADC)

Prepared by
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Management Summary

Reference	Cultural Impact Assessment for the Waiahole Water Systems Improvement Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMKs: [1] 9-2-001:001 and 9-2-004:006 por. (Parker et al. 2021)
Date	April 2021
Project Number (s)	Cultural Surveys Hawai‘i (CSH) Job Code: HONOULIULI 187
Agencies	State of Hawai‘i Department of Land and Natural Resources / State Historic Preservation Division (SHPD); State Office of Environmental Quality Control (OEQC)
Land Jurisdiction	The City and County Department of Planning and Permitting website shows the TMK: [1] 9-2-001:020 portion of the project area as part of a 1,689-acre parcel owned by Monsanto Company and the TMK: [1] 9-2-004:006 portion of the project area as part of a 725-acre parcel owned by Hartung Brothers Hawaii LLC.
Project Proponent	State of Hawai‘i Agribusiness Development Corporation (ADC)
Project Location	The project area lies on agricultural land in Kunia, on the southwest slope of O‘ahu’s central valley on the west side of Kunia Road with the elevation in the project area ranging from approximately 560 feet (ft) to 640 ft, or 170.6-195 m above mean sea level (AMSL) in Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMKs: [1] 9-2-001:020 por. and 9-2-004:006 por. The project area is depicted on a portion of the 1998 Schofield Barracks U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle, tax map plats, and a 2017 aerial photograph).
Project Description	The ADC is proposing improvements to the Waiahole Ditch system to improve the irrigation system’s efficiency and enhance water supply security. The project includes five major components: Ditch diversion and intake piping, new lined earthen reservoir, new water supply well, interconnecting pipelines and appurtenances/control valves for the system, and a new closed conduit at an existing hairpin bend in the ditch. Substantial excavation is indicated for the construction of a new 15-million gallon (MG) reservoir and for new irrigation lines (designated A, B, and C) with lesser excavation for certain connections and repair and for a new irrigation water well.
Project Acreage	The project includes two relatively large areas, the proposed new 15-MG reservoir estimated at 4.6 acres and a proposed new irrigation water well enclosure estimated at 0.4 acre, in addition to a total of approximately 7,030 ft of linear irrigation lines and amenities. These irrigation lines may well involve ground disturbance less than 3 ft wide but the precise alignment was often unclear and thus an estimated width of the study area for these lines is somewhat arbitrarily 20 ft; this yields an estimated project area for the lines of

	140,600 square (sq) ft (3.23 acres). The total project area is 8.23 acres (3.33 hectares).
Document Purpose	The purpose of this cultural impact assessment (CIA) is to comply with the State of Hawai‘i’s environmental review process under Hawai‘i Revised Statutes (HRS) §343, which requires consideration of the proposed project’s potential effect on cultural beliefs, practices, and resources. Through document research and cultural consultation efforts, this report provides information compiled to date pertinent to the assessment of the proposed project’s potential impacts to cultural beliefs, practices, and resources (pursuant to the Office of Environmental Quality Control’s Guidelines for Assessing Cultural Impacts) which may include traditional cultural properties (TCPs). These TCPs may be significant historic properties under State of Hawai‘i significance Criterion e, pursuant to Hawai‘i Administrative Rules (HAR) §13-275-6 and §13-284-6. Significance Criterion e refers to historic properties that “have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group’s history and cultural identity” (HAR §13-275-6 and §13-284-6). The document will likely also support the project’s historic preservation review under HRS §6E-8 and HAR §13-275.
Results of Background Research	Background research for this study yielded the following results, in approximate chronological order: 1. The ‘Ewa plains, south of the Wai‘anae mountain range consist largely of limestone and alluvial deposits pockmarked with karsts formed by the dissolution of limestone by underground fresh water. 2. Honouliuli is the largest *ahupua‘a* (land division usually extending from the uplands to the sea) in the *moku* (district) of ‘Ewa. One translation of the name for this district is given as “unequal” (Saturday Press, 11 August 1883). Others translate the word as “strayed” and associate it with the legends of the gods Kāne and Kanaloa. 3. The traditional *ka‘ao* (legends) associated with the area speak of the *akua* (godly) brothers, Kāne and Kanaloa. It was their supernatural feat of hurling pōhaku (stone) across the island that determined the boundaries of land divisions (Sterling and Summers 1987:1). Additional *mo‘olelo* (stories) speak of Hi‘iaka and her travels across the plains of ‘Ewa. In particular, the *wahi pana* (storied place) of Kaupe‘a (located southeast of the current project area) is described. Kamakau describes

	Kaupe‘a as a wide plain where a grove of *wiliwili* (Erythrina sandwicensis) stands (Kamakau 1991b:47). This plain is an *ao kuewa*, a realm belonging to homeless souls. In general, the *kama‘āina* (native born) of both Honouliuli Ahupua‘a and ‘Ewa District made a point to avoid this place. 4. Pu‘uokapolei is a prominent hill located on the ‘Ewa coastal plain that was the primary landmark for travelers on the trail running from Pearl Harbor to Wai‘anae. A *heiau* (temple) was once on the summit of the hill, however, by the time of McAllister’s survey of O‘ahu it had been destroyed (McAllister 1933:108). The hill was also used as a point of solar reference or as a place for celestial observations of the winter and summer solstice. A ceremony at a *heiau* on Pu‘uokapolei provides a vantage point to capture the sun setting directly behind Pu‘ulailai, a peak farther west in the Wai‘anae range. A coinciding ceremony at Kūpalaha Heiau in Waikīkī captures the same essence as the sun sets behind Pu‘uokapolei. 5. Additional *heiau* located within Honouliuli included Pu‘u Ku‘ua located at Palikea, in addition to two unidentified *heiau*. These two unidentified *heiau* are located at the foot of Pu‘u Kanehoa and Pu‘u Kuina, respectively. 6. John Papa ‘Ī‘ī describes a network of Leeward O‘ahu trails, which in later historic times encircled and crossed the Wai‘anae Range, allowing passage from West Loch to the Honouliuli lowlands, past Pu‘uokapolei and Waimānalo Gulch to the Wai‘anae coast and onward, circumscribing the shoreline of O‘ahu (‘Ī‘ī 1959:96–98). 7. The rich resources of Pu‘uloa—the fisheries in the lochs, the shoreline fishponds, the numerous springs, and the irrigated lands along the streams—made ‘Ewa a prize for competing chiefs. ‘Ewa Moku was also a political center and home to many chiefs in its day. Oral accounts of *ali‘i* (royalty) recorded by Hawaiian historian Samuel Kamakau date back to at least the twelfth century. *Ali‘i* associated with Honouliuli and greater ‘Ewa Moku included Kākuhihewa, Keaunui, Lakona, Mā‘ilikūkahi, and Kahahana. 8. Early foreign accounts describe the southwest coast of O‘ahu, including Honouliuli Ahupua‘a, as an area “a little distance from the sea, [where] the soil is rich and all the necessaries of life are abundantly produced” (Vancouver 1798 in Sterling and Summers 1978:36). A sailor among Vancouver’s crew observed, however, that “from the number of houses within

	the harbor it should seem to be very populous; but the very few inhabitants who made their appearance were an indication of the contrary” (Vancouver 1798 in Sterling and Summers 1978:36). 9. Following the Māhele of 1848, 96 individual land claims were made in the *ahupua‘a* of Honouliuli, with 72 claims being registered and awarded by King Kamehameha III to *maka‘āinana* (commoners). The 72 *kuleana* (land holding of a tenant or *hoa‘āina* residing in the *ahupua‘a*) awards were almost all made adjacent to Honouliuli Gulch, which contained fishponds, irrigated *lo‘i* (taro fields), *kula* (pasture or dry field), and house lots. 10. With the increasing foreign interests on O‘ahu Island during the last half of the nineteenth century, an array of agricultural enterprises were attempted. In 1877, James Campbell purchased most of Honouliuli Ahupua‘a for a total of $95,000. 11. The Waiahole Water Company was formally incorporated in 1913 and was originally a subsidiary of the Oahu Sugar Company. The Waiahole Ditch was designed by engineer Jorgen Jorgensen, with recommendations by engineer J.B. Lippencott and assisted by W.A. Wall. Upon its completion in 1916, the Waiahole Ditch was 35 km (21.9 miles) long and cost $2.3 million. The 32 million gallons of daily water enabled the Oahu Sugar Company to grow to “some 20 square miles […] ranging in elevation from 10 ft at the Waipio Peninsula […] to 700 ft at the Waiahole Ditch” (Condé and Best 1973:313). The ditch system is included on the State Inventory of Historic Places (SIHP) as site # 50-80-09-2268. The Waiahole Ditch System crosses through the western portion of the present project area. 12. The early twentieth century saw the lands of Honouliuli heavily utilized by both civilians and the U.S. military for transportation. The U.S. Government began acquiring the coastal lands of ‘Ewa for development of a naval base at Pearl Harbor. In 1901, the U.S. Congress formally ratified annexation of the Territory of Hawaii, and the first 1,356.01 acres of Pearl Harbor land were transferred to U.S. ownership. 13. Following the Japanese Navy’s attack on Pearl Harbor on 7 December 1941, the Territory of Hawaii was declared under martial law and the writ of habeas corpus (the requirement for a person under arrest to be brought before a judge or into court) was suspended (U.S. Department of the Interior 2014:6–7). Persons of Japanese and European ancestry in

	Hawai‘i suspected of disloyalty to the United States were rounded up and imprisoned by the U.S. military and the Federal Bureau of Investigations (FBI) (U.S. Department of the Interior 2014:xii).
Results of Community Consultation	CSH attempted to contact 71 Hawaiian organizations, agencies, and community members. Of the four people that responded, two provided written testimony and one *kama‘āina* (Native-born) and/or *kūpuna* (elders) participated in a formal phone interview for more in-depth contributions to the CIA. Consultation was received from community members as follows: • Christian Kaimanu Yee, *kama‘āina* and knowledgeable of *mo‘olelo* and *wahi pana* • Tom Berg, former Councilman, District 1 • Lynette Paglinawan, cultural practitioner, educator, teaches a course on Native Hawaiian Healing at University of Hawai‘i West O‘ahu
Impacts and Recommendations	Based on information gathered from the community consultation, participants voiced their concerns in a cultural context. 1. Mr. Tom Berg stated that the project has been “proposed on a pueo (owl) foraging and breeding ecosystem.” He noted records indicate that per earliest colonial contact, the pueo is most abundant on the slopes from Pu‘u Kapua‘i to West Loch, in the area where the project is slated. He added that “Hunehune Gulch, Kaloi Gulch, and Honouliuli Gulch are migratory routes used by the pueo to go from mountain to sea to court, mate, forage, and raise their brood.” He stated that the proposed project will “encroach on prime pueo habitat-considered to be graded A+—'a ten (10)’—when it comes to the degree of pueo habitat in use on this project site.” 2. Mr. Berg added that the *pueo* has “a direct connection to Native Hawaiian family lineage in Ewa Beach,” noting the *pueo* is the *‘aumakua* (personal or family guardian) for the Michael Lee family and their accounts which go back over seven generations are documented at the State Archives Building in Honolulu. 3. Mr. Berg also stated that the project site is “inhabited by the ōpe‘ape‘a [Hawaiian hoary bat, Lasiurus cinereus semotus] at various times of the seasons,” noting that in 1910, the government documented *‘ōpe‘ape‘a* within a half-mile of the project area. 4. Mr. Berg stated his concern that the “property in question will not receive the proper protocol to conclude no endangered

	species inhabit the area." Mr. Berg stated "a thorough and complete protocol is adopted to repeat the inventory exercise for pueo and ‘ōpe‘ape‘a over the course of a calendar year would be in order so the project does not inadvertently contribute to more endangered species habitat loss." He also recommended inquiring with Dr. Melissa Price and Dr. Javier Cotin of the Project Pueo Biologist Team and Department of Fish and Wildlife (DOFAW) Biologist Afsheen Siddiqi regarding *pueo* protocol. 5. Mr. Berg also expressed his concern for the possible negative aspects of light at an adjacent parcel. He expressed concern that a solar panel may reflect neighboring lighting operations into "the flight patterns of migrating birds and the ‘ōpe‘ape‘a and pueo in particular need to be addressed." 6. Ms. Paglinawan voiced concern over water being taken away from local Hawaiian farmers and local agriculture. She worries that the building of more reservoirs is a signal indicating increased development in the area. 7. Project construction workers and all other personnel involved in the construction and related activities of the project should be informed of the possibility of inadvertent cultural finds, including human remains. In the event that any potential historic properties are identified during construction activities, all activities will cease and the SHPD will be notified pursuant to HAR §13-280-3. In the event that *iwi kūpuna* (Native Hawaiian skeletal remains) are identified, all earth moving activities in the area will stop, the area will be cordoned off, and the SHPD and Police Department will be notified pursuant to HAR §13-300-40. In addition, in the event of an inadvertent discovery of human remains, the completion of a burial treatment plan, in compliance with HAR §13-300 and HRS §6E-43, is recommended. 8. In the event that *iwi kūpuna* and/or cultural finds are encountered during construction, project proponents should consult with cultural and lineal descendants of the area to develop a cultural preservation plan for proper cultural protocol, curation, and long-term maintenance.

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Section 1 Introduction

1.1 Project Background

At the request of R.M. Towill Corporation and on behalf of the State of Hawai‘i Agribusiness Development Corporation (ADC), Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this cultural impact assessment (CIA) for the Waiāhole Water System Improvements project, located in Kunia, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu (TMKs: [1] 9-2-001:001 por. and 9-2-004:006 por.).

The project has a number of components located west of Kunia Road at approximately 600-foot (ft) elevation located adjacent to the Waiahole Ditch and Kupehau Road. The project area is depicted on a portion of the 1998 Schofield Barracks U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), tax map plats (Figure 2 and Figure 3), and a 2017 aerial photograph (Figure 4) and is described in greater detail below.

ADC is proposing improvements to the Waiahole Ditch system to improve the irrigation system’s efficiency and enhance water supply security. The project has five major components:

1. Ditch diversion and intake piping;
2. New lined earthen reservoir;
3. New water supply well;
4. Interconnecting pipelines and appurtenances/control valves for the system;
5. New closed conduit at an existing hairpin bend in the ditch.

These components are discussed and summarized in greater detail below.

1. Ditch Connection 1 – Involves a new intake for the reservoir near Kunia Road and a new Irrigation Line “B” extending along the southeast side of an existing unimproved road to the new 15-million gallon (MG) reservoir (Figure 5). This work will include the following:
   a. Constructing a new shallow manhole over existing plugged 24-inch culvert connected to existing diversion on Waiahole Ditch;
   b. Installing a new trash rack and new 24-inch cast iron sluice gate at the existing diversion;
   c. Unplugging an existing 24-inch culvert;
   d. Connecting a new 30-inch Irrigation Line “B” to the new shallow manhole.
2. A new 15-MG reservoir to be built adjacent to the southeast side of an existing reservoir (Figure 6) will involve the following:
   a. Water from Waiahole Ditch will be diverted into an existing ditch between the reservoir and Waiahole Ditch and then into the existing reservoir.
   b. An existing pump will draw water from the existing reservoir and pump water *makai* (seaward) of the existing reservoir.

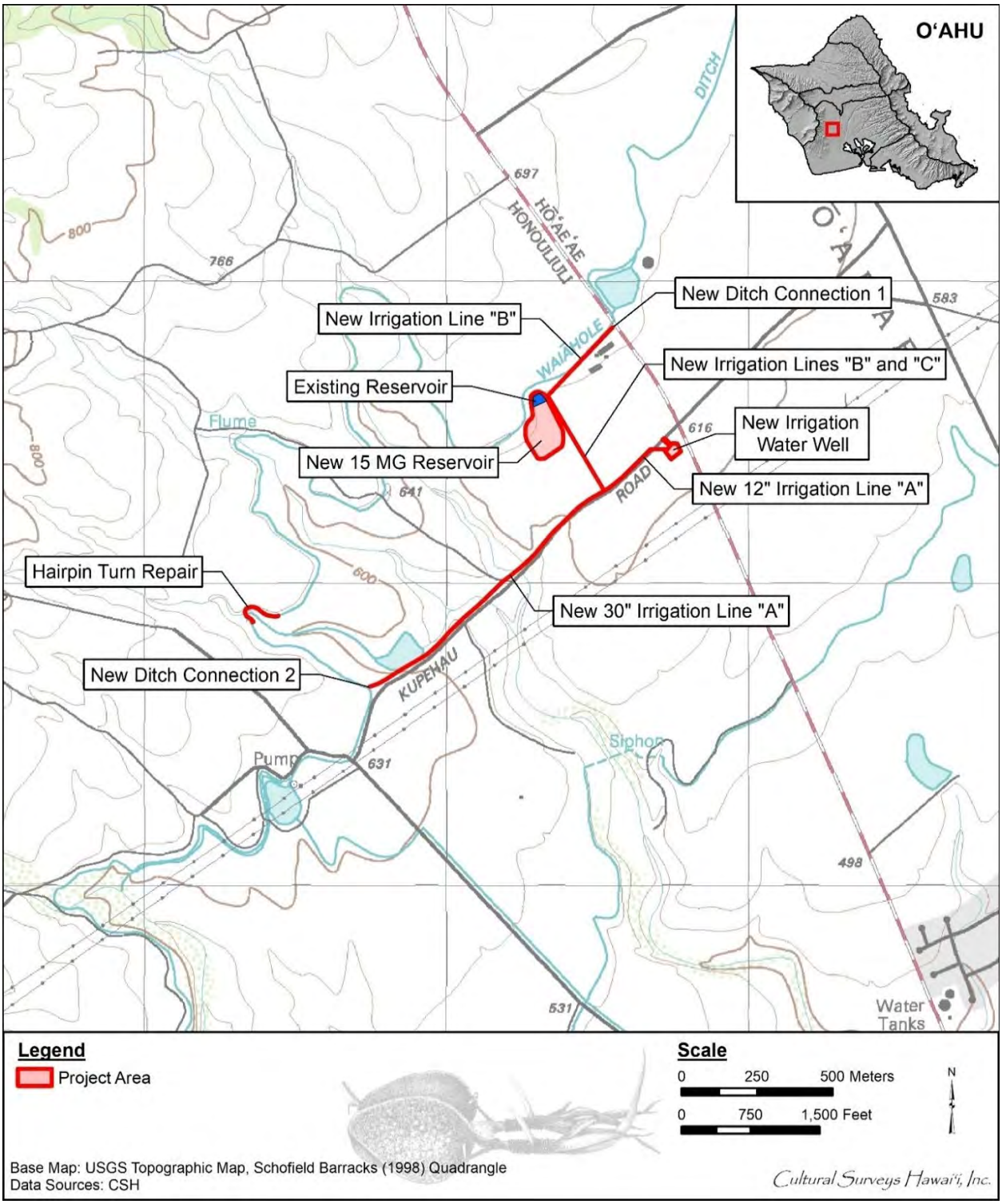


Figure 1. Portion of Schofield Barracks USGS 7.5 minute topographic quadrangle showing the location of the project area (1998)

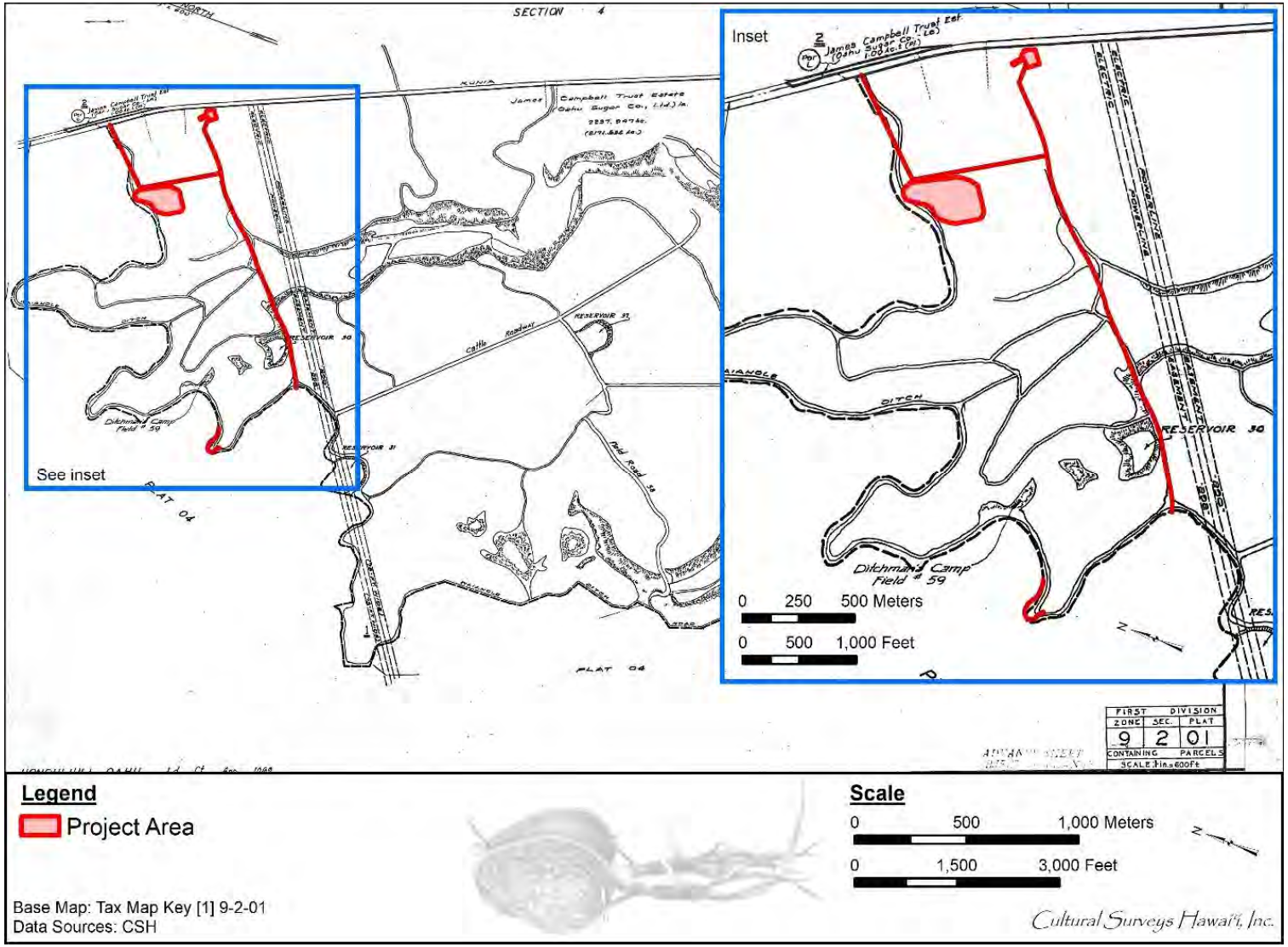


Figure 2. Tax Map Key (TMK) [1] 9-2-001 showing a portion of the project area (Hawai‘i TMK Service 2014)

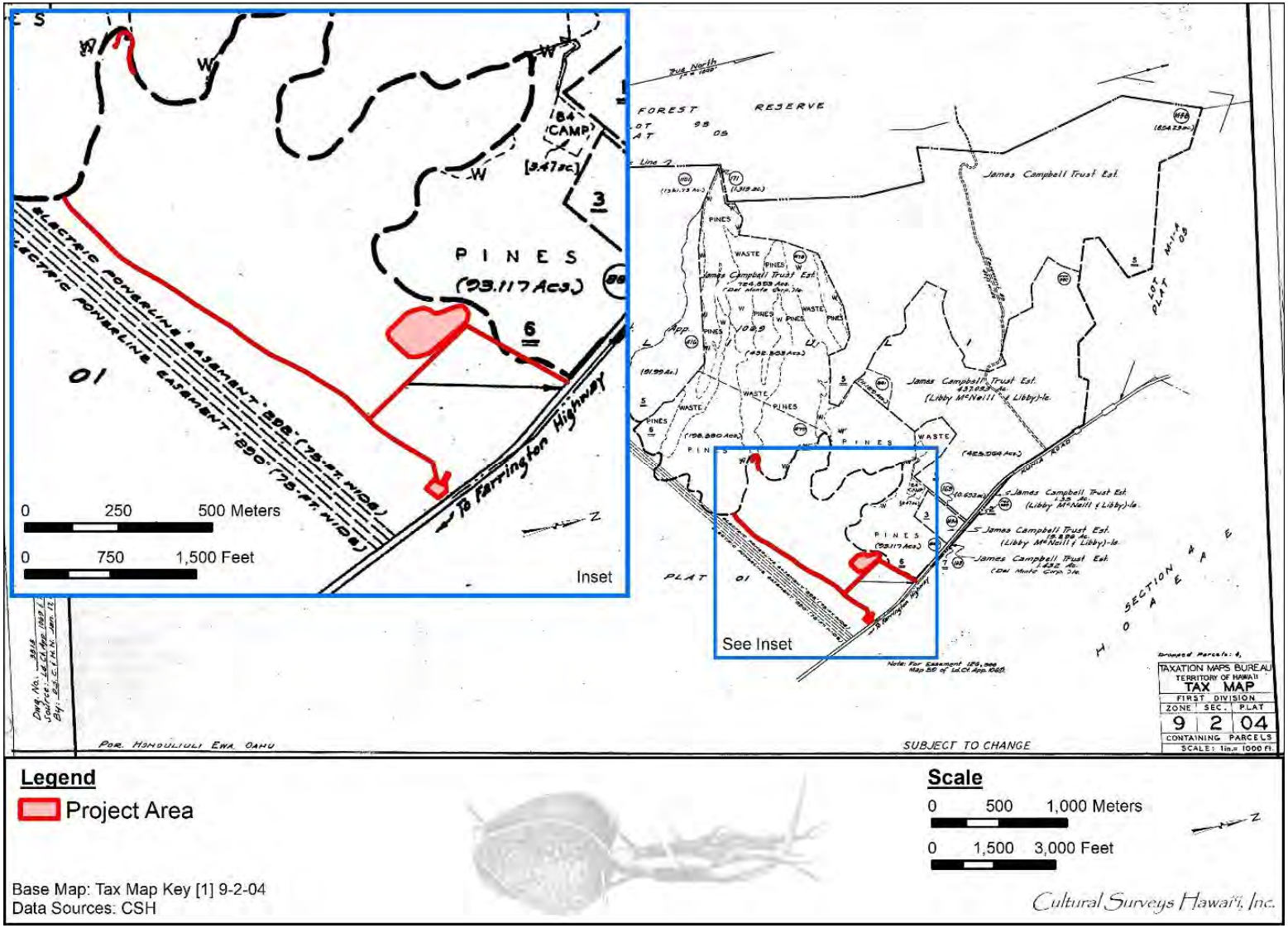


Figure 3. TMK: [1] 9-2-004 showing a portion of the project area (Hawai‘i TMK Service 2014)

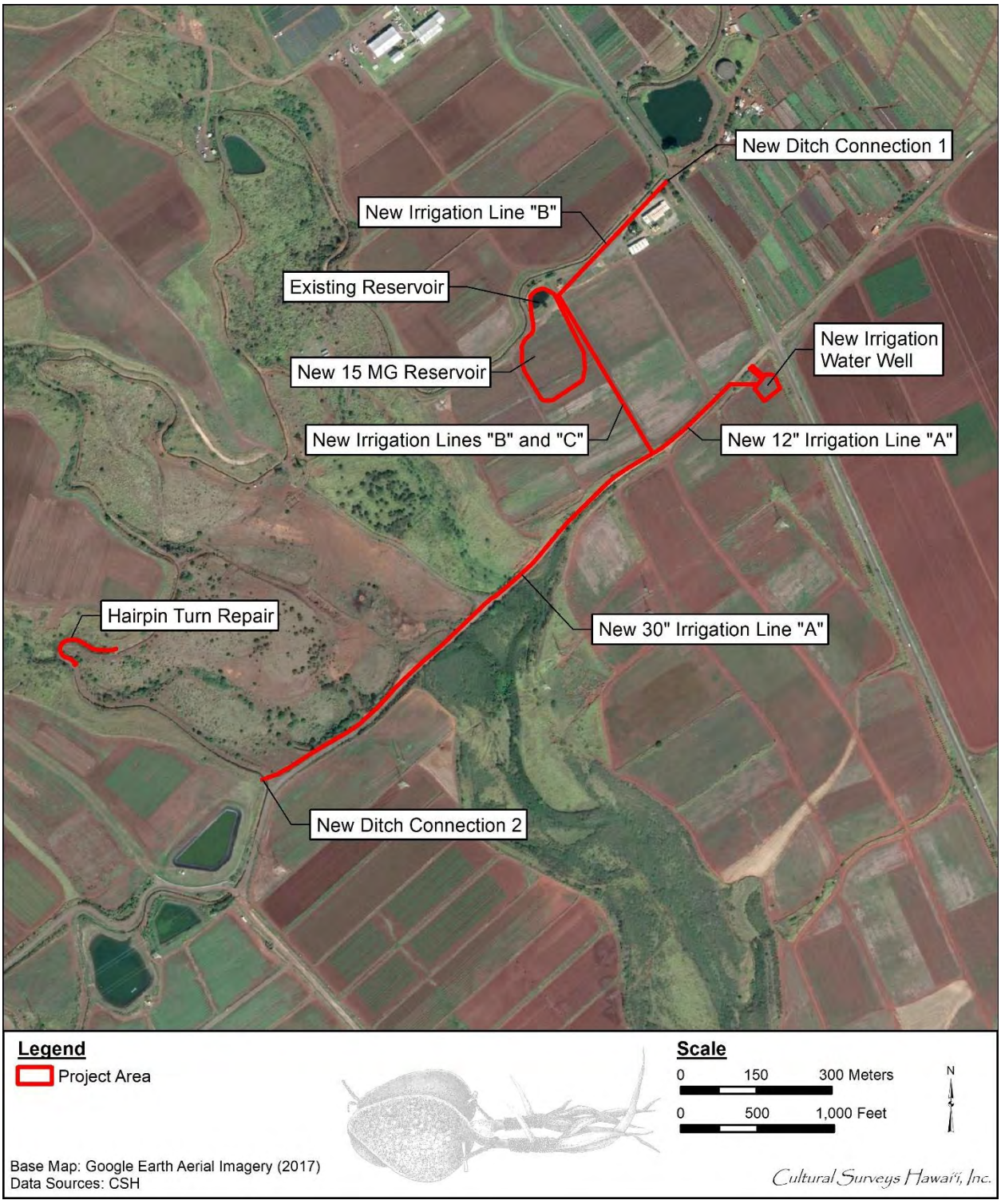


Figure 4. Aerial photograph of the project area (Google Earth 2017)

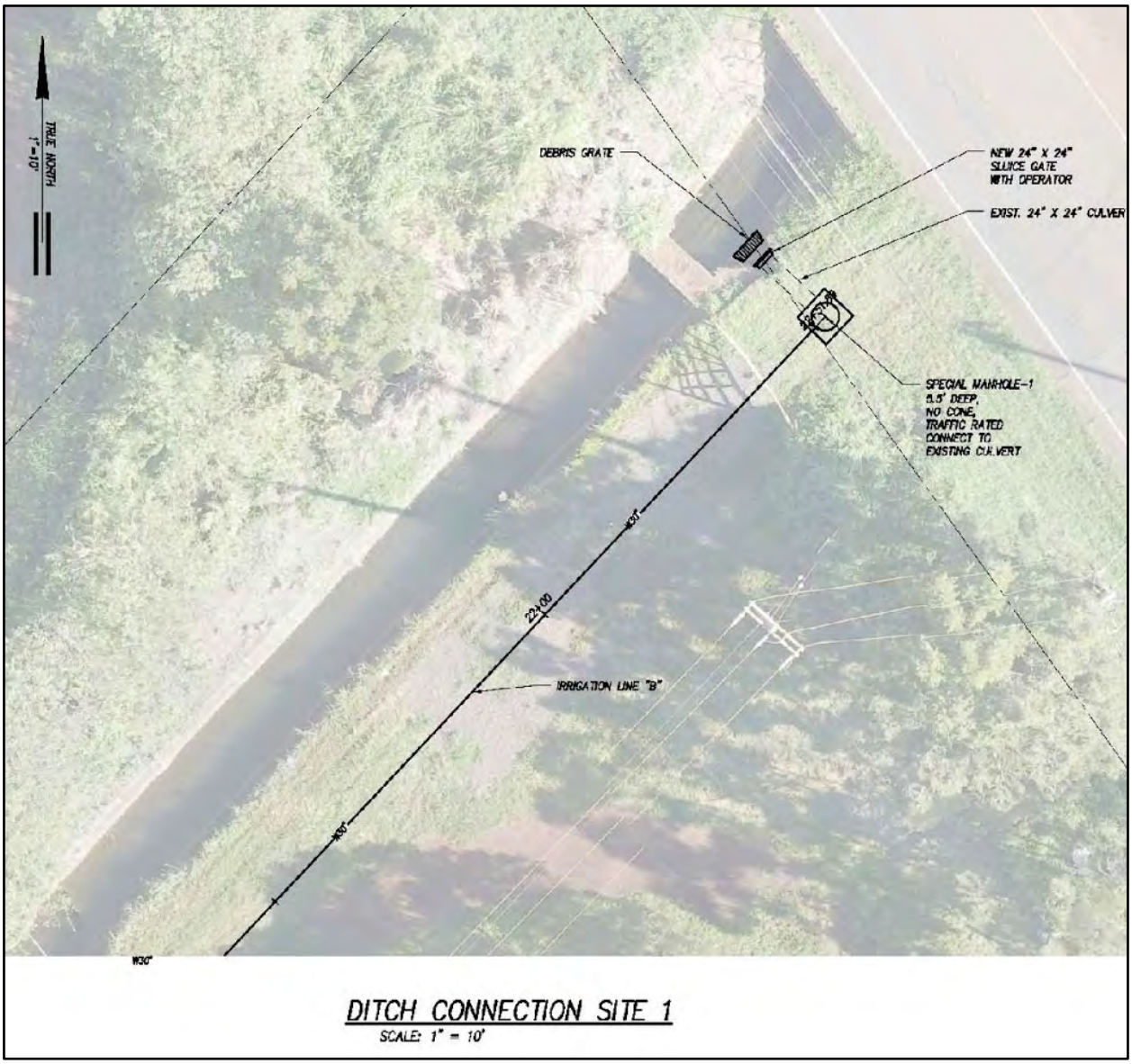


Figure 5. Ditch Connection 1 – Involves a new intake off the existing Waiahole Ditch (with new debris gate, sluice gate, and short connecting culvert) and a new Irrigation Line “B” extending along the southeast side of an existing unimproved road (parallel to and southeast of the existing Waiahole Ditch) to the new 15-MG reservoir (courtesy of client)

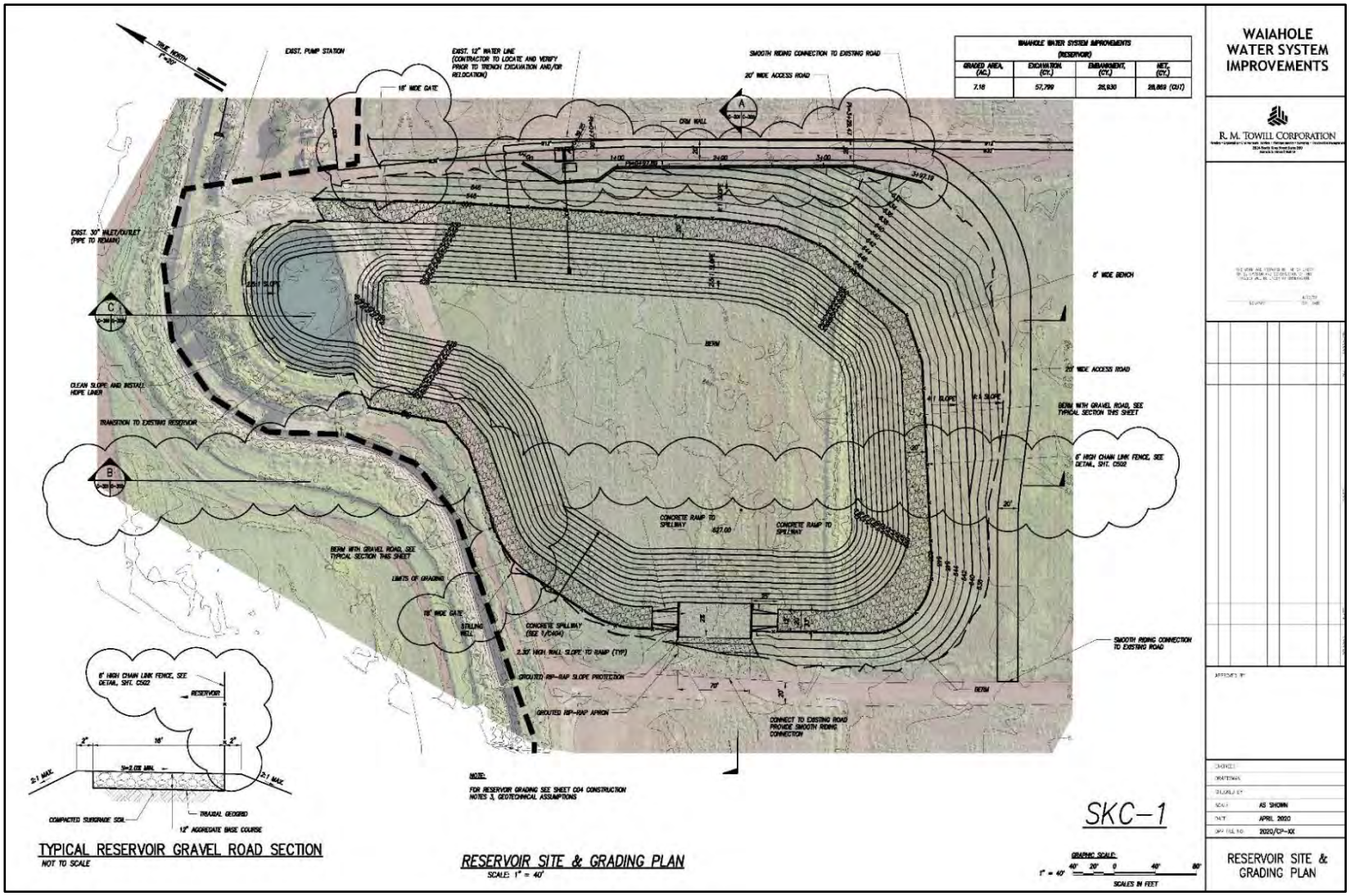


Figure 6. Reservoir site and grading plan (courtesy of client); the new 15-MG reservoir is to be built adjacent to the southeast side of an existing reservoir

c. A new 15-MG reservoir will be built connected to the southeast side of the existing reservoir.

d. The new reservoir will receive water from Ditch Connection 1 through the new Irrigation Line “B-1” through the northeast embankment or through new Irrigation Line “D” connected to the existing reservoir ditch.

e. The new reservoir may also receive water from a new backup irrigation water well through Irrigation Line “C-1” through the northeast embankment.

3. New Irrigation Lines “B” and “C” will be built extending southeast from the existing reservoir and the to-be-built reservoir.
    a. The alignment of a new 30-inch Irrigation Line “B” will be along existing roads connecting to the existing reservoir and adjacent to the northeast embankment of new reservoir, from Ditch Connection 1 to connection to the 12-inch Irrigation Line “A.”
    b. Alignment of 12-inch Irrigation Line “C” will be along an existing road adjacent to northeast embankment of the new reservoir, from connection to Irrigation Line “C-1” to the southeast to connect to Irrigation Line “A” that will run perpendicular (northeast/southwest).
4. A new backup irrigation water well will be built close to the west side of Kunia Road west of the new reservoir (Figure 11).
    a. Connection to 12-inch Irrigation Line “A.”
5. New Irrigation Line “A”
    a. Alignment will be along the existing dirt plantation road from Ditch Connection 2 on Waiahole Ditch to the site of the new well.
    b. Size will be 30-inch from Ditch Connection 2 to connection to 30-inch Irrigation Line “B” then reduce to 12-inch before connecting to 12-inch Irrigation Line “C.”
    c. A 30-inch beveled-gear gate valve (normally closed) will isolate the 12-inch pumped system (from the new well) from the 30-inch gravity system.
6. Ditch Connection 2 – Downstream from hairpin turn (Figure 8Figure 12)
    a. Construct new headwall at the existing cut in Waiahole Ditch
    b. Construct new 30-inch sluice gate at new headwall
7. Repair at hairpin turn (Figure 9Figure 13)
    a. Remove two existing 20-inch HDPE pipes from ditch and bulkheads at inlet and outlet.
    b. Place new 36-inch HDPE on new concrete saddles at center of ditch and strap to saddles; bend pipe to match curve of ditch.
    c. Encase new pipe in CLSM (controlled low-strength material).
    d. Construct new inlet and outlet concrete bulkheads

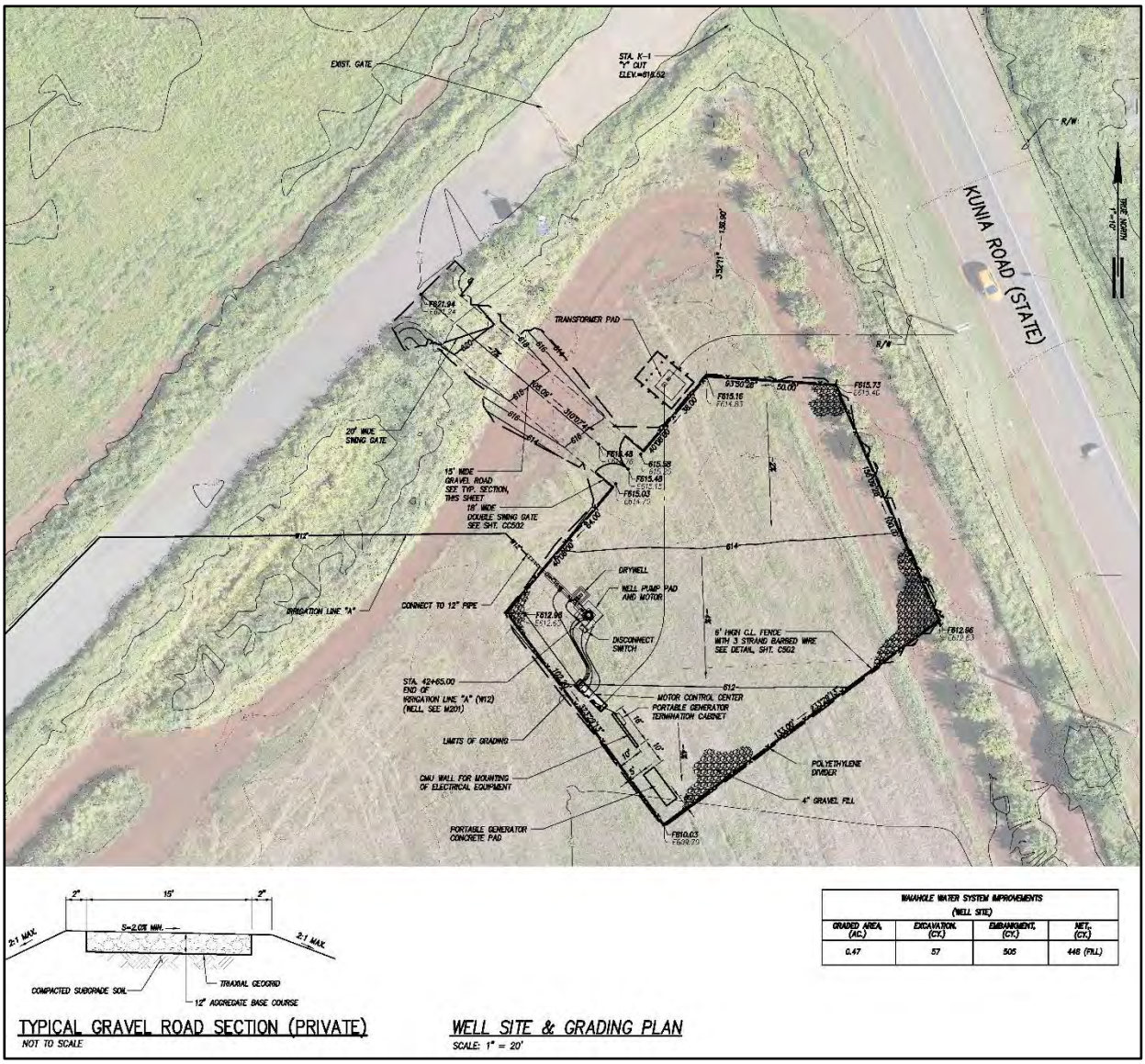


Figure 7. Well site and grading plan (courtesy of client); this new backup irrigation and water well within a chain link fence enclosure with a connecting 12-inch Irrigation Line “A” (extending to the southwest) is to be built close to Kunia Road (east of the new reservoir) with a short connecting driveway connecting with an access road to the northwest

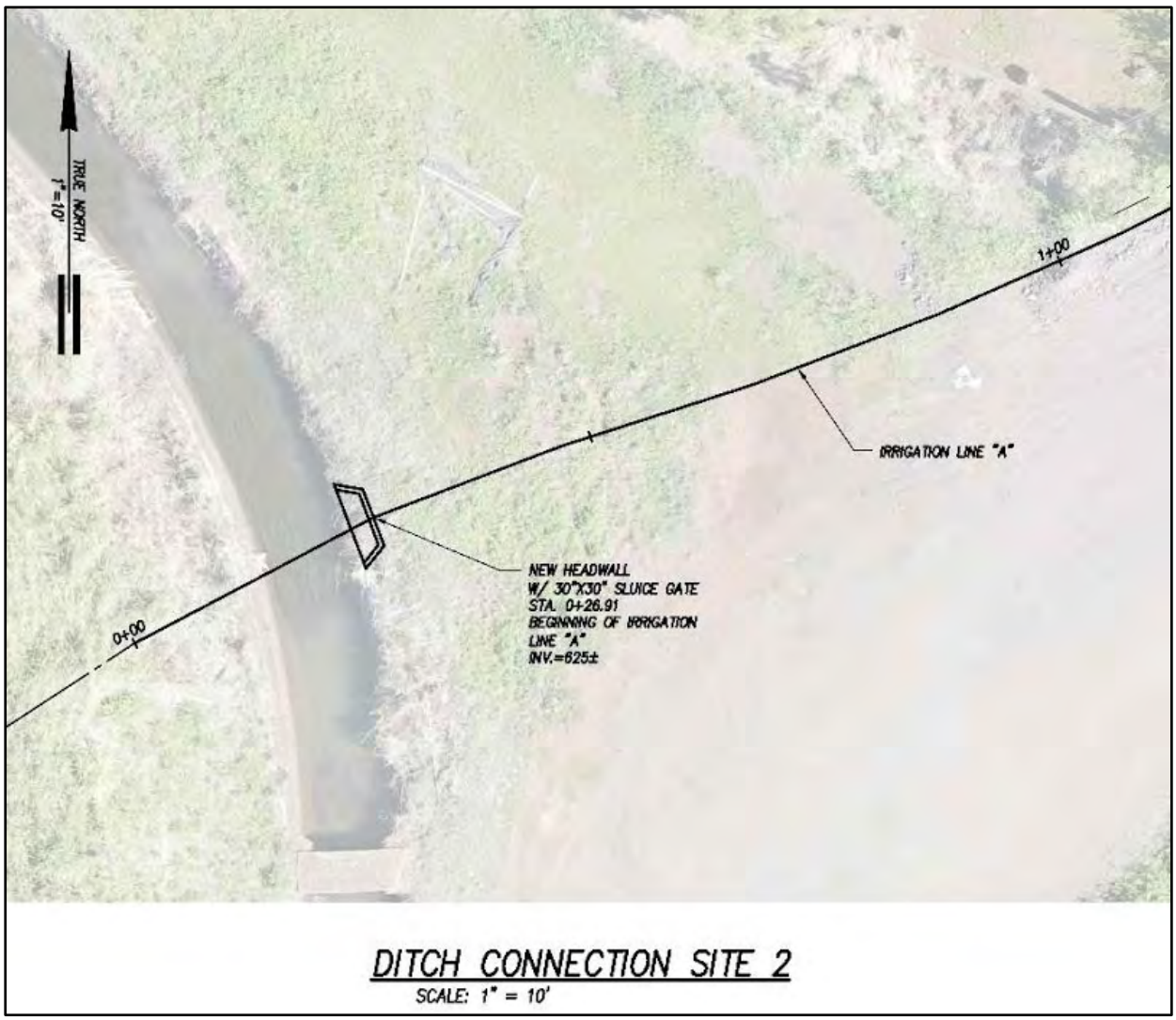


Figure 8. New Ditch Connection Site 2 is located at the extreme southwest end of the project area where the new 30-inch Irrigation Line “A” intersects the Waiahole Ditch involving the construction of a new headwall and sluice gate

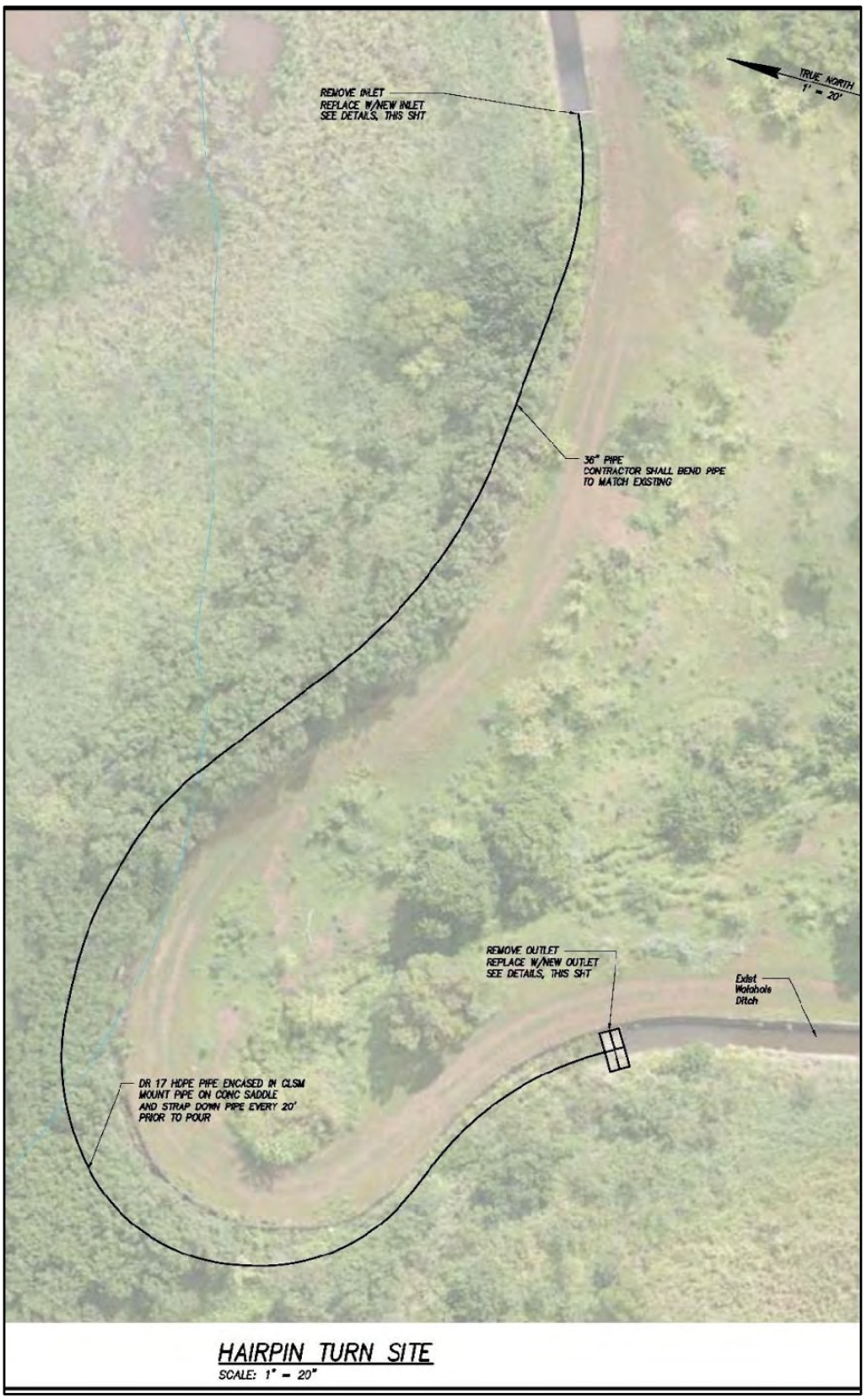


Figure 9. Hairpin turn site on the Waiahole Ditch in the west side of the project area (courtesy of client)

The project includes two relatively large areas, the proposed new 15-MG reservoir (see Figure 6) estimated at 4.6 acres and a proposed new irrigation water well enclosure (see Figure 7) estimated at 0.4 acre as well as a total of approximately 2,143 m (7,030 ft) of linear irrigation lines and amenities. These irrigation lines may well involve ground disturbance less than 3 ft wide but the precise alignment was often unclear and thus an estimated width of the study area for these lines is somewhat arbitrarily 20 ft; this yields an estimated project area for the lines of 140,600 square (sq) ft (3.23 acres) and an estimate for the total project area of 8.23 acres (3.33 hectares).

1.2 Document Purpose

The purpose of this CIA is to comply with the State of Hawai‘i’s environmental review process under HRS §343, which requires consideration of the proposed project’s potential effect on cultural beliefs, practices, and resources. Through document research and cultural consultation efforts, this report provides information compiled to date pertinent to the assessment of the proposed project’s potential impacts to cultural beliefs, practices, and resources (pursuant to the Office of Environmental Quality Control’s *Guidelines for Assessing Cultural Impacts*) which may include traditional cultural properties (TCPs). These TCPs may be significant historic properties under State of Hawai‘i significance Criterion e, pursuant to HAR §13-275-6 and §13-284-6. Significance Criterion e refers to historic properties that “have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group’s history and cultural identity” (HAR §13-275-6 and §13-284-6). The document is intended to support the project’s environmental review and may also serve to support the project’s historic preservation review under HRS §6E-8 and HAR §13-275.

This CIA investigation may also be used to support the National Historic Preservation Act (NHPA) Section 106 and the National Environmental Policy Act (NEPA) consultation, but does not, in itself, satisfy the consultation requirements of either Section 106 or NEPA and has no federal involvement.

1.3 Scope of Work

The scope of work for this CIA includes the following:

1. Examination of cultural and historical resources, including Land Commission documents, historic maps, and previous research reports, with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal, and other resources or agricultural pursuits as may be indicated in the historic record.
2. Review of previous archaeological work at and near the subject parcel that may be relevant to reconstructions of traditional land use activities; and to the identification and description of cultural resources, practices, and beliefs associated with the parcel.
3. Consultation and interviews with knowledgeable parties regarding cultural and natural resources and practices at or near the parcel; present and past uses of the parcel; and/or other practices, uses, or traditions associated with the parcel and environs.

4. Preparation of a report that summarizes the results of these research activities and provides recommendations based on findings.

1.4 Environmental Setting

The environmental setting draws from previous environmental and historical surveys conducted throughout the Hawaiian archipelago (Foote et al. 1972; Giambelluca et. al. 2013; Nakuina 1992) as well as cultural sources and may be thought of as being divided into two sections. The natural environment begins with a discussion of geologic history and then shifts to a description of prevailing winds, precipitation, streams, and coastal/marine environment found within and in proximity to the project area. Throughout these subsections, an effort is made to ground scientific knowledge within traditional cultural frameworks or knowledge systems. Understandings of the Honouliuli or ‘Ewa environment have also been informed by various traditional sources, including *mo‘olelo* (stories), *mele* (songs), or *oli* (chant). As pointed out by anthropologist Laura Nader and reiterated by Dr. Kathleen Kawelu, “science is not free of culture; rather, it is full of it” (Kawelu 2015:6; Nader 1996: xiii). The second section concludes with a description of the built environment, emphasizing a transitional change into modernity.

1.4.1 Natural Environment

The project area extends through the ‘Ewa Plain, *makai* (seaward) of the Wai‘anae Mountains. The ‘Ewa Plain is a Pleistocene (>38,000 years old) reef platform overlain by alluvium. The terrain consists of limestone and alluvial deposits, which overlie flows of the Wai‘anae volcanic series (Macdonald et al. 1983:423). A reconstruction of the pre-Contact landscape reveals that the project area would have been covered by lowland dry shrub and grassland; however, the area has been extensively disturbed and transformed by human activity and is now dominated by a variety of exotic grasses, weeds, and shrubs.

The project area lies on the southwest slope of O‘ahu’s central valley on the west side of Kunia Road, approximately 6 km northwest of the ocean at the West Loch of Pearl Harbor, with the elevation in the project area ranging from approximately 170.6-195 m (560 ft to 640 ft) above mean sea level (AMSL). The project area land is generally relatively flat with the exception of the significant tributary valley of Honouliuli Gulch in the central portion of the Kupehau Road/Irrigation Line “A” portion of the project area.

In pre-Contact Hawai‘i the project area would have been mostly lowland dry shrub and grassland, dominated by species such as *wiliwili* (*Erythrina sandwicensis*), *lama* (*Diospyros ferrea*), sandalwood (*Santalum* sp.), *‘a‘ali‘i* (*Dodonea eriocarpa*), scrub *‘ōhi‘a* (*Metrosideros collina*), and *pili* grass (*Heteropogon contortus*) (Frierson 1972). The predominant vegetation within the project area consists of corn fields, *haole koa* (*Leucaena glauca*), castor bean plants (*Ricinus ommunis*), and a variety of other exotic weeds.

1.4.2 *Ka Lepo* (Soils)

According to the U.S. Department of Agriculture (USDA) Soil Survey Geographic (SSURGO) database (2001) and soil survey data gathered by Foote et al. (1972), the project area’s soils consist of Kunia silty clay, 0 to 3% slope soils (KyA) with smaller areas of Kunia silty clay, 8 to 15% slope soils (KyC), Wahiawa silty clay, 0 to 3% slope soils (WaA), Kawaihapai clay loam, 2 to 6%

slopes (KIB) and Lahaina silty clay, 7 to 15% slopes (LaC3). Figure 10 illustrates the various soil sediments within the project area and the surrounding environment.

Soils of the Kunia series are

> […] well-drained soils on upland terraces and fans on the island of Oahu. These soils developed in old alluvium. They are nearly level to moderately sloping. Elevations range from 700 to 1,000 feet. […] Kunia soils occur on the foot slopes of the Waianae Range, near Schofield Barracks. […] These soils are used for sugarcane, pineapple, homesites, and military reservations. Most areas are cultivated, and the natural vegetation is not significant. [Foote et al. 1972:77]

Kunia silty clay, 0 to 3% slopes (KyA), are described as having slow runoff and no more than slight erosion hazard (Foote et al. 1972:77).

Soils of the Wahiawa series are

> […] well-drained soils on uplands on the island of Oahu. These soils developed m residuum and old alluvium derived from basic igneous rock. They are nearly level to moderately steep. Elevations range from 500 to 1,200 feet. Rainfall amounts to 40 to 60 inches annually; most of it occurs between November and April. The mean annual soil temperature is 71 F. Wahiawa soils are geographically associated with Kunia, Lahaina, Leilehua, and Manana soils. These soils are used for sugarcane, pineapple, pasture, and homesites. [Foote et al. 1972:124]

Wahiawa silty clay, 0 to 3% slopes (WaA) is described, “Permeability is moderately rapid. Runoff is slow, and the erosion hazard is no more than slight” (Foote et al. 1972:125).

Soils of the Lahaina series are

> […] well-drained soils on uplands on the islands of Lanai, Maui, Molokai, and Oahu. These soils developed in material weathered from basic igneous rock. They are nearly level to steep. Elevations range from 10 to 1,500 feet. The annual rainfall amounts to 20 to 35 inches […] Lahaina soils are geographically associated with Helemano, Hoolehua, Kahana, Molokai, Pamoa, and Wahiawa soils. [Foote et al. 1972:78]

Lahaina silty clay, 7 to 15% slopes (LoC) are described as follows: “On this soil, runoff is medium and the erosion hazard is moderate. […] This soil is used for sugarcane and pineapple. Small acreages are used for truck crops, pasture, and wildlife habitat” (Foote et al. 1972:79).

Soils of the Kawaihapai series are

> […] well-drained soils in drainageways and on alluvial fans on the coastal plains on the islands of Oahu and Molokai. These soils formed in alluvium derived from basic igneous rock in humid uplands. They are nearly level to moderately sloping. Elevations range from nearly sea level to 300 feet. The annual rainfall amounts to 30 to 50 inches. […] These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of kiawe, koa haole, lantana, and bermudagrass. [Foote et al. 1972:63–64]

Kawaihapai stony clay loam, 2 to 6% percent slopes soils, is described as having slow runoff and a slight erosion hazard (Foote et al. 1972:64).

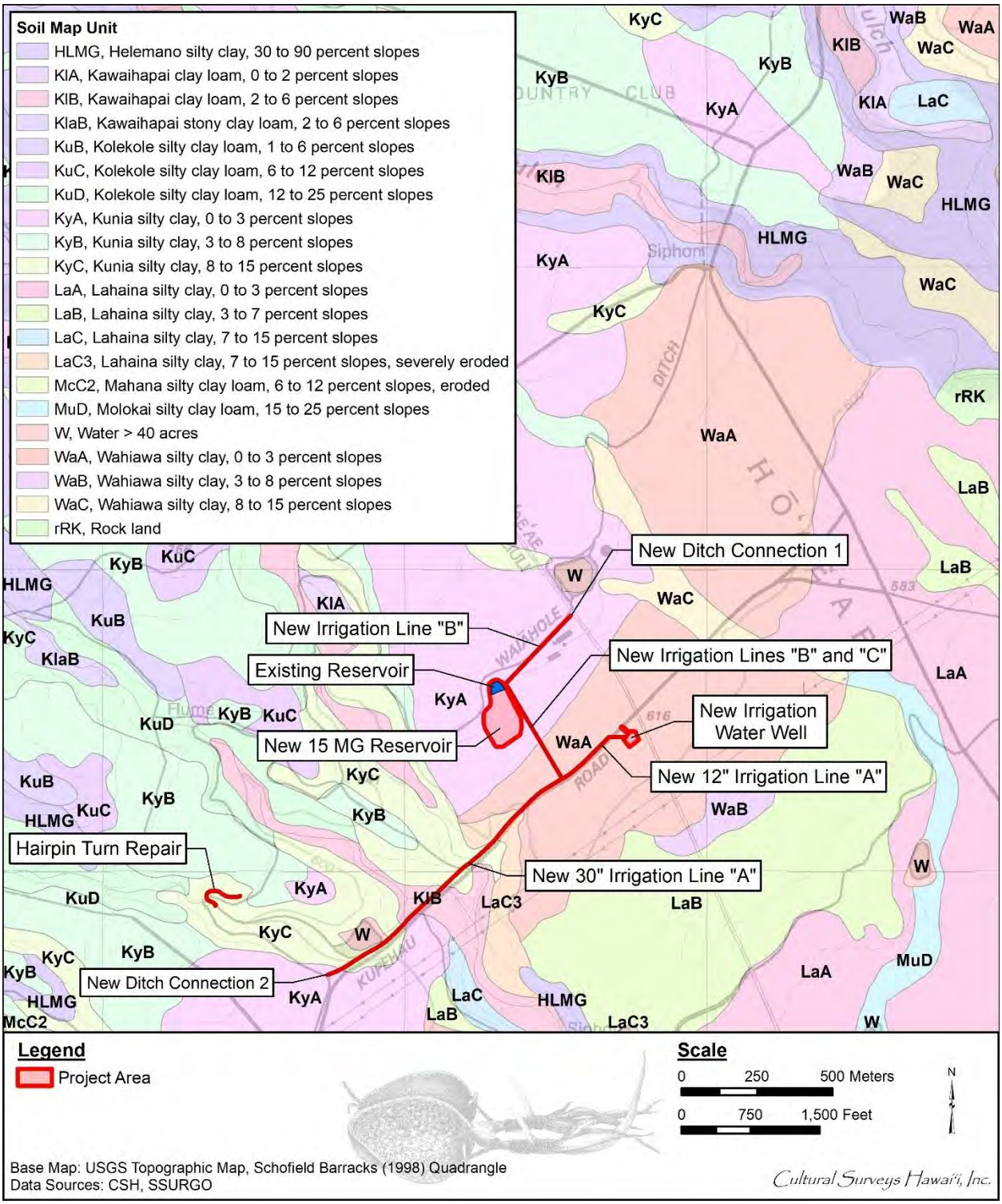


Figure 10. Portion of 1998 Schofield Barracks USGS topographic quadrangle with overlay of *Soil Survey of the State of Hawaii* (Foote et. al. 1972; USDA SSURGO 2001), indicating soil types within and surrounding the project area

1.4.3 *Nā Makani* (Winds)

Makani is the general Hawaiian term for wind. *A‘e loa* is another of the Hawaiian names given to the prevailing northeasterly trade winds (Nakuina 1992:138) along with A‘e (Pukui and Elbert 1986:3), Moa‘e, and Moa‘e Lehua (Pukui and Elbert 1986:249). The four commonly known winds associated with the *moku* of ‘Ewa are Māunuunu of Pu‘uloa, Moa‘e kū of Ewaloa, Waikōloa of Līhu‘e, and Kona of Pu‘ukapolei (Alameida 1997). Māunuunu is a strong blistering sea breeze at Pu‘uloa (Andrews 1865; Pukui and Elbert 1986). Moa‘e kū is a northeasterly wind which means to resist, or a foreign wind (Andrews 1865; Pukui and Elbert 1986). Waikōloa is a cold northwest wind (Pukui and Elbert 1986). Kona is a name of the southwest wind (Andrews 1865). Another mentionable wind found in most chants associated with the *moku* of ‘Ewa is Wai‘ōpua. Its literal translation means the water of cloud banks (Pukui and Elbert 1986).

In the traditional story *The Wind Gourd of La‘amaomao*, Pāka‘a and his son Kuāpāka‘a are descendants of the wind goddess La‘amaomao whose traditional home was in a wooden calabash (bowl), a gourd that also contained all of the sacred winds of Hawai‘i. La‘amaomao controlled and called forth the winds by chanting their names (Nakuina 1990). Pāka‘a’s chant traces the winds from the *moku* (district) of ‘Ewa. The winds of this region are poetically recalled as follows:

He Moae-ku ko Ewaloa	*Moa‘e-ku is of Ewaloa*
He Kehau ko Waiopua	*Kēhau is of Waiopua*
He Waikoloa ko Lihue	*Waikōloa is of Līhu‘e*
He Kona ko Puuokapolei	*Kona is of Pu‘uokapolei.*

[*Ke Au Okoa*, Volume III, Number 30, 14 November 1867; Nakuina 1992:51]

In *The Epic Tale of Hi‘iakaikapoliopele*, the goddess Hi‘iaka, the youngest sister of the fire goddess Pele, born an egg and carefully warmed and nourished by Pele herself (Westervelt 1916:69), embarks on a quest to retrieve her older sister’s lover, Lohi‘au. While crossing the island chain, Hi‘iaka encounters various gods and demi-gods, spirits, and shapeshifters, as well as chiefs and commoners. Hi‘iaka watches as her friend Hōpoe is killed by the embers of her sister Pele. She chants atop Pōhākea and tells of the cold harsh winds, Waikōloa, Maunauna and Wai‘ōpua.

KAU HO‘OKAHI HANERI A ME KANALIMAKUMAMĀKOLU	CHANT ONE HUNDRED AND FIFTY-THREE
Aloha ku‘u hoa i ka pū‘ali lā	Alas my friend of the rugged mountain pass
A luna i Pōhākea, he luna o Kamaoha	On high at Pohakea, above Kamaoha
He lae ‘ino ‘o Maunauna	Maunauna is a dangerous escarpment
‘O Līhu‘e ke hele ‘ia	Līhu‘e’s high plain yet to be traversed
Honi i ke ‘ala mau‘u	Inhaling the scent of the grasses
I ke ‘ala o ke kupukupu	The fragrance of kupukupu fern
E linoa ala e ka Waikōloa	Entwined by the Waikoloa breeze
E ka makani he Wai‘ōpua	By the wind called Wai‘ōpua
Ku‘u pua, me he pua lā i ku‘u maka	My blossom, like a flower in my sight

Ka ‘oni i ka haku ‘ōnohi, kā ka wai lā i li‘u	Moving before my eyes, washed salty by tears
I ku‘u maka lā, e uē au lā.	There in my sight, I weep.
[Ho‘oulumahiehie 2008b:232]	[Ho‘oulumahiehie 2008a:262]

1.4.4 *Nā Ua* (Rains)

Precipitation is a major component of the water cycle and is responsible for depositing *wai* (fresh water) on local flora. Pre-Contact *kānaka* (Native Hawaiians) recognized two distinct annual seasons. The first, known as *kau* (period of time, especially summer), lasts typically from May to October and is a season marked by a high-sun period corresponding to warmer temperatures and steady trade winds. The second season, *ho‘oilo* (winter, rainy season), continues through the end of the year from November to April and is a much cooler period when trade winds are less frequent, and widespread storms and rainfall become more common (Giambelluca et al. 1986:17). The project area averages about 710.6 mm (28.0 inches) of rainfall annually (Field 140 Station, Giambelluca 2013) which would be marginal at best for non-irrigated agriculture.

Each small geographic area on O‘ahu had a Hawaiian name for its own rains. According to Akana and Gonzalez (2015),

> Our kūpuna had an intimate relationship with the elements. They were keen observers of their environment, with all of its life-giving and life-taking forces. They had a nuanced understanding of the rains of their home. They knew that one place could have several different rains, and that each rain was distinguishable from another. They knew when a particular rain would fall, its color, duration, intensity, the path it would take, the sound it made on the trees, the scent it carried, and the effect it had on people. [Akana and Gonzalez 2015:xv]

Honouliuli was no exception to this naming practice. Despite the relative lack of rainfall in this area, the Nāulu rain is known to be associated with the *ahupua‘a* (traditional land division) of Honouliuli. This rain is generally understood as a sudden shower, and more commonly associated with Kawaihae, Hawai‘i and Ni‘ihau (notoriously dry locations as well) (Akana and Gonzalez 2015:187).

In *Ka Mo‘olelo o Hi‘iakaikapoliopele,* the Nāulu rain is mentioned in a chant offered by Hi‘iaka. During Hi‘iaka’s travels through ‘Ewa she recites this affectionate *oli* (chant) as she recalls the *kai‘okia* (edict) placed on her and Lohi‘au by Pele:

‘A‘ole au e hele i ke kaha o Kaupe‘a	I shall not tread Kaupe‘a’s expanse
Kēlā kaha kūpā koili a ka lā i ke kula	That stretch where the sun beats down on the plain
Ua kūpono a‘ela ka lā i ka piko o Wākea	The sun is right overhead, at the navel of Wākea
Ola i ke ahe aka makani Māunuunu	I am spared by the Māunuunu wind
I ka hapahapai mai aka makani ‘Ao‘aoa	By the uplifting ‘Ao‘aoa breeze

Ke koi lā i ke ao o ka Nāulu e hanini i ka wai	Urging the Nāulu storm clouds to pour down their waters
Ola ihola nā kupa kama‘āina i ka wai a ka ‘ōpua	The natives here survive on water from the clouds
Ke halihali a‘ela nā ‘ōpua i ke awa lau	Which billowing clouds carry along to the branching lochs
E koi mai ana iā Hi‘iaka e kūo‘e hele i ke kula	Compelling Hi‘iaka to trudge that open stretch
I kuleana i lāhui ai ka moe i Laila	Duty making rest forbidden there
I laila au lohe i ke kani leo le‘a a ka ‘ō‘ō i ke kula	There I heard the happy trill of the ‘ō‘ō bird on the plain
Ho‘āikāne ana lāua me ke kai o Wāwaemoku	Befriending the sea of Wāwaemoku
Mokumokuāhua loko, kupākupā koili i ka ‘ino	My heart grieves, thrashed by harm
I ‘ino ho‘i au i kēia kanaka i ka hiki ‘ana mai	I may be harmed by this person upon arrival
I kahela a‘ela ka ‘ai a ka manu	Leaving the birds to feed expansively
I ka pua o ka wiliwili	On the blossoms of the wiliwili trees
Wili a‘ela nā ‘ōpua i luna	The clouds spin above
No luna wau	I am from above
Wili a‘ela nā ‘ōpua i lalo	The clouds spin below
Lalo ē!	Below indeed!
Lilo i lalo ka hele ‘ana a ke kanaka	The movement of mankind is cast down
Kalakala ke ao no Hawai‘i	Craggy are the clouds from Hawai‘i
I ka pā ‘ia mai e kēia makani	Blown here by this wind
‘A‘ole a‘u makana i ka lā o ka hilahila	I have no gift to offer on this day of shame
E hili hewa paha auane‘i au	I shall perhaps end up astray
Wilia i na‘e, wilia i lalo	Spiraling windward, or to the lee
Wilia i kai, wilia i uka	Spinning toward the sea, toward the highlands
‘O kauhale a ka ‘ōlelo	O house made of words
Ho‘ohiki ihola i kānāwai	Utter as an edict
Kau ihola i kānāwai	Place as a law
He kānāwai ‘okia	An order of separation
‘Ālina ihola ka ‘o Pu‘uloa	Thus Pu‘uloa is branded by epithet

1.4.5 *Nā Kahawai a me Nā Pūnāwai* (Streams and Springs)

Honouliuli Ahupua‘a, and the encompassing ‘Ewa District, are notoriously dry. In traditional Hawaiian times, the areas of exposed coral (Pleistocene limestone) outcrop were undoubtedly more extensive. Limestone outcrop, composed of detritus, calcareous sand, reef dwelling organisms, and coralline algae, is subject to dissolution from water. This dissolution has formed a series of connected and isolated caves under the ‘Ewa Plains. Although invisible to human eyes, streams flow under the surface of Honouliuli via the karstic system. “Sink holes” would accumulate water within them via a subterranean water or karst system; this water also contained nutrient-rich sediment that allowed plants such as *kalo* (taro; *Calocasia esculenta*), *kī* (ti; *Cordyline fruticosa*), and *noni* (Indian mulberry; *Morinda citrifolia*) to survive.

The “karstic desert” and marginal characterization of the limestone plain, which is the most readily visible terrain, does not do justice to the *ahupua‘a* as a whole. A broad limestone plain with innumerable limestone sinkholes offered a nesting home for a large population of avifauna, in addition to providing agricultural opportunities. This resource may have been one of the early attractions to human settlement. The lower portion of Honouliuli Valley in the ‘Ewa plain offered rich level alluvial soils with plentiful water for irrigation from the stream as well as abundant springs. This irrigable land would have stretched well up the valley, consisting of an extensive upland forest zone extending as much as 12 miles inland from the edge of the coastal plain. As Handy and Handy (1972:469) have pointed out, the forest was much more distant from the lowlands here than on the windward coast, but it was much more extensive. Much of the upper reaches of the *ahupua‘a* contained biologically diverse forest with *kukui* (candlenut; *Aleurites moluccana*), *‘ōhi‘a lehua* (*Metrosideros macropus*), *‘iliahi* (sandalwood; *Santalum* spp.), *hau* (beach hibiscus; *Hibiscus tiliaceus*), *kī*, and banana. These valuable resources contributed to the richness of Honouliuli and the ‘Ewa Moku.

Proceeding *mauka* (inland) from the ‘Ewa Plain, a series of gulches mark the landscape. The largest of these is Honouliuli Gulch toward the east side of the plain that drains into West Loch. The gulch is bisected by the Honouliuli Stream, the primary water body of the Honouliuli Watershed. The tributary valley of Honouliuli Gulch is understood as an intermittent stream but may have run with water more frequently in traditional Hawaiian times prior to water diversion for commercial agriculture. The “perennial/intermittent” Honouliuli Stream and its tributaries “have a total stream length of 32.5 miles” (O‘ahu Resource Conservation and Development Council 2013:16).

To the west are fairly steep gradient gulches forming a more linear than dendritic drainage pattern. The major gulches from east to west are Awanui, Pālailai, Makaīwa, Waimānalo, and Limaloa. These gulches are steep-sided in the uplands and generally of a high gradient until they emerge onto the flat ‘Ewa plain. The alluvium they have carried has spread out in delta fashion over the *mauka* portions of the plain, which comprises a dramatic depositional environment at the stream gradient change. These gulches are generally dry, but during seasonal Kona storms they carry immense quantities of runoff onto the plain and into the ocean. As typical drainages in arid slopes, they are either raging uncontrollably or are dry, and do not form stable water sources for traditional agriculture in their upper reaches. The western Honouliuli gulches, in contrast to those draining into Pu‘uloa (Pearl Harbor) to the east, do not have valleys suitable for extensive irrigated

agriculture. However, this lack is more than compensated by the rich watered lowlands at the base of Honouliuli Gulch.

The lowlands fronting the west loch of Pu‘uloa (Kaihuopala‘ai) were suitable for the cultivation of the traditional Hawaiian staple crop, *kalo* (taro; Colocasia esculenta). For spiritual and dietary reasons, *kalo* was a sacred staple in the Hawaiian diet. According to Hawaiian mythology, man was born from the taro plant.

However, by the mid-nineteenth century traditional agriculture was becoming quickly supplanted by large-scale commercial ventures. The focus of agricultural production soon shifted toward sugarcane and pineapple, with concerted efforts made to turn open space into plantations. The drilling for artesian wells began in 1879 with cattle rancher James Campbell on the ‘Ewa Plains (Board of Water Supply, City and County of Honolulu 2017). Utilizing a well driller, Campbell drilled several hundred feet down until reaching a large supply of pure, fresh water (Board of Water Supply, City and County of Honolulu 2017). According to the Board of Water Supply (2017):

> This discovery led to a water boom on the island, as ranchers and plantation developers began drilling furiously for more of the precious resource. Within 20 years, the boom came to a bust. Artesian wells, abandoned and neglected, wasted millions of gallons of water. By the turn of the century, Oahu suffered a water panic. Wells were salting up. Water levels were dropping. The problem was that the system had grown too much, too fast and too haphazardly. [Board of Water Supply, City and County of Honolulu 2017]

Campbell’s first well was named *Waianiani* (“crystal waters”) by the *kama‘āina* of Honouliuli (Nellist 1925). By 1930, Ewa Plantation had drilled 70 artesian wells to irrigate cane lands; artesian wells provided fresh water to Honouliuli for nearly 60 years (Ho‘okuleana 2014). Campbell’s original Honouliuli well was finally sealed by the City and County of Honolulu in 1939 (Ho‘okuleana 2014).

1.4.6 *Lihikai ame ka Moana* (Seashore and Ocean)

Several naming traditions exist for Honouliuli, one being that it was named for the waters of Pu‘uloa (Jarrett 1930:22), which marks the eastern boundary of the *ahupua‘a*. According to *mo‘olelo*, Pu‘uloa was a storied place due to the presence of Ka‘ahupāhau. Ka‘ahupāhau, queen of all sharks of O‘ahu, dwelled in a large cavern on the Honouliuli side of Pearl Harbor (Clark 1977:69).

> The Hawaiians knew Pearl Harbor as Pu‘uloa, and they believed that there, dwelling in a large cavern on the Honouliuli side of the harbor, Ka‘ahupāhau, the queen of all sharks on O‘ahu, made her home. Her chief guard was a brother shark, who lived in a pit at the entrance to the lochs. The Hawaiian people said the drydock was built over the cavern of Ka‘ahupāhau’s son, who also lived in Pu‘uloa. Angered by the violation of his home, the shark prince destroyed the imposing structure. The engineers in charge of the project attributed the collapse of the foundation to hydrostatic pressure. Whatever the cause, several years’ work was wrecked within minutes […] this time, before starting to rebuild, they asked the Hawaiians to bless the site. After that the work continued without further trouble. [Clark 1977:69–70]

Both seashore and ocean provided physical and spiritual sustenance (NOAA 2017) for the people of Honouliuli. According to Malo, the ocean was divided into smaller divisions, stretching from *‘ae kai* (water’s edge) to *moana* (pelagic zone) (Malo 1951:25–26). Outside the coastal areas was the belt known as *kua-au*, where the shoal water ended (Malo 1951:26). Further out was the *kai-au*, deeper waters designated for surfing, swimming, or spearing squid (Malo 1951:26). For Honouliuli Ahupua‘a, specifically between Kalaeloa and Kūalaka‘i, the sea of this region was identified as Hilo-one. It appears the name is drawn from an on-shore locality known as Hilo-one. According to Maly and Maly (2012),

> That place, Hilo-one, […] is situated on the northern side of Kualakai, towards Kalaeloa. And the name of the spring in which Hiiaka looked and saw her reflection was Hoakalei (Reflection of a lei). It was at this place that Hiiaka saw the two lehua trees growing, from which she picked the blossoms too make her four garlands. [Maly and Maly 2012:125]

While walking the coastline between Kalaeloa and Kūalaka‘i, the goddess sang out the following:

O Hiiaka ka wahine,	Hiiaka is the woman
Ke ako la i ka pua o Hoakalei,	Who picked the flowers of Hoakalei,
Ke kui la, ke uo la i ka manai	And with a needle strung and made them into
Eha ka lei, ka apana lei lehua a ka wahine la	Four garlands, the sectioned lei of the woman
Kuu pokii.	O my younger sibling.
Kuu pokii mai ke ehu makani o lalo.	My younger sibling who came from the place where the dusty wind rises from below
Lulumi aku la i ke kai o Hilo-one.	Overturned in the sea of Hilo-one.
No Hilo ke aloha, Aloha wale ka lei—e.	The *aloha* is for Hilo, Love for the *lei.*

[*Ka Na‘i Aupuni*, Volume II, Number 6, 7 June 1906, Ka Moolelo o Hiiaka-i-ka-poli-o=Pele; Maly and Maly 2012:125]

Moving westward from Pu‘uloa are Iroquis Beach, Pu‘uloa Beach Park (formerly ‘Ewa Beach Park), One‘ula Beach Park, in addition to Keahi Point. These beaches comprise the coastal portion of Honouliuli; use of these beaches increased during the plantation era when employees of the nearby sugar plantations utilized the coastal areas for subsistence and recreation.

Traditionally, the seashore and ocean areas were vitally important for resource extraction in the early days of settlement; these areas provided both physical and spiritual sustenance (NOAA 2017) to the people of Honouliuli. Within the *ahupua‘a* there are 12 miles of coastline with continuous shallow fringing reef, which offers rich marine resources in addition to the 4 miles of waterfront along the west side of the West Loch of Pu‘uloa that offered extensive fisheries (mullet, *awa* [*Chanos chanos*; milkfish], shellfish) as well as frontage suitable for development of fishponds (e.g., Laulaunui). Fishermen along the coast maintained a respected status within traditional

Hawaiian society; Kanahele asserts that “early Hawaiians regarded fishing as the oldest, and hence the most prestigious of professions” (Kanahele 1995:17).

According to Charles Howard Edmondson (1946:5), the coastal waters of Pearl Harbor were “a natural aquarium for many varieties of marine animals.” Titcomb (1952:7) identifies the Pearl Harbor area as the only large natural inland lagoon, famous for its fish and fishponds. The *nehu* (anchovy; *Anchoviella purpurea*) was said to fill the lochs of Pearl Harbor. Citing Kamakau, Margaret Titcomb writes that the *nehu*, “filled the lochs from the channel of Pu‘uloa (Pearl Harbor) inland to the Ewas” (Titcomb 1952:97). Due to the presence of the *nehu*, the *kama‘āina* of Honouliuli and ‘Ewa developed this saying: “*He kai puhi nehu, puhi lala ke kai o ‘Ewa e, e noho i ka la‘i o ‘Ewa nui a La‘*akona (‘A sea that blows up nehu, blows them up in rows, is ‘Ewa, until they rest in the calm of great ‘Ewa-a-La‘akona’)” (Kamakau 1964:84).

1.4.7 Built Environment

In the late nineteenth and early twentieth centuries, the Ewa Plantation Company installed ditches running from the lower slopes of the Wai‘anae Mountains to the lowlands and then plowed the slopes vertically just before the rainy season to induce erosion (Frierson 1972:17). These activities relocated sediments from the higher, soil-rich slopes of the Wai‘anae Mountains down to the soil-poor Pleistocene limestone plains of the Kalaeloa area. Portions of the agricultural lands in Honouliuli were developed from this arable land expansion program. The project area was utilized for commercial sugarcane from the early twentieth century into the late 1970s. Some of the sugarcane plantation infrastructure in the vicinity was relatively elaborate with the Waiahole Ditch (partially within the project area) transporting irrigation water from windward O‘ahu into the foothills of the southern Wai‘anae Range. The sugarcane fields have remained fallow for decades. Some plantation infrastructure is still present in the form of cane haul roads and remnant irrigation feature. The aerial photos suggest active agricultural practices and fallow sugarcane fields that have been repurposed for other crops.

Section 2 Methods

2.1 Archival Research

Research centers on Hawaiian activities including *ka‘ao* (legends), *wahi pana* (storied places), *‘ōlelo no‘eau* (proverbs), *oli* (chants), *mele* (songs), traditional *mo‘olelo*, traditional subsistence and gathering methods, ritual and ceremonial practices, and more. Background research focuses on land transformation, development, and population changes beginning with the early post-Contact era to the present day.

Cultural documents, primary and secondary cultural and historical sources, historic maps, and photographs were reviewed for information pertaining to the study area. Research was primarily conducted at the CSH library. Other archives and libraries including the Hawai‘i State Archives, the Bishop Museum Archives, the University of Hawai‘i at Mānoa’s Hamilton Library, Ulukau, The Hawaiian Electronic Library (Ulukau 2014), the State Historic Preservation Division (SHPD) Library, the State of Hawai‘i Land Survey Division, the Hawaiian Historical Society, and the Hawaiian Mission Houses Historic Site and Archives are also repositories where CSH cultural researchers gather information. Information on Land Commission Awards (LCAs) were accessed via Waihona ‘Aina Corporation’s Māhele database (Waihona ‘Aina 2020), the Office of Hawaiian Affairs (OHA) Papakilo Database (Office of Hawaiian Affairs 2015), and the Ava Konohiki Ancestral Visions of ‘Āina website (Ava Konohiki 2015).

2.2 Community Consultation

2.2.1 Scoping for Participants

We begin our consultation efforts with utilizing our previous contact list to facilitate the interview process. We then review an in-house database of *kūpuna* (elders), *kama‘āina*, cultural practitioners, lineal and cultural descendants, Native Hawaiian Organizations (NHOs; includes Hawaiian Civic Clubs and those listed on the Department of Interior’s NHO list), and community groups. We also contact agencies such as SHPD, OHA, and the appropriate Island Burial Council where the proposed project is located for their response on the project and to identify lineal and cultural descendants, individuals and/or NHOs with cultural expertise and/or knowledge of the study area. CSH is also open to referrals and new contacts.

2.2.2 “Talk Story” Sessions

Prior to the interview, CSH cultural researchers explain the role of a CIA, how the consent process works, the project purpose, the intent of the study, and how their *‘ike* (knowledge) and *mana‘o* (thought, opinion) will be used in the report. The interviewee is given an Authorization and Release Form to read and sign.

“Talk Story” sessions range from the formal (e.g., sit down and *kūkākūkā* [consultation, discussion] in participants choice of place over set interview questions) to the informal (e.g., hiking to cultural sites near the study area and asking questions based on findings during the field outing). In some cases, interviews are recorded and transcribed later.

CSH also conducts group interviews, which range in size. Group interviews usually begin with set, formal questions. As the group interview progresses, questions are based on interviewee’s

answers. Group interviews are always transcribed and notes are taken. Recorded interviews assist the cultural researcher in 1) conveying accurate information for interview summaries, 2) reducing misinterpretation, and 3) catching missing details to *mo‘olelo*.

CSH sought *kōkua* (assistance) and guidance on identifying past and current traditional cultural practices of the study area. Those aspects include general history of the *ahupua‘a*; past and present land use of the study area; knowledge of cultural sites (for example, *wahi pana*, archaeological sites, and burials); knowledge of traditional gathering practices (past and present) within the study area; cultural associations (*ka‘ao* and *mo‘olelo*); referrals; and any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the study area.

In order to ensure the safety of participants and comply with state and county COVID-19 mandates, no in-person interviews were conducted as part of this CIA. While it is always a preference to meet with participants in person, CSH cultural researchers were able to effectively communicate with participants via telephone, email, and video conference call interviews.

2.2.3 Completion of Interview

After an interview, CSH cultural researchers transcribe and create an interview summary based on information provided by the interviewee. Cultural researchers give a copy of the transcription and interview summary to the interviewee for review and any necessary edits. Once the interviewee has made those edits, we incorporate their *‘ike* and *mana‘o* into the report. When the draft report is submitted to the client, cultural researchers then prepare a finalized packet of the participant’s transcription, interview summary, and any photos that were taken during the interview. We also include a thank you card and honoraria. This is for the interviewee’s records.

It is important to CSH cultural researchers to cultivate and maintain community relationships. The CIA report may be completed, but CSH researchers continuously keep in touch with the community and interviewees throughout the year—such as checking in to say hello via email or by phone, volunteering with past interviewees on community service projects, and sending holiday cards to them and their *‘ohana* (family). CSH researchers feel this is an important component to building relationships and being part of an *‘ohana* and community.

“*I ulu no ka lālā i ke kumu*—the branches grow because of the trunk,” an *‘ōlelo no‘eau* (#1261) shared by Mary Kawena Pukui with the simple explanation: “Without our ancestors we would not be here” (Pukui 1983:137). As cultural researchers, we often lose our *kūpuna* but we do not lose their wisdom and words. We routinely check obituaries and gather information from other informants if we have lost our *kūpuna*. CSH makes it a point to reach out to the *‘ohana* of our fallen *kūpuna* and pay our respects including sending all past transcriptions, interview summaries, and photos for families to have on file for genealogical and historical reference

Section 3 *Nā Ka‘ao* and *Mo‘olelo*

Hawaiian storytellers of old were greatly honored; they were a major source of entertainment and their stories contained lessons while interweaving elements of Hawaiian lifestyles, genealogy, history, relationships, arts, and the natural environment (Pukui and Green 1995:IX). According to Pukui and Green (1995), storytelling is better heard than read for much becomes lost in the transfer from the spoken to the written word and *ka‘ao* are often full of *kaona* or double meanings.

Nā ka‘ao are defined by Pukui and Elbert (1986:108) as a "legend, tale […], romance, [and/or], fiction." *Nā ka‘ao* may be thought of as oral literature or legends, often fictional or mythic in origin, and have been "consciously composed to tickle the fancy rather than to inform the mind as to supposed events" (Beckwith 1970:1). Conversely, Pukui and Elbert (1986:254) define *mo‘olelo* as a "story, tale, myth, history, [and/or] tradition." The *mo‘olelo* are generally traditional stories about the gods, historic figures or stories which cover historic events and locate the events with known places. *Mo‘olelo* are often intimately connected to a tangible place or space (*wahi pana)*.

In differentiating *ka‘ao* and *mo‘olelo* it may be useful to think of *ka‘ao* as expressly delving into the *wao akua* (realm of the gods), discussing the exploits of *akua* (gods) in a primordial time. *Mo‘olelo* on the other hand, reference a host of characters from *ali‘i* to *akua; kupua* (supernatural beings) to *maka‘āinana* (commoners); and discuss their varied and complex interactions within the *wao kānaka* (realm of man). Beckwith elaborates, "In reality, the distinction between *ka‘ao* as fiction and *mo‘olelo* as fact cannot be pressed too closely. It is rather in the intention than in the fact" (Beckwith 1970:1). Thus a so-called *mo‘olelo*, which may be enlivened by fantastic adventures of *kupua*, "nevertheless corresponds with the Hawaiian view of the relation between nature and man" (Beckwith 1970:1).

Both *ka‘ao* and *mo‘olelo* provide important insight into a specific geographical area, adding to a rich fabric of traditional knowledge. The preservation and passing on of these stories through oration remains a highly valued tradition. Additionally, oral traditions associated with the study area communicate the intrinsic value and meaning of a place, specifically its meaning to both *kama‘āina* as well as others who also value that place.

The following section presents traditional accounts of ancient Hawaiians living in the vicinity of the project area. Many relate an age of mythical characters whose epic adventures inadvertently lead to the Hawaiian race of *ali‘i* and *maka‘āinana*. The *ka‘ao* in and around the project area shared below are some of the oldest Hawaiian stories that have survived; they still speak to the characteristics and environment of the area and its people.

3.1 *Nā Ka‘ao*

3.1.1 Connections to Kahiki

Some of the traditional themes associated with this area include connections with Kahiki, the traditional homeland of Hawaiians in central Polynesia. There are several versions of the chief Kaha‘i leaving from Kalaeloa for a trip to Kahiki; on his return to the Hawaiian Islands he brought back the first breadfruit (Kamakau 1991a:110) and planted it at Pu‘uloa, near Pearl Harbor in ‘Ewa (Beckwith 1940:97). Several stories associate places in Honouliuli with the gods Kāne and Kanaloa, with the Hawaiian pig god Kamapua‘a and the Hina family, and with the sisters of Pele,

the Hawaiian volcano goddess, all of whom have strong connections with Kahiki (Pukui et al. 1974:200).

3.1.2 The Naming of Honoluilui

Pukui translates the name ‘Ewa as “crooked” in reference to a legend where the brother gods Kāne and Kanaloa threw stones to mark boundaries of land. The ‘Ewa stone was lost, but later found to be at Pili-o-Kahe (Pukui et al. 1974:28).

> When Kane and Kanaloa were surveying the islands they came to Oahu and when they reached Red Hill saw below them the broad plains of what is now Ewa. To mark boundaries of land they would throw a stone and where the stone fell would be the boundary line. When they saw the beautiful land lying below them, it was their thought to include as much of the flat level land as possible. They hurled the stone as far as the Waianae range and it landed somewhere in the Waimanalo section. When they went to find it, they could not locate the spot where if fell. So Ewa (strayed) became known by that name. The stone that strayed. [Sterling and Summers 1978:1]

3.1.3 Kāne and Kanaloa and the *Loko I‘a* (Fishpond) of Pu‘uloa

According to an account in the Hawaiian newspaper *Ka Loea Kālai‘āina* (10 June 1899), several of the fishponds in the Pu‘uloa area were made by the gods, Kāne and Kanaloa. A fisherman living in Pu‘uloa, named Hanakahi, prayed to unknown gods until one day two men came to his house. They revealed to him that they were the gods to whom he should pray. Kāne and Kanaloa then built fishponds at Ke‘anapua‘a, but were not satisfied. Then they built the fishpond Kepo‘okala, but were still not satisfied. Finally, they made the pond Kapākule, which they stocked with all manner of fish. They gifted all of these fishponds to Hanakahi and his descendants (Handy and Handy 1972:473; *Ka Loea Kālai‘āina*, 8 July 1899).

Mary Pukui (1943:56–57), who visited Kapākule Fishpond when she was young, writes that the pond was built by the *menehune* (legendary race of small people who worked at night, building fishponds, roads, temples) under the direction of the gods Kāne and Kanaloa. Pukui describes several unique aspects of this pond:

> On the left side of the pond stood the stone called Hina, which represented a goddess of the sea by that name. Each time the sea ebbed, the rock became gradually visible, vanishing again under water at high tide. Ku, another stone on the right, was never seen above sea level. This stone represented Ku‘ula, Red Ku, a god for fish and fishermen. From one side of the pond a long wall composed of driven stakes of hard wood, ran toward the island [Laulaunui] in the lochs. When the fish swam up the channel and then inside of this wall, they invariably found themselves in the pond. A short distance from the spot where the pond touched the shore was a small koa or altar composed of coral rock. It was here that the first fish caught in the pond was laid as an offering to the gods. [Pukui 1943:56]

The fishpond contained many fish, especially the *akule* (bigeye scad; *Selar crumenophthalmus*), thus its name, “the enclosure for *akule* fish” (Pukui 1943:56–57). The pond was destroyed when the channel to Pearl Harbor was dredged in the early twentieth century. The caretaker of the pond took the stones Kū and Hina to a deep place in the ocean and sunk them so “none would harm or

defile them.” Cobb (1905733) writes that the pond was used to catch the larger *akule* (goggler), *‘ōpelu* (mackerel scad; *Decapterus macarellus*), *weke* (goat fish; *Mullidae*), *kawakawa* (bonito; *Euthynnus affinis*), and sharks. It was unusual for having walls made of coral. This contradicts much of the *mo‘olelo* saying that sharks were not killed in Pearl Harbor. However, Kamakau does relate that Kekuamanoha and Kauhiwawaeono, two conspirators against Kamehameha I, lived at Pu‘uloa. The chief Kauhiwawaeono was known to murder people and use their bodies as shark bait (Kamakau 1992:182, 232).

3.1.4 Kamaunuaniho at Pu‘u-o-Kapolei

Pu‘uokapolei was the home of Kamaunuaniho, the grandmother of Kamapua‘a, the pig god. She was one of the three migrants from Kahiki who were ancestors to the people of O‘ahu. The following excerpt tells of taking his grandmother to Pu‘uokapolei (Fornander 1919a).

Kamapua‘a subsequently conquered most of the island of O‘ahu, and, installing his grandmother [Kamaunuaniho] as queen, took her to Puuokapolei, the lesser of the two hillocks forming the southeastern spur of the Wai‘anae Mountain Range, and made her establish her court there. This was to compel the people who were to pay tribute to bring all the necessities of life from a distance, to show his absolute power over all. [Nakuina 1904:50]

Emma Nakuina goes on to note, “A very short time ago [prior to 1904] the foundations of Kamaunuaniho’s house could still be seen at Puuokapolei” (Nakuina 1904:50). Another account in the Hawaiian newspaper *Ka Loea Kālai‘āina* (13 January 1900 in Sterling and Summers 1978:34) speaks of Kekele‘aikū, the older brother of Kamapua‘a, who also lived on Pu‘uokapolei. Kamapua‘a was born and raised in Kaluanui, an *ahupua‘a* located in the *moku* of Ko‘olauloa, but later escaped to ‘Ewa when he was pursued by the chief Olopana.

In another version of the *mo‘olelo*, Pele and Kamapua‘a meet and a battle ensues on Hawai‘i Island. Kamapua‘a tells Kekele‘aikū, “Listen to me, elder brother. You wait here. When you smell the stench of burning bristles, then you must assume I am dead. However, if indeed you do not smell the stench of the bristles, you will know that your younger brother has not been harmed and that he has ‘eaten of the cooked taro’” (Kame‘eleihiwa 1996:62). Kamapua‘a travels to Hawai‘i Island where Pele chases him with fire out of the *lehua* (*Metrosideros*) forest. Kamapua‘a ran from Pele but could only cling to an *‘ama‘uma‘u* (*Sadleria cyatheoides*) fern (Kame‘eleihiwa 1996:95). The fire continued to burn around Kamapua‘a as he clung for his life. His bristles began to burn as well, sending a stench of burning pig bristles around the Hawaiian Islands. Kekele‘aikū smelled the stench of burning pig bristles and began to cry, thinking that his brother perished in battle with Pele (Kame‘eleihiwa 1996:95). Kekele‘aikū then hung himself, deeply saddened for the loss of his beloved brother, Kamapua‘a. Kekele‘aikū’s body was left at Pu‘uokapolei with their grandmother.

Kamapua‘a eventually makes his way back to O‘ahu where he begins to call to Kekele‘aikū’s spirit:

Ho‘ālohaloha main a ana ia‘u ku‘u kaikua‘ana	Show me your love and compassion, O my elder brother
‘O ka pili manu kahi a kāua e haele pū ai	In the bird-catching places where we two have traveled together
I ke kula o Kahinahina	On the plain of Kahinahina

Iā ‘Oloheimiki	At ‘Oloheimiki
Iā ‘olua la ke kia holomanu	You two had the bird-snaring rod
Ia‘u la ke kia mahi‘ai	I had the farming rod
I na kea ali‘i kaikaina	Made by the younger brother chief
‘O koko maka pehupehu i ka lā e—	Of the bloody eyes, swollen in the sun
E ha‘a—e, ha‘a kai ‘a ha‘o o Ko‘olina—e	Dancing, dancing is the humble fish of Ko‘olina
‘O nā pa‘ako pani ua o Waiku‘i la	Of the rain-filled coral beds of Waiku‘i
Iā Waku‘i ho‘i e—	Yes, at Waiku‘i!
Ho‘ohali i kana i‘a ma waho	Bearing his fish outside
Ma loko ka ‘i‘o, ma waho ka iwi	Inside is the flesh, outside are the bones
‘O ka pipipi kai welawela	O the *pipipi* of the burning sea
‘O Kahunaiki‘ulalena nei la e—	O this Kahunaiki‘ulalena
‘O kou inoa ia, e ō mai ‘oe!	Her is your name chant—answer!

[Kame‘eleihiwa 1996:130]

The spirt of Kekele‘aikū returned and Kamapua‘a urged his brother’s spirit to return to Pu‘uokapolei to where his body lay with his grandmothers, Kamaunuaniho and Wahineokama‘o (Kame‘eleihiwa 1996:131). Kamapua‘a traveled to ‘Ewa when he saw several canoes filled with calabashes of food. Kamapua‘a watched the people eat until they were full and slept in a comfortable area (Kame‘eleihiwa 1996:132). Of the eight canoes that landed, Kamapua‘a raided six canoes for their provisions. Kamapua‘a filled the empty calabashes of food with his excrement and filled the water gourds with his urine. When the people awoke the next morning, they thought they did something wrong until they came across the remaining food in two canoes. The people began to realize this was the doing of Kamapua‘a.

3.1.5 Pu‘okapolei, Astronomical Marker and Heiau

Pu‘uokapolei was the primary landmark for travelers on the cross-*ahupua‘a* trail that ran from Pearl Harbor in the east to Wai‘anae in the West (‘Ī‘ī 1959:27, 29; Nakuina 1992:54; E.M. Nakuina 1904 in Sterling and Summers 1978:34). *Pu‘u* means “hill” and Kapolei means “beloved Kapo,” a reference to the sister of the goddess, Pele. Kamakau says ancient Hawaiians used Pu‘uokapolei as an astronomical marker to designate the seasons:

> […] the Oahu people who reckoned the time (Oahu *po‘e helu*) called the season Kau for the setting of the sun from Pu‘uokapolei, a hill in Honouliuli, ‘Ewa, to the opening of Mahinaona (*i ke kawaha o Mahinaona*). When the sun moved south from Pu‘uokapolei—and during the season of the sun in the south—for the coming of coolness and for the sprouting of new buds on growing things—the season was called Ho‘oilo [winter, rainy season]. [Kamakau 1976:14]

A ceremony commemorating the changing of the seasons is still observed each year in the beginning of May at Waikīkī and Honouliuli. This ceremony was documented in a previous cultural impact assessment conducted by CSH (Genz et al. 2012). Sam ‘Ohukani‘ōhi‘a Gon III, Na Wa‘a Lalani Kahuna O Pu‘u Koholā, and the late Kumu Hula John Keola Lake’s *hula hālau* (hula instruction) perform *oli* and *hula* (dance), explaining that the *kilo hōkū* (astronomers) of O‘ahu observed how, from the perspective of Waikīkī, the sun sets in a southerly direction over the ocean during the winter solstice and in a northerly direction behind the ‘Ewa ridgeline during the summer solstice. During the springtime, the position of the setting sun marches steadily northward each day, and at the beginning of May, the sun sets behind Pu‘uokapolei, perfectly centered within its depression from the vantage point of Kūpalaha Heiau just west of the Waikīkī Aquarium. A coinciding ceremony at a *heiau* on Pu‘uokapolei similarly views the setting of the sun behind Pu‘ula‘ila‘i farther west, and a line of sight extending eastward from Pu‘ula‘ila‘i, Pu‘uokapolei, and the former site of Kūpalaha Heiau ends at the closely associated Papa‘ena‘ena Heiau. Mr. Gon suggests Papa‘ena‘ena Heiau may have been part of the ceremonies of this astronomical event.

3.1.6 The Realm of Homeless Souls on the ‘Ewa Plain

There are several places on the ‘Ewa coastal plain associated with *ao kuewa*, the realm of the homeless souls. Samuel Kamakau (1991b) explains Hawaiian beliefs in the afterlife:

> There were three realms (*ao*) for the spirits of the dead. […] There were, first, the realm of the homeless souls, the *ao kuewa*; second, the realm of the ancestral spirits, the *ao ‘aumakua*; and third, the realm of Milu, *ke ao o Milu* […]
>
> The *ao kuewa*, the realm of homeless souls, was also called the *ao ‘auwana*, the realm of wandering souls. When a man who had no rightful place in the *‘aumakua* realm (*kanaka kuleana ‘ole*), his soul would wander about and stray amongst the underbrush on the plain of Kama‘oma‘o on Maui, or in the *wiliwili* grove of Kaupe‘a on Oahu. If his soul came to Leilono [in Hālawa, ‘Ewa near Red Hill], there he would find the breadfruit tree of *Leiwalo, ka‘ulu o Leiwalo*. If it was not found by an *‘aumakua* soul who knew it (*i ma‘a mau iaia*), or one who would help it, the soul would leap upon the decayed branch of the breadfruit tree and fall down into endless night, the *pō pau ‘ole o Milu*. Or, a soul that had no rightful place in the *‘aumakua* realm, or who had no relative or friend (*makamaka*) there who would watch out for it and welcome it, would slip over the flat lands like a wind, until it came to a leaping place of souls, a *leina a ka ‘uhane*. […] [Kamakau 1991b:47]
>
> On the plain of Kaupe‘a beside Pu‘uloa [Pearl Harbor], wandering souls could go to catch moths (*pulelehua*) and spiders (*nanana*). However, wandering souls could not go far in the places mentioned earlier before they would be found catching spiders by ‘aumakua souls, and be helped to escape. [Kamakau 1991b:49]

The breadfruit tree, Leilono, was said to have been located on the ‘Ewa-Kona border, above Āliamanu. In another section of his account of the dead, Kamakau (1991b:29) calls the plain of wandering souls the “plain at Pu‘uokapolei.” Fornander (Fornander 1919:6[2]:292) states Pu‘uokapolei may have been a jumping off place (also connected with the setting sun) and

associated with the wandering souls who roamed the plains of Kaupe‘a and Kānehili, makai of the hill. Kamakau also writes:

> There are many who have died and have returned to say that they had no claim to an ‘aumakua [realm] (kuleana‘ole). These are the souls, it is said, who only wander upon the plain of Kama‘oma‘o on Maui or on the plain at Pu‘uokapolei on Oahu. Spiders and moths are their food. [Kamakau 1991b:29]

3.2 *Nā Mo‘olelo*

3.2.1 Legend of Lepeamoa

Another explanation for the name Honouliuli comes from the “Legend of Lepeamoa,” the *kupua* (demigod or cultural hero, especially a supernatural being possessing several forms) of Pālama. In this legend, Honouliuli is the name of the husband of the chiefess Kapālama and grandfather of Lepeamoa (Westervelt 1923:164–184). Others translate the word as “strayed” and associate it with the legends of the gods Kāne and Kanaloa who surveyed the islands and marked land boundaries with large stones, as told in the associated *ka‘ao* in the previous sub-section.

According to S.K. Nawa‘a in Sterling and Summers 1978, the stone that was found at Pili o Kahe and is the dividing marker between two hills that run parallel, the hill on the ‘Ewa side was considered male and the Wai‘anae side marking the boundary between Nānākuli and Honouliuli was interpreted as female. The name “Pili o Kahe (Pili = cling to, Kahe = flow) refers, therefore, to the female or Waianae side hill. And that is where the boundary between the two districts runs” (Sterling and Summers 1978:1). The boundaries of Honouliuli Ahupua‘a extend from Paupauwela in the north, Ho‘ae‘ae to the east, and Pu‘uloa to the south with the coastline on the southern border.

3.2.2 Coastal Village of Kūalaka‘i

“Legend of the Children” is a tale that foretold the breaking of the eating *kapu* (taboo) by the *ali‘i*. A young brother and sister always fished at Kūalaka‘i, a beach area on the southern coast of Honouliuli. On this day, they laid out their nets, but all they caught was one *palani* (surgeonfish; *Acanthurus dussumieri*), a fish that was *kapu* for men; only women could eat it.

> […] They fished again and again until the afternoon and nothing was caught. The children were weary and went home without fish. When they came as far as Pu‘u-o-Kapolei where the blossoms of the ma‘o looked golden in the sunlight, the sister sat down to make ma‘o leis for themselves. When the leis were made they went across the breadth of Kaupe‘a to Waipio. [*Ka Loea Kālai‘āina*, 22 July 1899:15; translation in Sterling and Summers 1978:7]

They stopped at the stream of Ka‘aimalu on the way to their home and the sister convinced her brother to share the fish between the two, thus breaking the *kapu*. “Because these children ate fish secretly, the spot is called Ka‘ai-malu (Secret eating) to this day” (Sterling and Summers 1978:7).

3.2.3 The Death of Kahahana at Hō‘ae‘ae

The association of Pu‘uokapolei and Kānehili with wandering souls is also illustrated in a lament on the death of Kahahana, the paramount chief of O‘ahu who was killed by his foster father,

the Maui chief Kahekili, after Kahahana became treacherous and killed the high priest Ka‘opulupulu.

E newa ai o hea make i ka la,	Go carefully lest you fall dead in the sun
Akua noho la i Puuokapolei.	The god that dwells on Kapolei hill
E hanehane mai ana ka la i na wahine o Kamao,	The sun is wailing on account of the woman of Kamao,
Akua pee, pua ohai o ke kaha	A hiding god, blossoming *ohai* of the banks,
I walea wale i ke a-	Contented among the stones—
I ka ulu kanu a Kahai.	Among the breadfruit planted by Kahai
Haina oe e ka oo—	Hou was spoken of by the *oo*—
E ka manu o Kanehili.	By the bird of Kanehili.
[Fornander 1919]	

Fornander provides some notes on this lament. The god dwelling at Kapolei is the god Kahahana, stating that this is where his soul has gone. Kamao is one of the names to the door of the underworld. This lament draws an association between wandering souls and the place where the first breadfruit tree was planted by Kaha‘i at Pu‘uloa (Fornander 1919).

> Upon the arrival here at O‘ahu of Kahekili, Kahahana fled, with his wife Kekuapoi, and friend Alapa‘i, and hid in the shrubbery of the hills. They went to Āliamanu, Moanalua, to a place called Kinimakalehua; then moved along to Keanapua‘a, and Kepo‘okala, at the lochs of Pu‘uloa, and from there to upper Waipi‘o; thence to Wahiawā, Helemano, and on to Līhu‘e; thence they came to Po‘ohilo, at Honouliuli, where they first showed themselves to the people and submitted themselves to their care.
>
> While they were living there, report thereof was made to Kahekili, the King, who thereupon sent Kekuamanoha, elder brother of Kekuapoi, the wife of Kahahana, with men in double canoes from Waikiki, landing first at Kupahu, Hanapouli, Waipio, with instructions to capture and put to death Kahahana, as also his friend Alapa‘i, but to save alive Kekuapoi. When the canoes touched at Hanapouli, they proceeded thence to Waikele and Hoaeae, and from there to Poohilo, Honouliuli, where they met in conference with Kahahana and his party. At the close of the day Kekuamanoha sought by enticing words to induce his brother-in-law to go up with him and see the father King and be assured of no death condemnation, and by skilled flattery he induced Kahahana to consent to his proposition; whereupon preparation was made for the return. On the following morning, coming along and reaching the plains of Hoaeae, they fell upon and slew Kahahana and Alapa‘i there. [Fornander 1919:6:304]

Through deceit, Kahahana was induced to leave Po‘ohilo, Honouliuli and was killed on the plains of Hō‘ae‘ae (Thrum 1907:213–214).

3.2.4 The Traveling Mullet of Honouliuli

The story of (Ka) Ihuopala‘ai is also associated with the tradition of the *‘anae-holo* or traveling mullet (Thrum 1907:270–272):

> The home of the anae-holo is at Honouliuli, Pearl Harbor, at a place called Ihuopalaai. They make periodical journeys around to the opposite side of the island, starting from Puuloa and going to windward, passing successively Kumumanu, Kalihi, Kou, Kalia, Waikiki, Kaalawai, and so on, around to the Koolau side, ending at Laie, and then returning by the same course to their starting point. [Thrum 1907:271]

In Thrum’s account, Ihuopala‘ai is a male who possesses a *kū‘ula*, or fish god, which supplied the large mullet known as *‘anae*. His sister lived in Lā‘ie and there came a time when there were no fish. She sent her husband to visit Ihuopala‘ai who was kind enough to send the fish following his brother-in-law on his trip back to Lā‘ie.

This story is associated with a poetical saying documented by Mary Kawena Pukui about Honouliuli:

> *Ka i‘a hali a ka makani* The fish fetched by the wind.
>
> [Pukui 1983:145]

Pukui explains, “The ‘anaeholo, a fish that travels from Honouliuli, where it breeds, to Kaipāpa‘u on the windward side of O‘ahu. It then turns about and returns to its original home. It is driven closer to shore when the wind is strong” (Pukui 1983:145).

3.2.5 He Mo‘olelo Ka‘ao no Keaomelemele

In recounting the legend of Keaomelemele, Moses Manu makes a reference to a *mo‘o* (supernatural water spirit or lizard) named Maunauna who lived above Līhu‘e (presumably at the landform of that name in extreme northern Honouliuli) and who was regarded as a bad lizard (Fornander 1919).

3.2.6 Kanekua‘ana

Kanekua‘ana is a *mo‘o* and *kia‘i* (guardian) of ‘Ewa. She took care of the people that lived from Hālawa to Honouliuli. Even those who were not her descendants were cared for in times of need. When *i‘a* (fish) became scarce they would build a *waihau heiau* (a temple where hogs, bananas, and coconuts were sacrificed, but not human beings; a *heiau* for *mo‘o* spirits) and pray for Kanekua‘ana’s blessing. She would in turn, bless them with an abundance of *i‘a*.

> The *pipi* (pearl oyster)—strung along from Namakaohalawa to the cliffs of Honouliuli, from the *kuapa* fishponds of inland ‘Ewa clear out to Kapakule. That was the oyster that came in from deep water to the mussel beds near shore, from the channel entrance of Pu‘uloa to the rocks along the edges of the fishponds. They grew right on the *nahawele* mussels, and thus was this *i‘a* obtained. Not six months after the *hau* branches [that placed a *kapu* on these waters until the *pipi* should come in] were set up, the *pipi* were found in abundance—enough for all ‘Ewa—and fat with flesh. Within the oyster was a jewel (*daimana*) called a pearl (*momi*), beautiful as the eyeball of a fish, white and shining; white as the cuttlefish, and shining with the colors of the rainbow—reds and yellows and blues, and some pinkish white, ranging in size from small to large. They were of great bargaining value (*he waiwai kumuku‘ai nui*) in the ancient days, but were just ‘rubbish’ (‘*opala*) in ‘Ewa. [Kamakau 1991b:83]

The people were also blessed with many other *i‘a*, including *‘ōpae huna* (transparent shrimp, *palaemon debilis*), *‘ōpae kakala*, spiked shrimp, *nehu maoli* (anchovy, *stolephorus purpureus*), *nehu pala* (anchovy), *mahamoe*, and *‘okupe*. Some of these marine resources are no longer seen today (Maly and Maly 2003:60).

3.2.7 The First *‘Ulu* (Breadfruit) Brought from Kahiki

The chief Kaha‘i left from Kalaeloa, a coastal area in Honouliuli Ahupua‘a, for a trip to Kahiki. On his return to the Hawaiian Islands, he brought back the first breadfruit (Kamakau 1991a:110) and planted it near the waters of Pu‘uloa or “long hill,” now known as Pearl Harbor (Beckwith 1940:97).

3.2.8 Palila

In the *mo‘olelo* of the hero Palila, the famous warrior had a supernatural war club. He could throw the club a long distance, hang on to the end of it, and fly along the club’s path. Using this power, he touched down in several places in Honouliuli, Waipi‘o, and Waikele. One day he used his supernatural war club to carry himself to Ka‘ena Point at Wai‘ānae, and from there east across the district of ‘Ewa. Fornander writes:

> *Ha‘alele keia ia Ka‘ena, hele mai la a Kalena, a Pōhākea, Maunauna, Kānehoa, a ke kula o Keahumoa, nana ia ‘Ewa. Kū kēia i laila nānā i ke kū a ka ea o ka lepo i nā kānaka, e pahu aku ana kēia i ka la‘au palau aia nei i kai o Honouliuli, kū ka ea o ka lepo, nu lalo o ka honua, me he olai la, makau nā kānaka holo a hiki i Waikele. A hiki o Palila, i laila, e pa‘apu ana nā kānaka i ka nānā lealea a ke ‘li‘i o O‘ahu nei, oai o Ahuapau.*
>
> After leaving Ka‘ena, he came to Kalena, then on to Pōhākea, then to Manuauna [a peak in Honouliuli], then to Kānehoa [a peak in Honouliuli], then to the plain of Keahumoa [upland plain from Honouliuli to Waipi‘o] and looked toward ‘Ewa. At this place he stood and looked at the dust as it ascended into the sky caused by the people who had gathered there; he then pushed his war club toward Honouliuli. When the people heard something roar like an earthquake they were afraid and they all ran to Waikele. When Palila arrived at Waikele he saw the people gathered there to witness the athletic games that were being given by the king of O‘ahu, Ahupau by name. [Fornander 1918:142–143]

3.2.9 Kākuhihewa

The Hawaiian *ali‘i* were also attracted to Honouliuli Ahupua‘a. One historical account of particular interest, appearing in the newspaper *Ke Au Hou*, refers to an *ali‘i* residing in Ko‘olina, to the west of the project area:

> Ko‘olina is in Waimānalo near the boundary of ‘Ewa and Wai‘ānae. This was a vacationing place for chief Kākuhihewa and the priest Napuaikamao was the caretaker of the place. Remember reader, this Ko‘olina is not situated in the Waimānalo on the Ko‘olau side of the island but the Waimānalo in ‘Ewa. It is a lovely and delightful place and the chief, Kākuhihewa loved this home of his. [*Ke Au Hou* 13 July 1910 in Sterling and Summers 1978:41]

3.3 *Nā Wahi Pana*

Wahi pana are legendary or storied places of an area. These legendary or storied places may include a variety of natural or human-made structures. Oftentimes dating to the pre-Contact period, most *wahi pana* are in some way connected to a particular *mo‘olelo*, however, a *wahi pana* may exist without a connection to any particular story. Davianna McGregor outlines the types of natural and human-made structures that may constitute *wahi pana*:

> Natural places have *mana* or spiritual power, and are sacred because of the presence of the gods, the *akua*, and the ancestral guardian spirits, the *‘aumakua*. Human-made structures for the Hawaiian religion and family religious practices are also sacred. These structures and places include temples, and shrines, or *heiau*, for war, peace, agriculture, fishing, healing, and the like; *pu‘uhonua*, places of refuge and sanctuaries for healing and rebirth; agricultural sites and sites of food production such as the *lo‘i* pond fields and terraces slopes, *‘auwai* irrigation ditches, and the fishponds; and special function sites such as trails, salt pans, *hōlua* slides, quarries, petroglyphs, gaming sites, and canoe landings. [McGregor 1996:22]

As McGregor makes clear, *wahi pana* can refer to natural geographic locations such as streams, peaks, rock formations, ridges, offshore islands and reefs, or they can refer to Hawaiian land divisions such as *ahupua‘a* or *‘ili*, and man-made structures such as fishponds. In this way, the *wahi pana* of Honouliuli tangibly link the *kama‘āina* of Honouliuli to their past. It is common for places and landscape features to have multiple names, some of which may only be known to certain *‘ohana* or even certain individuals within an *‘ohana*, and many have been lost, forgotten or kept secret through time. Place names also convey *kaona* and *huna* (secret) information that may even have political or subversive undertones. Before the introduction of writing to the Hawaiian Islands, cultural information was exclusively preserved and perpetuated orally. Hawaiians gave names to literally everything in their environment, including individual garden plots and *‘auwai* (water courses), house sites, intangible phenomena such as meteorological and atmospheric effects, *pōhaku*, *pūnāwai* (freshwater springs), and many others. According to Landgraf (1994), Hawaiian *wahi pana* “physically and poetically describes an area while revealing its historical or legendary significance” (Landgraf 1994:v). Place names and *wahi pana* of Honouliuli are listed in Table 1.

3.4 Place Names of Honouliuli

Below in Table 1, *wahi pana* within Honouliuli Ahupua‘a are listed. The table displays the McAllister (1933) site number (if applicable), and identifies the place name, significance, and source. Figure 11 depicts the locations of *wahi pana* throughout Honouliuli Ahupua‘a. In-depth descriptions of prominent *wahi pana* follow.

3.4.1 *Nā Heiau* (Pre-Christian Place of Worship)

Heiau were pre-Christian places of worship. Construction of some *heiau* was elaborate, consisting of large communal structures, while others were simple earth terraces or shrines (McAllister 1933:8). *Heiau* are most commonly associated with important religious ceremony; large structures with platforms or altars of one or more terraces were indicative of such function (McAllister 1933:8). Archaeologist Gilbert McAllister reports on two known *heiau* in the *ahupua‘a* of Honouliuli, as well as two other sites that could have possibly been *heiau*. These

heiau were located on Pu‘u o Kapolei, on Pu‘u Ku‘ua, at the foot of Pu‘u Kanehoa, and at the foot of Mauna Kapu (McAllister 1933).

3.4.2 Pu‘u o Kapolei

A *heiau* was once located on Pu‘u o Kapolei, but it had been destroyed by the time of McAllister’s (1933:108) survey of the island in 1930. The hill was used as a point of solar reference or as a place for such observations (Fornander 1919:6[2]:297). Pu‘uokapolei may have been

Table 1. Place names with significance including McAllister (1933) site number (if available) and source

Place Name	Description	Source
Awanui Gulch	Gulch located north of Pu‘u Pālailai	Sterling and Summers 1978
Enclosures	A number of enclosures sit inland from the old ranch house on the land of Kukuilua; leveled-off areas; the largest enclosure is 85 ft x 100 ft with low walls and facings; probably *kuleana* (land claim) sites; McAllister Site 135	McAllister 1933
‘Ēkahanui Gulch	Gulch in Honouliuli; literally “large bird’s-nest fern”	Pukui et al. 1974
Heiau	A small enclosure said to be a *heiau* on a slight elevation in the gulch at the foot of Pu‘u Kanehoa; one of McAllister’s informants, Reiney, recalls old Hawaiians respecting the area; enclosure is approx. 25 ft x 30 ft; inside, walls are between 2-3 ft high with width ranging from 2-5 ft depending on the slope of the land; walls evenly faced with fill of smaller stones; site surrounded by lantana and thick grass; a few guava trees grow inside the *heiau*; possibly not a *heiau*, but a small enclosure; McAllister Site 133	McAllister 1933
Honouliuli Stream	The stream passes through the eastern portion of project area and Honouliuli Taro Lands eventually drain into West Loch	USGS Orthoimagery 2005
Kahe, Kahe Point	Beach park (approx. 4.5 acres), ideal for diving; close to Nānākuli Ahupua‘a; also known as Electric Beach as it is adjacent to the Hawaiian Electric Company Power Plant; literally means “flow”	Clark 2002
Kalaeloa (Barbers Point)	Regional park consisting of approx. 120 acres; formerly Barbers Point Naval Air Station, turned over to the state on 2 July 1999; literally meaning “long point,” probably named for the view of the point from the east (Diamond Head) end of Māmala Bay, from which it appears to be an extremely long point	Clark 2002
Kalanamaihiki Fishing Shrine (*ko‘a*)	Located at Kapapapuhi, Honouliuli; two large rough stones near the end of the small tongue of land that juts out opposite Laulaunui Island in West Loch; approx. 2.5 ft in size with six or seven smooth stones averaging 1 ft in size in a small pile	McAllister 1933

Place Name	Description	Source
	adjoining the larger stones; entire site is covered in *‘ākulikuli* (general name for succulent plants); McAllister Site 139	
Kalo‘i Gulch	Gulch in Honouliuli; literally “the taro patch”	Pukui et al. 1974
Kānehili	An *‘ili* extending south of project area to shoreline	Sterling and Summers 1978
Kapapapuhi Point	Translates to “the numerous eels”; a land section southeast of the project area; point located on West Loch	Pukui and Elbert 1986
Kaupe‘a	Plain; where ghosts wandered to catch night moths and spiders for food; extending from *wiliwili* (*Erythrina sandwicensis*; Hawaiian leguminous tree) trees of Kaupea to Kānehili	*Ke Au Hou*, 12 July 1911 in Sterling and Summers 1978
Ko‘olina	Beaches, man-made lagoons, private marina, gated community, and hotels; literally “delightful, lovely”	Clark 2002
Kualaka‘i	Area near Barbers Point; a spring here is called Hoaka-lei (“lei reflection”) because Hi‘iaka picked *‘ōhi‘a lehua* flowers here to make a lei (garland, wreath) and saw her reflection in the water; literally “Tethys” (a sea creature)	Pukui et al. 1974
Kupehau	Translates to “hibiscus canoe-rim,” this is an *‘ili* in the *mauka* section of Honouliuli Ahupua‘a	Pukui and Elbert 1986
Līhu‘e	Former land division near Schofield Barracks; literally “cold chill”	Pukui et al. 1974
Limaloa Gulch	Gulch located in Nānākuli; Limaloa is the name of a luckless lover in the Kamapua‘a legend; literally “long arm”	Pukui et al. 1974
Makaīwa Gulch	Gulch near Barbers Point; literally “mother-of-pearl eyes” (as an image)	Pukui et al. 1974
Mauna Kapu	Mountain in the Wai‘anae Range separating Nānākuli and Honouliuli forest reserves	Pukui et al. 1974
Maunauna	Hill in Honouliuli Ahupua‘a standing approx. 1,769 ft high; literally “mountain sent [on errands]”; the *mo‘olelo* behind this feature is of two servant *mo‘o* (lizard) who lived here and had no keepers to supply their needs	Pukui et al. 1974; Sterling and Summers 1978
Namo‘opuna	Mountain peak within central Honouliuli Ahupua‘a	USGS Orthoimagery 2005
One‘ula	Beach park located in Honouliuli Ahupua‘a; literally “red sand”	Pukui et al. 1974

Place Name	Description	Source
Pālehua	Land division, hill (elevation 2,566 ft), and road; literally “lehua flower enclosure”	Pukui et al. 1974
Palikea	Peak above Lualualei (approx. 3,098 ft high) in the Wai‘anae Mountains; literally “white cliff”	Pukui et al. 1974
Paupauwela	Northernmost *‘ili* within Honouliuli Ahupua‘a; near Wai‘anae Uka	Sterling and Summers 1978
Pili o Kahe	Land section; literally “clinging to Kahe”	Pukui et al. 1974
Platform	Located near Mauna Kapu on the ridge that divides ‘Ewa and Wai‘anae District; McAllister Site 136	McAllister 1933
Pōhākea Pass	Mountain and pass (approx. 2,200 ft high) in Wai‘anae Mountains; from this point, Hi‘iaka saw by cloud omens that her *lehua* groves on Hawai‘i Island had been burned by her sister Pele, and that her friend Hōpoe had been turned to stone; this is where Ka-uhi brutally murdered his wife, Ka-hala-o-Puna, because he thought she had been defiled; literally “white stone” (*pōhā* is short for *pōhaku*, which means stone or rock)	Pukui et al. 1974
Pouilihale	Mountain peak within central Honouliuli Ahupua‘a	USGS Orthoimagery 2005
Pu‘u Hāpapa	Literally translates to “rock stratum,” this mountain converges at the border of Honouliuli, Wahiawā, and Wai‘anae Districts	Sterling and Summers 1978
Pu‘u Kānehoa	Peak (approx. 2,728 ft high) in Honouliuli Ahupua‘a; named for native shrubs	Pukui et al. 1974
Pu‘u o Kapolei and Heiau	The stones from the *heiau* supplied the rock crusher located on the side of this elevation, about 100 ft away on the sea side; formerly a rock shelter was on the *makai* side where Kamapua‘a is said to have lived with his grandmother; hill located in Honouliuli; Kamapua‘a, the pig-man demigod, established his grandmother as queen here after conquering most of O‘ahu; McAllister Site 138	McAllister 1933; Pukui et al. 1974
Pu‘u Kapua‘i	Hill (approx. 1,047 ft high); literally “foot print hill”	Pukui et al. 1974
Pu‘u Kaua	*Heiau* located on the ridge, overlooking Nānākuli, as well as Honouliuli, at approx. height of 1,800 ft; most of the *heiau* stones were used for a cattle pen located on the sea side of the site; portion of the *heiau* not been cleared for pineapples has been planted in ironwoods; peak; literally “war hill” or	McAllister 1933; Pukui et al. 1974

Place Name	Description	Source
	“fort hill”; place where chiefs lived in ancient times; McAllister Site 137	
Pu‘u Ku‘ina Heiau	Aikukai, Honouliuli, located in a gulch at foot of Mauna Kapu; suggestion of a terrace is about all that remains; no idea of the size of the *heiau* or number of terraces can be obtained; McAllister Site 134	McAllister 1933
Pu‘u Ku‘ua Heiau	Hill located in Honouliuli Ahupua‘a; Pele’s sister, Kapo, once left her flying vagina (*kohe lele*) there; literally “relinquished hill”	Pukui et al. 1974
Pu‘u Makakilo	Hill near Honouliuli Ahupua‘a; literally “observing eyes hill”	Pukui et al. 1974
Pu‘u Manawahua	Peak (approx. 2,401 ft high) located in Nānākuli Ahupua‘a; literally “great grief hill” or “nausea hill”	Pukui et al. 1974
Pu‘u Pālailai	Hill (approx. 492 ft high) located in ‘Ewa; literally “young lai fish hill”	Pukui et al. 1974
Waimānalo	Land division, road, gulch near Barbers Point; also the site of Chief Kākuhihewa’s home; literally “potable water”	Pukui et al. 1974

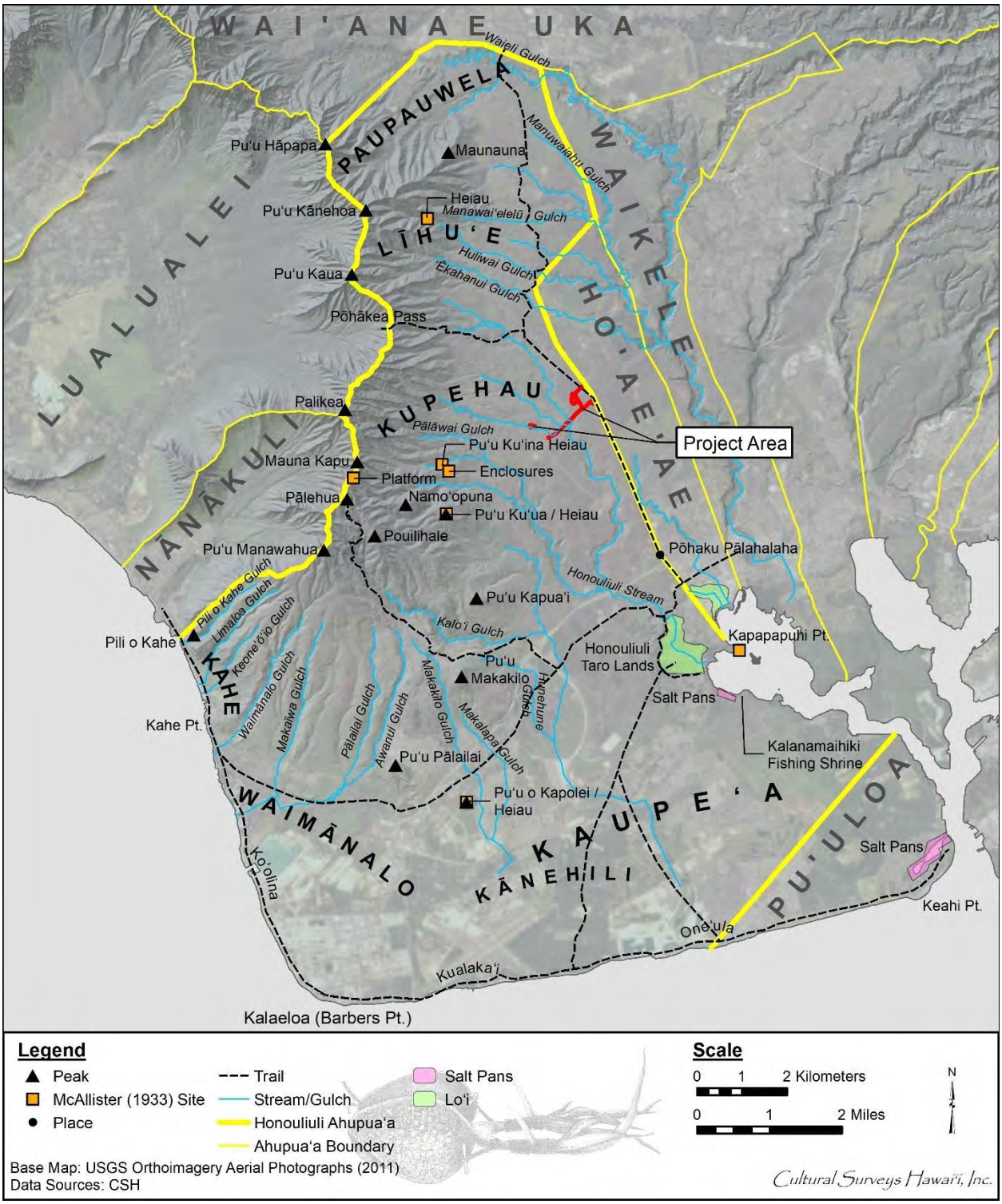


Figure 11. Portion of a 2011 USGS Orthoimagery aerial photograph showing place names, trails, and streams of Honouliuli Ahupua‘a and the location of the project area

regarded as the gate of the setting sun, just as the eastern gate of Kumukahi in Puna is regarded as the gate of the rising sun; both places are associated with the Hawaiian goddess Kapō (Emerson 1915:41). This somewhat contradicts some Hawaiian cosmologies, in which Kū was the god of the rising sun, and Hina, the mother of Kamapua‘a, was associated with the setting of the sun. Fornander (1919:6[2]:292) states that Pu‘uokapolei may have been a *leina*, jumping off point associated with the wandering souls who roamed the plains of Kaupe‘a and Kānehili, *makai* (toward the sea) of the hill.

McAllister writes that the stones from the *heiau* supplied the rock crusher located on the side of this elevation, about 100 ft away on the sea side. There was once a large rock shelter on the *makai* side where it is said to have been the residence of Kamapua‘a and his grandmother. (McAllister 1933:108). After conquering the majority of O‘ahu, he established his grandmother as queen of this *wahi pana* (Pukui et al. 1974:203).

3.4.3 Pu‘u Ku‘ua

Pu‘u Ku‘ua Heiau located in Palikea, Honouliuli, overlooks both Honouliuli and Nānākuli, and is at the height of approximately 1,800 ft. Most of the stones from the *heiau* were used for a cattle pen located on the *makai* side of the site. The part of the *heiau* that hadn’t been cleared for pineapples has been planted in ironwoods (McAllister 1933:108).

3.4.4 Unidentified Heiau at the Foot of Pu‘u Kanehoa

Located at the foot of Pu‘u Kanehoa is a small enclosure thought to have possibly been a *heiau*. McAllister writes,

> My informant, Reiney, recalls the respect the old Hawaiians had for the place when he was punching cattle with them in his youth. It is a walled enclosure 25 by 35 feet. On the inside the walls are between 2 and 3 feet high, and on the outside they range from 2 to 5 feet, depending upon the slope of the land. On three sides the walls are 2 feet wide, but the fourth is 3 feet wide. The walls are evenly faced with a fill of smaller stones. At present the site is surrounded with a heavy growth of *Lantana*; but only a thick growth of grass and two small guava bushes are in the interior, which is most unusual unless human hands keep the interior clear. Possibly this is not a *heiau* but a small inclosure considered sacred for some reason. [McAllister 1933:107]

3.4.5 Unidentified *Heiau* at the Foot of Pu‘u Kuina

Located in Aikukai, Honouliuli, at the foot of Pu‘u Kuina what looked to be a terrace is all that remained when McAllister cataloged Site 134. He notes of the inability to determine the size of the *heiau* or the number of terraces that once stood (McAllister 1933:107).

3.4.6 Plains of ‘Ewa

3.4.6.1 The Plains of *Kaupe‘a*

Several places on the ‘Ewa coastal plain are associated with *ao kuewa*, the realm of the homeless souls. Samuel Kamakau explains Hawaiian beliefs in the afterlife:

> There were three realms (*ao*) for the spirits of the dead […] There were, first, the realm of the homeless souls, the *ao kuewa*; second, the realm of the ancestral spirits, the *ao ‘aumakua*; and third, the realm of Milu, *ke ao o Milu.*
>
> The *ao kuewa*, the realm of homeless souls, was also called the *ao ‘auwana*, the realm of wandering souls. When a man who had no rightful place in the *‘aumakua* [family or personal gods] realm (*kanaka kuleana ‘ole*) died, his soul would wander about and stray amongst the underbrush on the plain of Kama‘oma‘o on Maui, or in the *wiliwili* grove of Kaupe‘a on Oahu. If his soul came to Leilono [in Hālawa, ‘Ewa near Red Hill], there it would find the breadfruit tree of Leiwalo, *ka‘ulu o Leiwalo*. If it was not found by an *‘aumakua* soul who knew it (*i ma‘a mau iaia*), or one who would help it, the soul would leap upon the decayed branch of the breadfruit tree and fall down into endless night, the *po pau ‘ole o Milu*. Or, a soul that had no rightful place in the *‘aumakua* realm, or who had no relative or friend (*makamaka*) there who would watch out for it and welcome it, would slip over the flat lands like a wind, until it came to a leaping place of souls, *a leina a ka ‘uhane*.
>
> On the plain of Kaupe‘a beside Pu‘uloa [Pearl Harbor], wandering souls could go to catch moths (*pulelehua*) and spiders (*nanana*). However, wandering souls could not go far in the places mentioned earlier before they would be found catching spiders by *‘aumakua* souls, and be helped to escape. [Kamakau 1991a:47, 49]

This association of Pu‘uokapolei and Kānehili with wandering souls is also illustrated in a lament on the death of Kahahana, the paramount chief of O‘ahu, who was killed by his father, Kahekili, after Kahahana became treacherous and killed the high priest Ka‘opulupulu.

E newa ai o hea make i ka lā,	Go carefully lest you fall dead in the sun,
Akua noho la i Pu‘uokapolei.	The god that dwells on Kapolei hill.
E hanehane mai ana ka lā i nā wahine o Kamao,	The sun is wailing on account of the women of Kamao,
Akua pe‘e, pua ‘ohai o ke kaha,	A hiding god, blossoming ohai of the banks
I walea wale i ke a-	Contented among the stones
I ka ulu kanu a Kahai.	Among the breadfruit planted by Kahai.
Haina ‘oe e ka oo-	Thou hast spoken of by the oo-
E ka manu o Kānehili.	By the bird of Kānehili.

[*Ka Nupepa Kuokoa*, Volume VII, Number 23, 6 June 1868, He Mele Kanikau no Walia Kahaha na ka moi o Oahu; Fornander 1919:6(2):297]

Fornander provides some notes on this lament. The god dwelling at Kapolei is the god Kahahana, stating that this is where his soul has gone. Kamao is one of the names to the door of the underworld. This lament draws an association with wandering souls and the place where the first breadfruit tree was planted by Kaha‘i at Pu‘uloa (Fornander 1919:6[2]304).

Pukui (1983) offers this Hawaiian saying, which places the wandering souls in a *wiliwili* (*Erythrina sandwicensis*) grove at Kaupe‘a:

> *Ka wiliwili o Kaupe‘a.*
> The *wiliwili* grove of Kaupe‘a
> In ‘Ewa, O‘ahu said to be where homeless ghosts wander among the trees.
> [Pukui 1983:180]

Pukui also shared her personal experience with the wandering spirits on the plain of Kaupe‘a.

> A wide plain lies back of Keahi and Pu‘uloa where the homeless, friendless ghosts were said to wander about. These were the ghosts of people who were not found by their family *‘aumakua* or gods and taken home with them, or had not found the leaping places where they could leap into the nether world. Here [on the plain of Honouliuli] they wandered, living on the moths and spiders they caught. They were often very hungry for it was not easy to find moths or to catch them when found.
>
> Perhaps I would never have been told of the plain of homeless ghosts if my cousin’s dog had not fainted there one day. My cousin, my aunt and I were walking to Kalaeloa, Barber’s Point, from Pu‘uloa accompanied by Teto, the dog. She was a native dog, not the so-called poi dog of today, with upright ears and body the size of a fox terrier. For no accountable reason, Teto fell into a faint and lay still. My aunt exclaimed and sent me to fetch sea water at once which she sprinkled over the dog saying, ‘*Mai hana ino wale ‘oukou i ka holoholona a ke kaikamahine. U oki ko ‘oukou makemake ‘ilio.*’ ‘Do not harm the girl’s dog. Stop your desire to have it.’ Then with a prayer to her *‘aumakua* for help she rubbed the dog. It revived quickly and, after being carried a short way, was as frisky and lively as ever.
>
> Then it was that my aunt told me of the homeless ghosts and declared that some of them must have wanted Teto that day because she was a real native dog, the kind that were roasted and eaten long before foreigners ever came to our shores. [Pukui 1943:60–61]

Beckwith (1970:154) has stressed that “the worst fate that could befall a soul was to be abandoned by its ‘aumakua (ancestral spirit) and left to stray, a wandering spirit (kuewa) in some barren and desolate place.” These wandering spirits were often malicious, so the places where they wandered were avoided.

3.4.6.2 The Plains of Pukaua

The Hawaiian language newspaper *Ka Loea Kālai‘āina* (13 January 1900) relates that near Pu‘uokapolei, on the plain of Pukaua, on the *mauka* side of the road, there was a large rock. This *mo‘olelo* suggests the plain around Pu‘uokapolei was called Pukaua. The *mo‘olelo* is as follows:

> If a traveler should go by the government road to Waianae, after leaving the village of gold, Honouliuli, he will first come to the plain of Puu-ainako and when that is passed, Ke-one-ae. Then there is a straight climb up to Puu-o-Kapolei and there look seaward from the government road to a small hill. That is Puu-Kapolei […] You go down some small inclines, then to a plain. This plain is Pukaua and on the mauka side of the road, you will see a large rock standing on the plain […] There were two supernatural old women or rather peculiar women with strange powers and Puukaua belonged to them. While they were down fishing at Kualakai [near Barbers Point] in the evening, they caught these things, aama crabs (Grapsus

> tenuicrustatus), pipipi shellfish (Nerita picea), and whatever they could get with their hands. As they were returning to the plain from the shore and thinking of getting home while it was yet dark, they failed for they met a one-eyed person [bad omen]. It became light as they came near to the plain, so that passing people were distinguishable. They were still below the road and became frightened lest they be seen by men. They began to run—running, leaping, falling, sprawling, rising up and running on, without a thought of the a‘ama crabs and seaweeds that dropped on the way, so long as they would reach the upper side of the road. They did not go far for by then it was broad daylight. One woman said to the other, ‘Let us hide lest people see us,’ and so they hid. Their bodies turned into stone and that is one of the famous things on this plain to this day, the stone body. This is the end of these strange women. When one visits the plain, it will do no harm to glance on the upper side of the road and see them standing on the plain. [*Ka Loea Kālai‘āina*, 13 January 1900, translation in Sterling and Summers 1978:39]

In another version of this story, the two women met Hi‘iaka as she journeyed toward the ‘Ewa coast. The women were *mo‘o* and were afraid that Hi‘iaka would kill them, so they changed into their lizard form. One of the lizards hid in a little space on a stone beside the coastal trail, and the other hid nearby (*Ka Hōkū o Hawai‘i*, 15 February 1927, translated in Maly 1997:19). From that time on the stone was known as “Pe‘e-kāua,” meaning “we two hidden.” Hi‘iaka greeted the two women but did not harm them, and passed on.

When she reached Pu‘uokapolei, she also greeted two old women who lived at an *‘ohai* (*Sesbania tomentosa*) grove on the hill. These women were named Pu‘uokapolei and Nāwahineokama‘oma‘o (*Ka Hōkū o Hawai‘i*, 22 February 1927, translated in Maly 1997:19). As she continued her travels, she looked to the ocean and saw the canoe carrying Lohi‘au:

Kuu kane i ke awa lau o Puuloa	My man on the many harbored sea of Pu‘uloa
Mai ke kula o Peekaua ke noho	As seen from the plain of Pe‘ekāua
E noho kaua i ke kaha o ka ohai	Let us dwell upon the *‘ōhai* covered shore
I ka wiliwili i ka pua o ka lau noni	Where the *noni* blossoms are twisted together
O ka ihona i Kanehili la	Descending along Kānehili
Ua hili hoi au-e	I am winding along.

[*Ka Hōkū o Hawai‘i*, 22 February 1927, translated in Maly 1997:20]

3.4.6.3 The Inland Plain of Keahumoa

In several legends of ‘Ewa, mention is made of the “plain of Keahumoa.” John Papa ‘Ī‘ī (1959:96) has this plain opposite the trail to Pōhakea Pass, stretching across the *ahupua‘a* of Honouliuli and Hō‘ae‘ae. McAllister (1933:107) states that the plain was west of Kīpapa Gulch in Waikele. It is also mentioned in legends of Waipi‘o. Thus, this is probably a general name for the flat plain *mauka* of the productive floodplain area directly adjacent to Pearl Harbor. This plain would have been east of the present corridor alignment.

3.4.6.4 Legend of Nāmakaokapao‘o

Nāmakaokapao‘o was a Hawaiian hero of legendary strength. Nāmakaokapao‘o’s mother was Pokai and his father was Kaulukahai, a great chief of Kahiki, the ancestral home of the Hawaiians. The two met in Hō‘ae‘ae and conceived their child there. The father returned to his home in Kahiki before the birth of his son, leaving his O‘ahu family destitute. A man named Puali‘i saw Pokai and married her. The couple then resided on the plains of Keahumoa, planting sweet potatoes. Nāmakaokapao‘o was a small, brave child who took a dislike to his stepfather, and pulled up the sweet potatoes Puali‘i had planted at their home in Keahumoa. When Puali‘i came after Nāmakaokapao‘o with an axe, Nāmakaokapao‘o delivered a death prayer against him, and slew Puali‘i, hurling his head into a cave in Waipouli, near the beach at Honouliuli (Fornander 1919:5[2]:274–276).

3.4.6.5 Legend of Pikoi

Pikoi was a legendary hero, the son of a crow (*‘alalā*) and brother to five god-sisters in the form of rats. He was famous for his ability to shoot arrows, and often made bets that he could hit rats from a long distance (Fornander 1917:4[3]:450–463). Pikoi’s skill was commemorated in a saying (Pukui 1983:200):

Ku aku la i ka pana a	Shot by the arrow of Pikoi-[son]
Pikoi-a-ka-‘alalā, keiki pana	of-the-crow, the expert rat-shooter
‘iole o ke kula o Keahumoa.	Of the plain of Keahumoa.
[Pukui 1983:200]	

3.4.6.6 The Demi-god Māui

In the stories of the demi-god Māui, Keahumoa is the home of Māui‘s grandfather, Kūolokele (Kū-honeycreeper). One day, Māui’s wife, Kumulama, was stolen by the chief Pe‘ape‘amakawalu, called the eight-eyed-bat, who is identified in the creation chant, *Kumulipo*, as the octopus god (Beckwith 1951:136). The chief disappeared with Kumulama in the sky beyond the sea, and escaped so quickly that Māui could not catch him. To recover his wife, Māui’s mother advised him to visit the hut of his grandfather at Keahumoa:

> Maui went as directed until he arrived at the hut; he peeped in but there was no one inside. He looked at the potato field on the other side of Poha-kea, toward Hono-uli-uli, but could see no one. He then ascended a hill, and while he stood there looking, he saw a man coming toward Waipahu with a load of potato leaves, one pack of which, it is said, would cover the whole land of Keahumoa. [Thrum 1923:253–254]

Kūolokele made a *moku-manu* (“bird-ship”) for Māui, who entered the body of the bird and flew to Moanaliha, the land of the chief Pe‘ape‘amakawalu. This chief claimed the bird as his own when it landed on a sacred box, and took it with him into the house he shared with Māui’s wife. When Peapeamakawalu fell asleep, Māui killed him, cut off his head, and flew away back to O‘ahu with his wife and the chief’s head (Thrum 1923:252–259).

3.4.6.7 Paupauwela and Līhu‘e

Paupauwela, also spelled Popouwela (derivation unknown), is the name of the land area in the extreme *mauka* section of Honouliuli Ahupua‘a. The land area of Līhu‘e is just *makai* of this land,

and extends into the *ahupua‘a* of Waipi‘o (adjacent to the eastern border of Honouliuli). Both place names are mentioned in a chant recorded by Abraham Fornander, which was composed as a *mele* for the O‘ahu king, Kūali‘i, as he was preparing to battle Kuiaia, the chief of Wai‘anae:

*Ihea, ihea la ke kahua,*Where?	Where is the battle field
Paio ai o ke koa-a?	Where the warrior is to fight?
I kai i kahua i Kalena,	On the field of Kalena,
I Manini, i Hanini	At Manini, at Hanini,
I ninia i ka wai akua,	Where was poured the water of the god
I ko hana i Malamanui	By your work at Malamanui;
Ka luna o Kapapa, i Paupauwela,	On the heights of Kapapa, at Paupauwela,
I ka hilinai i ke kalele,	Where they lean and rest;
Ka hala o Halahalanui maauea,	At the hala trees of indolent Halahalanui,
E kula ohia ke Pule-e,	At the ohia grove of Pule-e
Ke ‘kua o Lono o Makalii	The god of Lono, of Makalii
Ka lala aalao Ukulonoku,	The fragrant branch of the Ukulonoku,
No Kona paha, no Lihue.	Mayhap from Kona, from Lihue,
No ka la i Maunauna,	For the day at Maunauna
No ka wai i Paupauwela.	For the water at Paupauwela.
Ula ka wai i Paupauwela,	Red is the water of Paupauwela,
Ke kilau o Malamani	From the slain at Malamani,
Ka moo kilau i Kapapa.	The slain on the ridge at Kapapa.
[Fornander 1917:4(2):384–386]	

3.4.7 Maunauna

The hill Maunauna lies between the lands Paupauwela and Līhu‘e. One translation of Maunauna is “mountain sent [on errands].” Two servant *mo‘o* who lived here had no keepers to supply their needs” (Pukui et al. 1974:149). It was at Maunauna, according to one tradition, that the forces of the chiefs Kūali‘i and Kuiaia of Wai‘anae met to do battle, which was averted when a *mele* honoring the god Kū was chanted (see Section 3.7.1). (Fornander 1917:4[2]:348). In the Legend of Ke-ao-melemele, a woman named Paliuli traveled in this area.

> In a very short time she [Paliuli] walked over the plain of Ewa; Ewa that is known as the land of the silent fish (pearl oysters) […] She went on to the plain of Punalu‘u and turned to gaze at Maunauna point and the plain of Lihue. [Manu 1885, translation in Sterling and Summers 1978:21]

Certain place names in the uplands, including Maunauna, are also mentioned in the story of Lolale’s Lament. The place of Lolale’s residence is given in King Kalākaua’s version of this story (Kalākaua 1990:232): “There lived there at that time in Lihue, in the district of Ewa, on the island of O‘ahu, a chief named Lo-Lale, son of Kalona-iki, and brother of Piliwale, the *alii-nui*, or nominal sovereign, of the island, whose court was established at Waialua.”

In this story, Lolale was a chief of O‘ahu who asked his friend Kalamakua to find him a bride (Kalākaua 1990:228–246; Skinner 1971:217–219). Kalamakua traveled to Maui and chose Kelea, the chief’s sister, and returned with her to O‘ahu; during this time the two grew close. Kelea lived with Lolale for a while, but he was a silent type who was often away from home playing sports and walking in the woodlands. Longing for Kalamakua, Kelea decided to leave her husband, Lolale voiced no “spoken bitterness”; however, after she left, he sang this lament:

> Farewell, my partner of the lowland plains,
> On the waters of Pohakeo,
> Above Kanehoa,
> On the dark mountain spur of Mauna-una!
> O, Lihue, she is gone!
> Sniff the sweet scent of the grass,
> The sweet scent of the wild vines
> That are twisted by Waikoloa,
> By the winds of Waiopua,
> My flower!
> As if a mote were in my eye.
> The pupil of my eye is troubled;
> Dimness covers my eyes. Woe is me!
> [Kalākaua 1990:228–246

3.4.8 Kūalaka‘i

Kūalaka‘i is the name of an area near Barbers Point, located on the southwestern side of Honouliuli Ahupua‘a. Clark (1977:74) says it is named for a type of sea cucumber that squirts a purple fluid when squeezed. Pukui identifies the sea creature as *Tethys* a member of the invertebrate fdamily *Aplysiidae* commonly called sea hares (Pukui et al. 1974:119). Pukui adds this area was once the site of a spring called Hoaka-lei (“lei reflection”) “because Hi‘iaka picked *lehua* flowers here to make a *lei* (garland) and saw her reflection in the water” (Pukui et al. 1974:119).

3.4.9 Kalaeloa

Kalaeloa literally means “the long point” (Pukui et al. 1974:72). Kalaeloa Point was the home of Uhu Makaikai, a *kupua* who could take the form of a man or a giant parrotfish (*uhu).* He is mentioned in several legends concerning the hero Kawelo and with Kawelo’s struggles with the ruling chief of Kaua‘i, ‘Aikanaka.

> This friend was Kauahoa also an alii of Wailua (Kauai). Their king, Aikanaka, in the time of Kakuhihewa of Oahu and Lonoikamakahiki of Hawaii. Aikanaka got offended with Kawelo and sent him to live at Waikiki. Cause. The king at a surf bathing told Kawelo to get a calabash of water for him to wash off with, but on Kawelo’s failing to do it, he took a calabash of soft poi and threw it over Kawelo and sent him off as already stated. At Waikiki, Kawelo studied the art of fighting to be revenged on Aikanaka. A kupua, Uhu makaikai, a fish was his teacher. Makuakeke was his helper in the canoe. The fish lived at Pohaku o Kawai near

Kalailoa (Kalaeloa), Oahu (Barber’s Point) […] [Hawaiian Ethnological Notes, Bishop Museum Vol. II:114, translation in Sterling and Summers 1978:41]

3.5 *Nā Ala Hele* (Trails)

John Papa ‘Ī‘ī describes a network of Leeward O‘ahu trails (Figure 12 and Figure 13) which in later historic times encircled and crossed the Wai‘anae Range, allowing passage from West Loch to the Honouliuli lowlands, past Pu‘uokapolei and Waimānalo Gulch to the Wai‘anae coast and onward circumscribing the shoreline of O‘ahu (‘Ī‘ī 1959:96–98). The main trail along the south shore of O‘ahu would have been approximately 1.5 km to the southeast. A main trail extending up the central valley of O‘ahu would have been approximately 3 km to the east. The 1873 Alexander map (see Figure 13), one of the earliest detailed maps of the vicinity, shows no development near the project area.

3.5.1 Pōhākea Pass

Pōhākea Pass, on the Wai‘anae Mountain Range, has an elevation of 671 m (2,200 ft) amsl. Pōhākea literally translates to “white stone” (Pukui et al. 1974:185). Pōhākea serves as a passage between *ahupua‘a* of Honouliuli and Lualualei. This is also the location where Hi‘iaka saw cloud omens that her *lehua* (flower of the *‘ōhia* tree [*Metrosideros polymorpha*]) groves had been burned by her sister Pele, and her friend Hōpoe had been turned into stone.

In *The Epic Tale of Hi‘iakaikapoliopele*, Hi‘iaka watches as her beloved friend Hōpoe is killed by the embers of her sister Pele. She chants atop Pōhākea and tells of the winds of Waikōloa and Wai‘ōpua:

KAU HO‘OKAHI HANERI A ME KANALIMAKUMAMĀKOLU	CHANT ONE HUNDRED AND FIFTY-THREE
Aloha ku‘u hoa i ka pū‘ali lā	Alas my friend of the rugged mountain pass
A luna i Pōhākea, he luna o Kamaoha	On high at Pōhākea, above Kamaoha
He lae ‘ino ‘o Maunauna	Maunauna is a dangerous escarpment
‘O Līhu‘e ke hele ‘ia	Lihu‘e’s high plain yet to be traversed
Honi i ke ‘ala mau‘u	Inhaling the scent of the grasses
I ke ‘ala o ke kupukupu	The fragrance of kupukupu fern
E linoa ala e ka Waikōloa	Entwined by the Waikoloa breeze
E ka makani he Wai‘ōpua	By the wind called Wai‘ōpua
Ku‘u pua, me he pua lā i ku‘u maka	My blossom, like a flower in my sight
Ka ‘oni i ka haku ‘ōnohi, kā ka wai lā i li‘u	Moving before my eyes, washed salty by tears
I ku‘u maka lā, e uē au lā.	There in my sight, I weep.

[Ho‘oulumahiehie 2008a:262; Ho‘oulumahiehie 2008b:262]

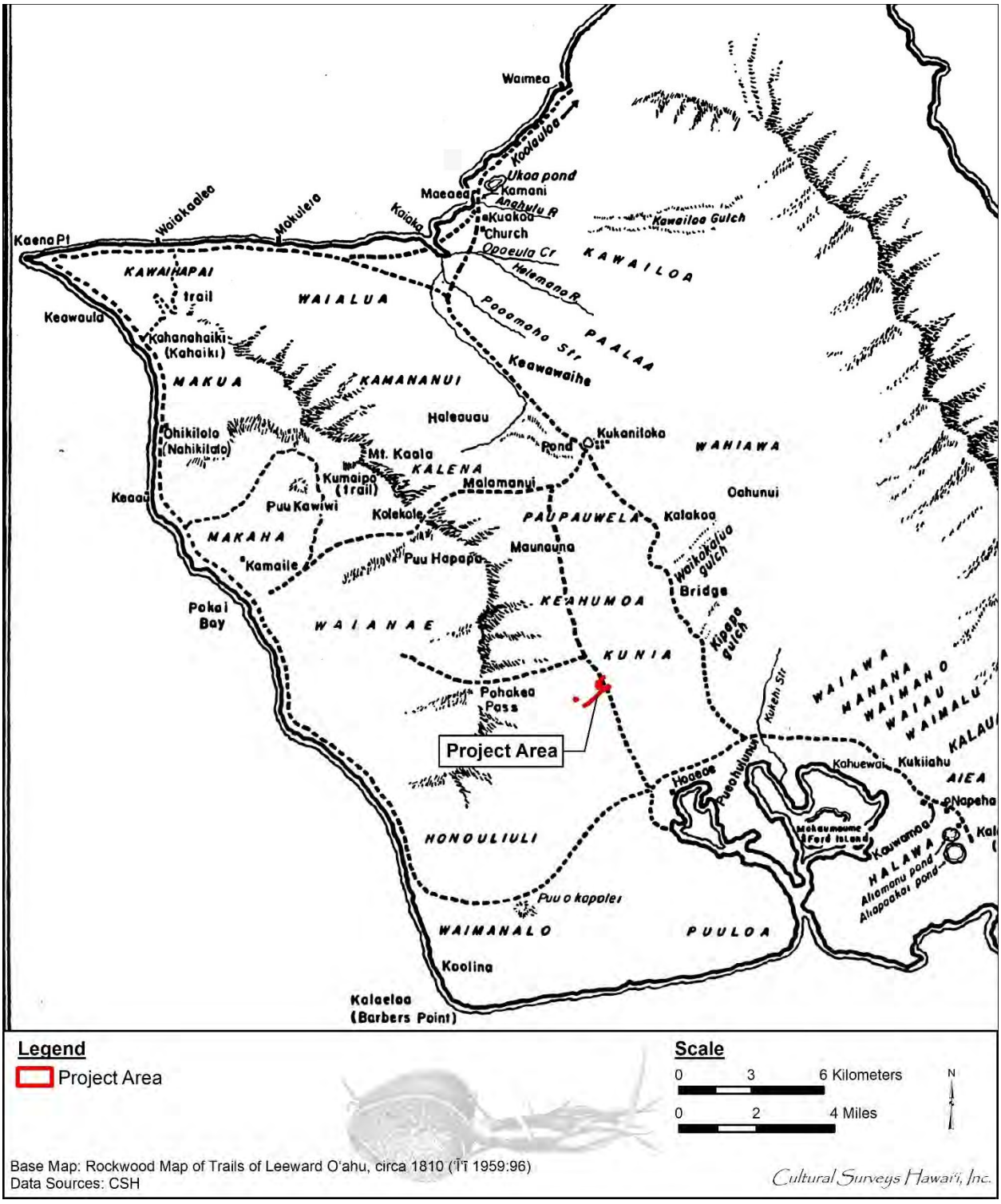


Figure 12. Portion of the 1810 Rockwood map of trails of Leeward O‘ahu with overlay of project area (‘Ī‘ī 1959:96)

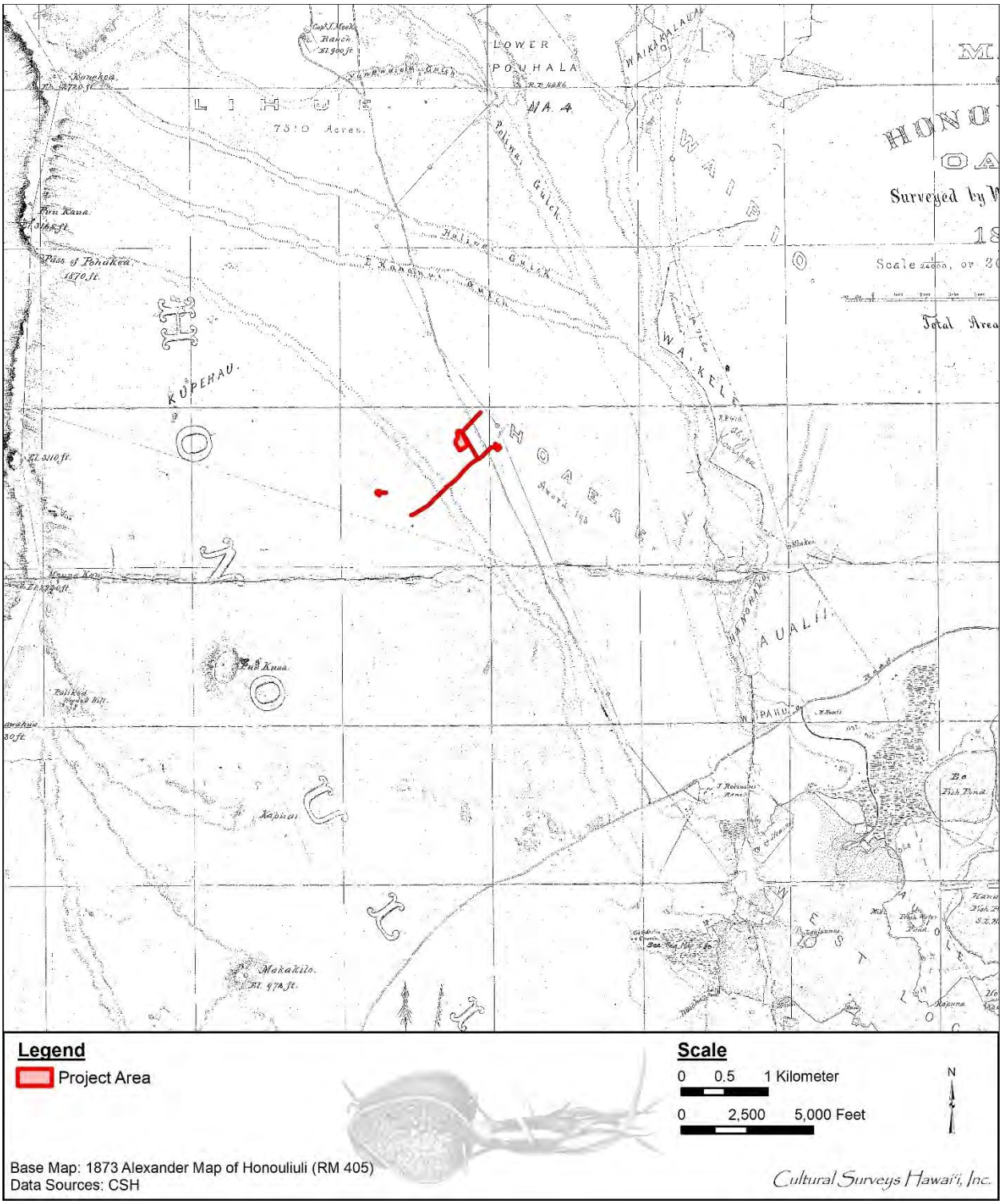


Figure 13. Portion of the 1873 Alexander map of Honouliuli showing trail network in vicinity of project area

3.6 *Nā ‘Ōlelo No‘eau*

Hawaiian knowledge was shared by way of oral histories. One’s *leo* (voice) is often presented as *ho‘okupu* (“a tribute or gift” given to convey appreciation, to strengthen bonds, and to show honor and respect); the high valuation of spoken word underscores the importance of oral tradition (in this case, Hawaiian sayings or expressions), and its ability to impart traditional Hawaiian “aesthetic, historic, and educational values” (Pukui 1983:vii). Thus, these expressions may be understood as inspiring growth within the reader or between speaker and listener:

> They reveal with each new reading ever deeper layers of meaning, giving understanding not only of Hawai‘i and its people but of all humanity. Since the sayings carry the immediacy of the spoken word, considered to be the highest form of cultural expression in old Hawai‘i, they bring us closer to the everyday thoughts and lives of the Hawaiians who created them. Taken together, the sayings offer a basis for an understanding of the essence and origins of traditional Hawaiian values. The sayings may be categorized, in Western terms, as proverbs, aphorisms, didactic adages, jokes, riddles, epithets, lines from chants, etc., and they present a variety of literary techniques such as metaphor, analogy, allegory, personification, irony, pun, and repetition. It is worth noting, however, that the sayings were spoken, and that their meanings and purposes should not be assessed by the Western concepts of literary types and techniques. [Pukui 1983:vii]

Simply, *‘ōlelo no‘eau* may be understood as proverbs. The Webster dictionary notes it as “a phrase which is often repeated; especially, a sentence which briefly and forcibly expresses some practical truth, or the result of experience and observation.” It is a pithy or short form of folk wisdom. Pukui equates proverbs as a treasury of Hawaiian expressions (Pukui 1995:xii). Oftentimes within these Hawaiian expressions or proverbs are references to places. This section draws from the collection of author and historian Mary Kawena Pukui and her knowledge of Hawaiian proverbs describing *‘āina* (land), chiefs, plants, and places.

3.6.1 Concerning Sharks

The east shore of Honouliuli lies on Pu‘uloa which has many *mo‘olelo* about sharks, particularly Ka‘ahupāhau, the queen shark of O‘ahu and the most famous guardian shark in Pu‘uloa. Thus, Honouliuli is closely associated with shark *‘aumakua* and *mo‘olelo* which say the people of ‘Ewa were protected by sharks. The following *‘ōlelo no‘eau* are associated with sharks.

3.6.1.1 ‘Ōlelo No‘eau #105

> *Alahula Pu‘uloa, he alahele na Ka‘ahupāhau.*
>
> Everywhere in Pu‘uloa is the trail of Ka‘ahupāhau.
>
> Said of a person who goes everywhere, looking, peering, seeing all, or of a person familiar with every nook and corner of a place. Ka‘ahupāhau is the shark goddess of Pu‘uloa (Pearl Harbor) who guarded the people from being molested by sharks. She moved about, constantly watching. [Pukui 1983:14]

3.6.1.2 ‘Ōlelo No‘eau #1014

> *Ho‘ahewa na niuhi ia Ka‘ahupāhau*

The man-eating sharks blamed Ka‘ahupāhau

Evil-doers blame the person who safeguards the rights of others. Ka‘ahupāhau was the guardian shark goddess of Pu‘uloa (Pearl Harbor) who drove out or destroyed all the man-eating sharks. [Pukui 1983:108]

3.6.1.3 ‘Ōlelo No‘eau #2152

Mehameha wale no o Pu‘uloa, i ka hele a Ka‘ahupāhau

Pu‘uloa became lonely when Ka‘ahupāhau went away

The home is lonely when a loved one has gone. Ka‘ahupāhau, guardian shark of Pu‘uloa (Pearl Harbor), was dearly loved by the people. [Pukui 1983:234]

3.6.1.4 ‘Ōlelo No‘eau #2111

Make o Mikololou a ola i ke alelo

Mikololou died and came to life again through his tongue

Said of one who talks himself out of a predicament. [Pukui 1983:229–230]

3.6.2 Concerning the *Pipi* or Pearl Oyster of Pu‘uloa

Pearl Harbor or Pu‘uloa, derived from the name Waimomi, or “water of the pearl,” an alternate name for the Pearl River. The harbor was thus named after pearl oysters of the family Pteriidae (mainly *Pinctada radiata*), which were once abundant on the harbor reefs and after which many *‘ōlelo no‘eau* were generated.

3.6.2.1 ‘Ōlelo No‘eau #1331

Ka i‘a hāmau leo o ‘Ewa

The fish of ‘Ewa that silences the voice

The pearl oyster, which has to be gathered in silence. [Pukui 1983:145]

Handy and Handy (1972:471) offer a different interpretation: “The pipi was sometimes called ‘the silent fish,’ or, *‘i‘a hamau leo o ‘Ewa*,’ ‘Ewa’s silent sea creature since the collectors were supposed to stay quiet while harvesting the shells.”

3.6.2.2 ‘Ōlelo No‘eau #493

Haunāele ‘Ewa i ka Moa‘e

‘Ewa is disturbed by the Moa‘e wind

Used about something disturbing, like a violent argument. When the people of ‘Ewa went to gather the *pipi* (pearl oyster), they did so in silence, for if they spoke, a Moa‘e breeze would suddenly blow across the water, rippling it, and the oysters would disappear. [Pukui 1983:59]

3.6.2.3 ‘Ōlelo No‘eau #274

E hāmau o makani mai auane‘i

Hush, lest the wind rise

> Hold your silence or trouble will come to us. When the people went to gather pearl oysters at Pu‘uloa, they did so in silence, for they believed that if they spoke, a gust of wind would ripple the water and the oysters would vanish. [Pukui 1983:34]

3.6.2.4 ‘Ōlelo No‘eau #1357

> *Ka i‘a kuhi lima o ‘Ewa*
>
> The gesturing fish of ‘Ewa
>
> The pipi, or pearl oyster. Fishermen did not speak when fishing for them but gestured to each other like deaf-mutes. [Pukui 1983:148]

3.6.2.5 Concerning the *‘Anae-holo* of Honouliuli

The migration of the *‘anae-holo* of Honouliuli is described in the following excerpt from which the *‘ōlelo no‘eau* below derives:

> The home of the *‘anae-holo* is at Honouliuli, Pearl Harbor, at a place called Ihuopala‘ai. They make periodical journeys around to the opposite side of the island, starting from Pu‘uloa and going to windward, passing successively Kumumanu, Kalihi, Kou, Kālia, Waikīkī, Ka‘alāwai, and so on, around to the Ko‘olau side, ending at Lā‘ie, and then returning by the same course to their starting point. [Nakuina 1998:271]

3.6.2.6 ‘Ōlelo No‘eau #1330

> *Ka i‘a hali a ka makani*
>
> The fish fetched by the wind
>
> The ‘anaeholo, a fish that travels from Honouliuli, where it breeds, to Kaipāpa‘u, on the windward side of O‘ahu. It then turns about and returns to its original home. It is driven closer to shore when the wind is strong. [Pukui 1983:145]

3.6.3 Concerning *Kalo*

A rare taro called the *“kāī o ‘Ewa*,” was grown in mounds in marshy locations in ‘Ewa (Handy and Handy 1972:471). The cultivation of this prized and delicious taro led to the following saying:

3.6.3.1 ‘Ōlelo No‘eau #2770

> *Ua ‘ai i ke kāī-koi o ‘Ewa*
>
> He has eaten the kāī-koi taro of ‘Ewa
>
> Kāī is O‘ahu’s best eating taro; one who has eaten it will always like it. Said of a youth of a maiden of ‘Ewa, who, like the kāī taro, is not easily forgotten. [Pukui 1983:305]

3.6.4 Concerning the Ao Kuewa, Realm of the Homeless Souls

3.6.4.1 ‘Ōlelo No‘eau #1666

> *Ka wiliwili o Kaupe‘a*

The wiliwili grove of Kaupe‘a

In ‘Ewa, O‘ahu. Said to be where homeless ghosts wander among the trees. [Pukui 1983:180]

Pukui (1983:180) offers this Hawaiian saying, which places the wandering souls in a "*wiliwili*" grove at Kaupe‘a, a place in Honouliuli where homeless ghosts wandered among the trees.

3.6.5 Concerning the Landscape of ‘Ewa

3.6.5.1 ‘Ōlelo No‘eau #80

The following proverb describes the red landscape of the ‘Ewa plain.

‘Āina koi ‘ula i ka lepo.

Land reddened by the rising dust.

Said of ‘Ewa, O‘ahu. [Pukui 1983:11]

The expression below describes the residents of Kaupe‘a ‘Ili.

3.6.5.2 ‘Ō‘ū ō loa na manu o Kaupe‘a.

The birds of Kaupe‘a trill and warble.

Said of the chatter of happy people. [Pukui 1983:278]

3.6.5.3 ‘Ōlelo No‘eau #1855

The expression below discusses the boundaries between *ali‘i* and *maka‘āinana* lands in ‘Ewa.

Ku a‘e ‘Ewa; Noho iho ‘Ewa.

Stand-up ‘Ewa; Sit-down ‘Ewa.

The names of two stones, now destroyed, that once marked the boundary between the chiefs' land (Kua‘e ‘Ewa) and that of the commoners (Noho iho ‘Ewa) in ‘Ewa, O‘ahu. [Pukui 1983:200]

> [The] realm of wandering souls. When a man who had no rightful place in the *‘aumakua* realm (*kanaka kuleana ‘ole*), his soul would wander about and stray amongst the underbrush on the plain of Kama‘oma‘o on Maui, or in the *wiliwili* grove of Kaupe‘a on Oahu. If his soul came to Leilono [in Hālawa, ‘Ewa near Red Hill], there he would find the breadfruit tree of Leiwalo, *ka‘ulu o Leiwalo*. If it was not found by an *‘aumakua* soul who knew it (*i ma‘a mau iaia*), or one who would help it, the soul would leap upon the decayed branch of the breadfruit tree and fall down into endless night, *the pō pau ‘ole o Milu*. Or, a soul that had no rightful place in the *‘aumakua* realm, or who had no relative or friend (*makamaka*) there who would watch out for it and welcome it, would slip over the flat lands like a wind, until it came to a leaping place of souls, a *leina a ka ‘uhane*. […] [Kamakau 1991b:47]
>
> On the plain of Kaupe‘a beside Pu‘uloa [Pearl Harbor], wandering souls could go to catch moths (*pulelehua*) and spiders (*nanana*). However, wandering souls could

> not go far in the places mentioned earlier before they would be found catching spiders by *‘aumakua* souls, and be helped to escape. [Kamakau 1991b:49]

The breadfruit tree Leilono was said to have been located on the ‘Ewa-Kona border, above Āliamanu. In another section of his account of the dead, Kamakau (1991b:29) calls the plain of wandering souls the “plain at Pu‘uokapolei.” Fornander (Fornander 1919:6[2]:292) states Pu‘uokapolei may have been a jumping off place (also connected with the setting sun) and associated with the wandering souls who roamed the plains of Kaupe‘a and Kānehili, *makai* of the hill. Kamakau also writes,

> There are many who have died and have returned to say that they had no claim to an ‘aumakua [realm] (kuleana‘ole). These are the souls, it is said, who only wander upon the plain of Kama‘oma‘o on Maui or on the plain at Pu‘uokapolei on Oahu. Spiders and moths are their food. [Kamakau 1991b:29]

3.7 *Nā Mo‘olelo*

3.7.1 Legend of Lepeamoa

Another explanation for the name Honouliuli comes from the “Legend of Lepeamoa,” the *kupua* (demigod or cultural hero, especially a supernatural being possessing several forms) of Pālama. In this legend, Honouliuli is the name of the husband of the chiefess Kapālama and grandfather of Lepeamoa (Westervelt 1923:164–184). One translation of the name for this district is given as “unequal” (*Saturday Press*, 11 August 1883). Others translate the word as “strayed” and associate it with the legends of the gods Kāne and Kanaloa who surveyed the islands and marked land boundaries with large stones, as told in the associated *ka‘ao* in the previous sub-section.

According to S.K. Nawaa (22 March 1954) in Sterling and Summers, the stone that was found at Pili o Kahe and is the dividing marker between two hills that run parallel; the hill on the ‘Ewa side was considered male and the one on the Wai‘anae side marking the boundary between Nānākuli and Honouliuli was interpreted as female. The name “Pili o Kahe (Pili = cling to, Kahe = flow) refers, therefore, to the female or Waianae side hill. And that is where the boundary between the two districts runs” (Sterling and Summers 1978:1). The boundaries of Honouliuli Ahupua‘a extend from Paupauwela in the north, Ho‘ae‘ae to the east, and Pu‘uloa to the south with the coastline on the southern border.

3.7.2 Coastal Village of Kūalaka‘i

“Legend of the Children” is a tale that foretold the breaking of the eating *kapu* (taboo) by the *ali‘i*. A young brother and sister always fished at Kūalaka‘i, a beach area on the southern coast of Honouliuli. On this day, they laid out their nets, but all they caught was one *palani* (surgeonfish; *Acanthurus dussumieri*), a fish that was *kapu* for men; only women could eat it.

> […] They fished again and again until the afternoon and nothing was caught. The children were weary and went home without fish. When they came as far as Pu‘u-o-Kapolei where the blossoms of the ma‘o looked golden in the sunlight, the sister sat down to make ma‘o leis for themselves. When the leis were made they went across the breadth of Kaupe‘a to Waipio. [*Ka Loea Kālai‘āina*, 22 July 1899:15; translation in Sterling and Summers 1978:7]

They stopped at the stream of Ka‘aimalu on the way to their home and the sister convinced her brother to share the fish between the two, thus breaking the *kapu*. “Because these children ate fish secretly, the spot is called Ka‘ai-malu (Secret eating) to this day” (Sterling and Summers 1978:7).

3.7.2.1 The Death of Kahahana at Hō‘ae‘ae

The association of Pu‘uokapolei and Kānehili with wandering souls is also illustrated in a lament on the death of Kahahana, the paramount chief of O‘ahu who was killed by his foster father, the Maui chief Kahekili, after Kahahana became treacherous and killed the high priest Ka‘opulupulu.

E newa ai o hea make i ka la,	Go carefully lest you fall dead in the sun,
Akua noho la i Puuokapolei.	The god that dwells on Kapolei hill
E hanehane mai ana ka la i na wahine o Kamao,	The sun is wailing on account of the women of Kamao,
Akua pee,	A hiding god, blossoming
pua ohai o ke kaha,	*ohai* of the banks,
I walea wale i ke a-	Contented among the stones-
I ka ulu kanu a Kahai.	Among the breadfruit planted by Kahai.
Haina oe e ka oo-	Thou wast spoken of by the *oo*—
E ka manu o Kanehili.	By the bird of Kanehili.
[Fornander 1919:6:297]	

Fornander provides some notes on this lament. The god dwelling at Kapolei is the god Kahahana, stating that this is where his soul has gone. Kamao is one of the names to the door of the underworld. This lament draws an association between wandering souls and the place where the first breadfruit tree was planted by Kaha‘i at Pu‘uloa (Fornander 1919).

> Upon the arrival here at O‘ahu of Kahekili, Kahahana fled, with his wife Kekuapoi, and friend Alapa‘i, and hid in the shrubbery of the hills. They went to Āliamanu, Moanalua, to a place called Kinimakalehua; then moved along to Keanapua‘a, and Kepo‘okala, at the lochs of Pu‘uloa, and from there to upper Waipi‘o; thence to Wahiawā, Helemano, and on to Līhu‘e; thence they came to Po‘ohilo, at Honouliuli, where they first showed themselves to the people and submitted themselves to their care.
>
> While they were living there, report thereof was made to Kahekili, the King, who thereupon sent Kekuamanoha, elder brother of Kekuapoi, the wife of Kahahana, with men in double canoes from Waikiki, landing first at Kupahu, Hanapouli, Waipio, with instructions to capture and put to death Kahahana, as also his friend Alapa‘i, but to save alive Kekuapoi. When the canoes touched at Hanapouli, they proceeded thence to Waikele and Hoaeae, and from there to Poohilo, Honouliuli, where they met in conference with Kahahana and his party. At the close of the day Kekuamanoha sought by enticing words to induce his brother-in-law to go up with him and see the father King and be assured of no death condemnation, and by skilled flattery he induced Kahahana to consent to his proposition; whereupon

> preparation was made for the return. On the following morning, coming along and reaching the plains of Hoaeae, they fell upon and slew Kahahana and Alapa‘i there. [Fornander 1919:6:304]

Through deceit, Kahahana was induced to leave Po‘ohilo, Honouliuli and was killed on the plains of Hō‘ae‘ae (Thrum 1907:213–214).

3.7.3 The Traveling Mullet of Honouliuli

The story of (Ka) Ihuopala‘ai is also associated with the tradition of the *‘anae-holo* or traveling mullet (Thrum 1907:270–272):

> The home of the anae-holo is at Honouliuli, Pearl Harbor, at a place called Ihuopalaai. They make periodical journeys around to the opposite side of the island, starting from Puuloa and going to windward, passing successively Kumumanu, Kalihi, Kou, Kalia, Waikiki, Kaalawai, and so on, around to the Koolau side, ending at Laie, and then returning by the same course to their starting point. [Thrum 1907:271]

In Thrum’s account, Ihuopala‘ai is a male who possesses a *kū‘ula*, or fish god, which supplied the large mullet known as *‘anae*. His sister lived in Lā‘ie and there came a time when there were no fish. She sent her husband to visit Ihuopala‘ai who was kind enough to send the fish following his brother-in-law on his trip back to Lā‘ie.

This story is associated with a poetical saying documented by Mary Kawena Pukui (1983:145) about Honouliuli:

> *Ka i‘a hali a ka makani* The fish fetched by the wind.
>
> [Pukui 1983:145]

Pukui explains, “The ‘anaeholo, a fish that travels from Honouliuli, where it breeds, to Kaipāpa‘u on the windward side of O‘ahu. It then turns about and returns to its original home. It is driven closer to shore when the wind is strong” (Pukui 1983:145).

3.7.4 He Mo‘olelo Ka‘ao no Keaomelemele

In recounting the legend of Keaomelemele, Moses Manu makes a reference to a *mo‘o* (supernatural water spirit or lizard) named Maunauna who lived above Līhu‘e (presumably at the landform of that name in extreme northern Honouliuli) and who was regarded as a bad lizard (Manu 2002:161).

3.7.5 Kanekua‘ana

Kanekua‘ana is a *kia‘i*, a guardian in the form of a *mo‘o*, of ‘Ewa that took care of the people that lived from Hālawa to Honouliuli. Even those who were not her descendants were cared for in times of need. When *i‘a* (fish) became scarce they would build a *waihau heiau* (a temple where hogs, bananas, and coconuts were sacrificed, but not human beings; a *heiau* for *mo‘o* spirits) and pray for Kanekua‘ana’s blessing. She would in turn, bless them with an abundance of *i‘a*.

> The *pipi* (pearl oyster)—strung along from Namakaohalawa to the cliffs of Honouliuli, from the *kuapa* fishponds of inland ‘Ewa clear out to Kapakule. That was the oyster that came in from deep water to the mussel beds near shore, from

> the channel entrance of Pu‘uloa to the rocks along the edges of the fishponds. They grew right on the *nahawele* mussels, and thus was this *i‘a* obtained. Not six months after the *hau* branches [that placed a *kapu* on these waters until the *pipi* should come in] were set up, the *pipi* were found in abundance—enough for all ‘Ewa—and fat with flesh. Within the oyster was a jewel (*daimana*) called a pearl (*momi*), beautiful as the eyeball of a fish, white and shining; white as the cuttlefish, and shining with the colors of the rainbow—reds and yellows and blues, and some pinkish white, ranging in size from small to large. They were of great bargaining value (*he waiwai kumuku‘ai nui*) in the ancient days, but were just ‘rubbish’ (‘*opala*) in ‘Ewa. [Kamakau 1991b:83]

The people were also blessed with many other *i‘a*, including *‘ōpae huna* (transparent shrimp), *‘ōpae kakala* (spiked shrimp), *nehu maoli* (anchovy), *nehu pala* (anchovy), *mahamoe* (shellfish), and *‘okupe (mollusk)*. Some of these marine resources are no longer seen today (Maly and Maly 2003:60).

3.7.6 The First ‘Ulu (Breadfruit) Brought from Kahiki

The chief Kaha‘i left from Kalaeloa, a coastal area in Honouliuli Ahupua‘a, for a trip to Kahiki. On his return to the Hawaiian Islands, he brought back the first breadfruit (Kamakau 1991a:110) and planted it near the waters of Pu‘uloa or “long hill,” now known as Pearl Harbor (Beckwith 1940:97).

3.7.7 Palila

In the *mo‘olelo* of the hero Palila, the famous warrior had a supernatural war club. He could throw the club a long distance, hang on to the end of it, and fly along the club’s path. Using this power, he touched down in several places in Honouliuli, Waipi‘o, and Waikele. One day he used his supernatural war club to carry himself to Ka‘ena Point at Wai‘ānae, and from there east across the district of ‘Ewa. Fornander writes: *Ha‘alele keia ia Ka‘ena, hele mai la a Kalena, a Pōhākea, Maunauna, Kānehoa, a ke kula o Keahumoa, nana ia ‘Ewa. Kū kēia i laila nānā i ke kū a ka ea o ka lepo i nā kānaka, e pahu aku ana kēia i ka la‘au palau aia nei i kai o Honouliuli, kū ka ea o ka lepo, nu lalo o ka honua, me he olai la, makau nā kānaka holo a hiki i Waikele. A hiki o Palila, i laila, e pa‘apu ana nā kānaka i ka nānā lealea a ke ‘li‘i o O‘ahu nei, oai o Ahuapau.*

> After leaving Ka‘ena, he came to Kalena, then on to Pōhākea, then to Manuauna [a peak in Honouliuli], then to Kānehoa [a peak in Honouliuli], then to the plain of Keahumoa [upland plain from Honouliuli to Waipi‘o] and looked toward ‘Ewa. At this place he stood and looked at the dust as it ascended into the sky caused by the people who had gathered there; he then pushed his war club toward Honouliuli. When the people heard something roar like an earthquake they were afraid and they all ran to Waikele. When Palila arrived at Waikele he saw the people gathered there to witness the athletic games that were being given by the king of O‘ahu, Ahupau by name. [Fornander 1918:142–143]

3.7.8 Kākuhihewa

The *ali‘i* were also attracted to Honouliuli Ahupua‘a. One historical account of particular interest, appearing in the newspaper *Ke Au Hou*, refers to an *ali‘i* residing in Ko‘olina, to the west of the project area:

> Ko‘olina is in Waimānalo near the boundary of ‘Ewa and Wai‘ānae. This was a vacationing place for chief Kākuhihewa and the priest Napuaikamao was the caretaker of the place. Remember reader, this Ko‘olina is not situated in the Waimānalo on the Ko‘olau side of the island but the Waimānalo in ‘Ewa. It is a lovely and delightful place and the chief, Kākuhihewa loved this home of his. [*Ke Au Hou* 13 July 1910 in Sterling and Summers 1978:41]

3.8 *Nā Oli* (Chants)

Nā oli, according to Mary Kawena Pukui (Pukui 1995:xvi–xvii) are often grouped according to content. Chants often were imbued with *mana* (divine power); such *mana* was made to manifest through the use of themes and *kaona*. According to Pukui, chants for the gods (*pule*; prayers) came first, and chants for the *ali‘i*, “the descendants of the gods,” came second in significance. Chants “concerning the activities of the earth peopled by common humans,” were last in this hierarchy (Pukui 1995:xvi–xvii). Emerson conversely states:

> In its most familiar form the Hawaiians–many of whom [were lyrical masters]–used the oli not only for the songful expression of joy and affection, but as the vehicle of humorous or sarcastic narrative in the entertainment of their comrades. The dividing line, then, between the oli and those other weightier forms of the mele, the inoa, the kanikau (threnody), the pule, and that unnamed variety of mele in which the poet dealt with historic or mythologic subjects, is to be found almost wholly in the mood of the singer. [Emerson 1965:254]

While *oli* may vary thematically, subject to the perspective of the *ho‘opa‘a* (chanter), it was undoubtedly a valued art form used to preserve oral histories, genealogies, and traditions, to recall special places and events, and to offer prayers to *akua* and *‘aumākua* alike. Perhaps most importantly, as Alameida (1993:26) writes, “chants […] created a mystic beauty […] confirming the special feeling for the environment among Hawaiians: their *one hānau* (birthplace), their *kula iwi* (land of their ancestors).”

3.8.1 *Oli* for Kūali‘i

A chant for the chief Kūali‘i, an ancient chief of O‘ahu, mentions the *ahupua‘a* names of the ‘Ewa District including Honouliuli Ahupua‘a. Each phrase usually contains a play on words, as the place name and one meaning of the word, or portion of the word, appears on each line, for example, *kele* in Waikele means “slippery.” However, these word plays are not necessarily related to the actual place name meanings of the *ahupua‘a*.

Uliuli ka poi e piha nei—o Honouliuli;	Blue is the *poi* [pounded taro] which appeases [the hunger] of Honouliuli;
Aeae ka paakai o Kahuaiki—Hoaeae;	Fine the salt of Kahuaike—Hoaeae;
Pikele ka ia e waikele—o Waikele;	Slippery the fish of Waikele—
Ka hale pio i Kauamoa—o Waipio;	The arched house at Kauamoa— of Waipio;
E kuu kaua i ka loko awa—o Waiawa;	Let us cast the net in the *awa*-pond—of Waiawa;
Mai hoomanana ia oe—o Manana.	Do not stretch yourself at—Manana.
He kini kahawai,	Many are the ravines,
He lau kamano—o Waimano;	Numerous the sharks, at Waimano;

Ko ia kaua e ke au—o Waiau;	We are drawn by the current—of Waiau;
Kukui malumalu kaua—Waimalu;	In the *kukui* grove we are sheltered—in Waimalu;
E ala kaua ua ao-e—o Kalauao;	Let us arise, it is daylight—at Kalauao;
E kipi kaua e ai—o Aiea,	Let us enter and dine—at Aiea;
Mai hoohalawa ia oe—o Halawa.	Do not pass by—Halawa.

[*Ka Nupepa Kuokoa*, Book 7, Number 21, 23 May 1868, He mele no Kualii, Kulanipipili, Kulanioka, Kunuiakea; Fornander 1917b:4(2):400–401]

A chant for the Kaua‘i chief of Kaumuali‘i, a rival of Kamehameha I, also mentions place names of the ‘Ewa District. In a portion of this chant, the wind that blows from one end of ‘Ewa to the other is compared to love.

3.8.1 Hi‘iaka and the Plains of Keahumoa

While passing through ‘Ewa, Hi‘iaka, sister of the goddess Pele, met women stringing *lei* with *ma‘o* (*Gossypium tomentosum*, Hawaiian cotton) flowers. Desiring a *lei* of her own, Hi‘iaka offered a chant:

E lei ana ke kula o Keehumoa i ka ma‘o	The plains of Ke‘ehumoa are garlanded with ma‘o
Ohuohu wale na wahine kui lei o ka nahele	The lei-stringing women of the forest are festively adorned

[Ho‘oumāhiehiemalie 2008a:287; 2008b:268]

In the chant, Hi‘iaka mentions the plains of Ke‘ehumoa, which according to McAllister (1933:107) are located west of Kīpapa Gulch in Waikele. Ke‘ehumoa was also possibly a general name for the flat plain *mauka* of the productive floodplain area directly adjacent to Pearl Harbor.

3.8.1 Hi‘iaka and the Plains of Kaupe‘a

Hi‘iaka sang this bitter chant addressed to Lohi‘au and Wahine‘ōma‘o, which uses the association of the Plains of Kaupe‘a as a place for the wandering of lost souls:

Ku‘u aikana i ke awa lau o Pu‘uloa,	We meet at Ewa’s leaf-shaped lagoon, friends;
Mai ke kula o Pe‘e-kaua, ke noho oe,	Let us sit, if you will on this lea
E noho kaua e kui, e lei i ka pua o ke kauno‘a,	And bedeck us with wreaths of Kauno‘a,
I ka pua o ke akuli-kuli, o ka wili-wili;	Of *akuli-kuli* and *wili-wili*,
O ka iho‘na o Kau-pe‘e i Kane-hili,	My soul went astray in this solitude;
Ua hili au; akahi no ka hili o ka la pomaika‘i;	It lost the track for once, in spite of luck,
E Lohiau ipo, e Wahine-oma‘o,	As I came down the road to Kau-pe‘a.
Hoe ‘a mai ka wa‘a i a‘e aku au.	No nightmare dream was that which tricked my soul.
	This way, dear friends; turn the canoe this way;
	Paddle hither and let me embark.

[Emerson 1915:167–168]

Several other Honouliuli places are mentioned in this chant, including Pe‘ekaua, which may be a variation of Ka-pe‘e or Kaupe‘a, and the plains of Kānehili, the last of which again refers to wandering, as the word *hili* means “to go astray” (Emerson 1993:162). In the chant, Hi‘iaka is moving downhill from Kaupe‘a, probably the plains adjacent to Pu‘uokapolei, toward the coast, the plain of Kānehili.

3.8.1 Ka‘ao no Halemano

In the Legend of Halemano, the romantic O‘ahu anti-hero, he chants a love song with a reference to Honouliuli:

> *Huli a‘e la Ka‘ala kau i luna, Waiho wale kai o Pōka‘ī, Nānā wale ke aloha i Honouliuli, Kokolo kēhau he makani no Līhu‘e* […]
>
> Search is made to the top of Ka‘ala, the lower end of Pōka‘ī is plainly seen. Love looks in from Honouliuli, The dew comes creeping, it is like the wind of Līhu‘e […] [Fornander 1919:5(2):252]

3.9 *Nā Mele* (Songs)

The following section draws from the Hawaiian art of *mele*, poetic songs intended to create two styles of meaning.

> Words and word combinations were studied to see whether they were auspicious or not. There were always two things to consider the literal meaning and the *kaona*, or ‘inner meaning.’ The inner meaning was sometimes so veiled that only the people to whom the chant belonged understood it, and sometimes so obvious that anyone who knew the figurative speech of old Hawai‘i could see it very plainly. There are but two meanings: the literal and the *kaona*, or inner meaning. The literal is like the body and the inner meaning is like the spirit of the poem. [Pukui 1949:247]
>
> The Hawaiians were lovers of poetry and keen observers of nature. Every phase of nature was noted and expressions of this love and observation woven into poems of praise, of satire, of resentment, of love and of celebration for any occasion that might arise. The ancient poets carefully selected men worthy of carrying on their art. These young men were taught the old *meles* and the technique of fashioning new ones. [Pukui 1949:247]

There exist a few *mele* that speak of or mention Honouliuli. These particular *mele* may also be classified as *mele wahi pana* (songs for legendary or historic places). *Mele wahi pana* such as those presented here may or may not be accompanied by *hula* or *hula wahi pana* (dance for legendary or historic places). As the Hula Preservation Society notes:

> *Hula Wahi Pana* comprise a large class of dances that honor places of such emotional, spiritual, historical, or cultural significance that chants were composed for them. Only the composers of the chants could know the deepest meanings, as they would be reflections of their feelings and experiences […] Since the subjects of *Wahi Pana* compositions are extremely varied, their implementation through hula are as well. Coupled with the differences from one *hula* style and tradition to the next, *Hula Wahi Pana* can be exceptionally diverse. They can be done sitting

> or standing, with limited body movement or wide free movement; with or without the use of implements or instruments; with the dancers themselves chanting and/or playing an implement or being accompanied by the *ho‘opa‘a* [drummer and *hula* chanter (memorizer)]. Beyond the particular *hula* tradition, what ultimately determines the manner in which a *Hula Wahi Pana* is performed are the specific place involved, why it is significant, the story being shared about it, and its importance in the composer's view. [Hula Preservation Society 2014]

3.9.1 Me Eia Mai Au ‘o Makalapua

This particular *mele* honors the royal train called *Lanakila*.and its most honored and well-known passenger, Queen Lili‘uokalani. This *mele* may also be understood as a protest song. In analyzing this *mele*, cultural historian Kīhei de Silva notes that "Eia mai Au ‘o Makalapua" is the second of three chants that make up *hō‘alo i ka ihu o ka Lanakila* (Three Train Chants for Lili‘uokalani). He adds that these songs,

> […] when considered in chronological succession […] add a Hawaiian dimension to the story of Benjamin Franklin (B.F.) Dillingham's Oahu Railway and Land Company (OR&L), a story that otherwise reads far too much like an early script of *How the West was Won.* [de Silva 2003]

De Silva provides a chronology of B.F. Dillingham's rise to influence within Hawaiian political spheres, and his eventual founding and construction of the OR&L line. Dillingham also figures prominently within Honouliuli Ahupua‘a (see Section 4.3.1). Dillingham's personal history is described by de Silva as follows:

> Arrived in Honolulu in 1865 as first mate of the *Whistler*.
>
> He promptly fell off a horse and broke his leg. When his ship left without him, he took a job as a clerk in a hardware store.
>
> 20 years later, in 1885, he had become Hawai‘i's first big-time land speculator, buying and leasing vast tracts of property in West O‘ahu in hopes of reselling it to housing and ag. interests.
>
> When no one, in fact, took interest in his largely inaccessible property, he decided to build a railroad through it.
>
> In 1888, Dillingham convinced Kalākaua to sign a franchise giving him three years to build a line running from Honolulu to the far end of Pearl River Lagoon. His critics called it 'Dillingham's Folly,' but Dillingham boasted that he would put his railroad into operation by Sept. 4, 1889, his 45th birthday.
>
> Things did not go well in the early months of construction, and in order to fulfill this boast, Dillingham had to fire up a miniscule saddle-tank engine named *Kauila*, hitch it to a flatcar that carried his passengers on jury-rigged seats, and send it bucking, wheezing, and spewing greasy foam down a mile-and-a-half of track that ended in the rice paddies of Pālama.
>
> Despite this farcical beginning, the construction of Dillingham's railroad then proceeded in rather impressive fashion: the line was opened to ‘Aiea in November

> 1889, to Mānana in January 1890, to Honouliuli and ‘Ewa Mill in June and July 1890, to Wai‘anae in July 1895, to Waialua in June, 1898, and to Kahuku in January 1899. [de Silva 2003]

In 1890, as construction of the railway moved forward, B.F. Dillingham bought and shipped to Hawai‘i a passenger coach named *The Pearl* and a locomotive named *General Valleho.* According to de Silva (2003), the *Pearl* was built in San Francisco and was “paneled in rich woods and outfitted with plush chairs, velvet drapes, electric lights, a kitchen, a lānai with a striped canvas awning, and a new-fangled contraption called a flush toilet.” The *General Valleho* was renamed the *Lanakila* by Dillingham:

> […] [He] gave it the number 45, a tribute to his 45th birthday boast and erstwhile victory in the rice paddies of Pālama. The Lanakila became Dillingham’s 4th locomotive—after the Kauila, Leahi, and Ka‘ala—and for many years it was regarded as the most attractive engine in the OR&L stable. Dillingham apparently wasted no time in hitching the Pearl to the Lanakila and using the pair as his wine-‘em and dine-‘em celebrity train, the vehicle in which he wooed financial and political support for his business ventures. [de Silva 2003]

As part of Dillingham’s plans to woo the influential, he invited King Kalākaua on the inaugural ride on the *Lanakila*. Dillingham also insisted the luxury coach *Pearl* serve as the king’s own royal car. De Silva (2003) notes it is “safe for us to assume that Queen Lili‘u[okalani] rode in the Pearl when the *Lanakila* took her on the train rides.” With the opening of the ‘Ewa Mill station, Queen Lili‘uokalani once again embarked on a journey on the *Lanakila*; this particular journey took her through “the lowlands of Honouliuli, and finally to the exposed coral plain of Pōlea on which the ‘Ewa Mill Station was located” (de Silva 2003).

Eia mai au ‘o Makalapua	Here I am, Makalapua
Hō‘alo i ka ihu o ka Lanakila.	Traveling where the *Lanakila* goes.
‘O ke ku‘e a ka hao a i Kūwili	The piston works at Kūwili
Ka hiona ‘olu a‘o Hālawa.	And down the pleasant descent of Hālawa.
Ua lawa ka ‘ikena i ke awalau	Satisfying is the view of the lochs
Iā ‘Ewa ka i‘a hāmau leo.	Of ‘Ewa, “land of the silent fish.”
Ua piha ka uahi a i Mānana	The smoke rises at Mānana
Aweawe i ke kula o Waipi‘o.	And streams along at Waipi‘o.
I kai ho‘i au a Honouliuli	Then I reached the lowlands of Honouliuli
Ahuwale ke ko‘a o Pōlea.	Where the corals of Pōlea lie exposed.
Ha‘ina ‘ia mai ana ka puana	This is the conclusion of the song
Hō‘alo i ka ihu a ka Lanakila.	Of traveling where the *Lanakila* goes.
[de Silva 2003]	

De Silva (2003) provides a remarkable breakdown of this *mele*, delving into the subtext to reveal another layer of understanding, of *kaona*:

> ‘Makalapua’ shares […] the sense of awesome efficiency and harmony […] These are apparent in ‘Makalapua’s’ description of the working of the train’s piston at Kūwili, in the rising and billowing of steam at Mānana and Waipi‘o, and especially in the sense of speed with which the mele whisks us from Honolulu to Pōlea in the

space of its six, two-line verses. Efficiency and harmony, however, are not at the heart of ‘Makalapua;’ it is inspired and driven, instead, by *aloha ‘āina*—love for the land—and by *kū‘ē ho‘ohui ‘āina*—resistance to annexation. In my reading of the mele, the dominant imagery is that of flower-stringing. The train and track serve as the contemporary equivalent of lei needle and thread; with them, Lili‘u sews a series of beloved place-names and place-associations into a lei of adornment and protection for Ke-awalau-o-Pu‘uloa. Keawalauopu‘uloa, the many-harbored sea of Pu‘uloa, is the old name for Pearl Harbor. The cession of Pearl Harbor to America in return for sugar reciprocity was one of the hottest political issues of ‘Makalapua’s’ day. Lili‘u was absolutely opposed to any Keawalau deals; her brother, on the other hand, had regularly waved this bait at the American nose; he was even rumored, on his Nov. 1890 departure to San Francisco, to have harbored a hidden Pearl Harbor agenda. The key lines of ‘Makalapua’ are ‘Ua lawa ka ‘ikena i ke awalau / Iā ‘Ewa ka i‘ā hāmau leo […] I kai ho‘i au a Honouliuli / Ahuwale ke ko‘a o Pōlea.’ In my reading, these lines say: ‘We hold to our knowledge of Keawalau, we are like its closed-mouthed pipi, its oysters; we will never give up the pearl that we contain; here at the shoreline of Honouliuli we normally silent fish reveal this deeply held conviction.’ [de Silva 2003]

Section 4 Traditional and Historical Background

4.1 Pre-Contact to Early Post-Contact Period

4.1.1 Traditional Settlement Patterns

Early historical accounts of the general region typically refer to the more populated areas of the ‘Ewa district, where missions and schools were established and subsistence resources were perceived to be greater. However, the presence of archaeological sites along the barren coral plains and coast of southwest Honouliuli Ahupua‘a indicates pre-Contact and early historic populations also adapted to less inviting areas, despite the environmental hardships.

Oral traditions related to the ‘Ewa line of chiefs recall battles and chiefly claims upon valuable territories. The rich resources of Pu‘uloa—the fisheries in the lochs, the shoreline fishponds, the numerous springs, and the irrigated lands along the streams—made ‘Ewa a prize for competing chiefs. Battles were fought for the ‘Ewa lands, sometimes by competing O‘ahu chiefs and invading chiefs from other islands.

‘Ewa was a political center and home to many chiefs in its day. Oral accounts of *ali‘i* recorded by Hawaiian historian Samuel Kamakau date back to at least the twelfth century:

> The chiefs of Līhu‘e [upland area in ‘Ewa], Wahiawā, and Halemano on O‘ahu were called *lō ali‘i*. Because the chiefs at these places lived there continually and guarded their *kapu*, they were called *lō ali‘i* [from whom a ‘guaranteed’ chief might be obtained, *loa‘a*]. They were like gods, unseen, resembling men. [Kamakau 1991b:40]

In the mid-eleventh century, Māweke, a direct lineal descendant of the illustrious Nanaulu, ancestor of Hawaiian royalty, was a chief of O‘ahu (Fornander 1996:47). Keaunui, the second of his three sons, became the head of the powerful ‘Ewa chiefs. Tradition tells of him cutting a navigable channel through the Pearl River using his canoe. Keaunui’s son, Lakona, became the progenitor of the ‘Ewa chiefs around 1400 (Fornander 1996:224–226). Chiefs within his line, the Māweke-Kumuhonua line, reigned until about 1520-1540, with their major royal center in Līhu‘e in ‘Ewa (Cordy 2002:24). Haka was the last chief of the Māweke-Kumuhonua line. He was slain by his men at the fortress of Waewae near Līhu‘e (Fornander 1996:88; Kamakau 1991b:54).

Mā‘ilikūkahi was born *ali‘i kapu* (sacred chief) at the birthing stones of Kūkaniloko (Kamakau 1991b:53) and became *mō‘ī* (king) of O‘ahu between 1520-1540 (Cordy 2002:19). Mā‘ilikūkahi was popular during his reign and was remembered for initiating land reforms that brought about peace, and for encouraging agricultural production, which brought about prosperity. He also prohibited the chiefs from plundering the *maka‘āinana*, a prohibition that was punishable by death (Kamakau 1991b:55).

Upon consenting to become *mō‘ī* at the age of 29, Mā‘ilikūkahi was taken to Kapukapuākea Heiau at Pa‘ala‘akai in Waialua to be consecrated. Soon after becoming king, Mā‘ilikūkahi was taken by the chiefs to live at Waikīkī. He was probably one of the first chiefs to live there, as the chiefs had previously always lived at Waialua and ‘Ewa. Under his reign, the land divisions were reorganized and redefined (Pukui et al. 1974:113).

In reference to the productivity of the land and the population during Mā‘ilikūkahi’s reign, Kamakau writes,

> In the time of Mā‘ili-kūkahi, the land was full of people. From the brow, lae, of Kulihemo to the brow of Maunauna in ‘Ewa, from the brow of Maunauna to the brow of Pu‘ukua [Pu‘u Ku‘ua] the land was full of chiefs and people. From Kānewai to Halemano in Wai‘alua, from Halemano to Paupali, from Paupali to Hālawa in ‘Ewa the land was filled with chiefs and people. [Kamakau 1991b:55]

Mā‘ilikūkahi’s peaceful reign was interrupted by an invasion which would change ‘Ewa forever. Fornander describes the Battle of Kīpapa (to be paved [with the corpses of the slain]) at Kīpapa Gulch in Waipi‘o Ahupua‘a:

> I have before referred to the expedition by some Hawaii chiefs, *Hilo-a-Lakapu*, *Hilo-a-Hilo-Kapuhi*, and *Punaluu*, joined by *Luakoa* of Maui, which invaded Oahu during the reign of *Mailikukahi*. It cannot be considered as a war between the two islands, but rather as a raid by some restless and turbulent Hawaii chiefs […] The invading force landed at first at Waikiki, but, for reasons not stated in the legend, altered their mind, and proceeded up the Ewa lagoon and marched inland. At Waikakalaua they met *Mailikukahi* with his forces, and a sanguinary battle ensued. The fight continued from there to the Kipapa gulch. The invaders were thoroughly defeated, and the gulch is said to have been literally paved with the corpses of the slain, and received its name ‘Kipapa,’ from this circumstance. *Punaluu* was slain on the plain which bears his name, the fugitives were pursued as far as Waimano, and the head of *Hilo* was cut off and carried in triumph to Honouliuli, and stuck up at a place still called *Poo-Hilo*. [Fornander 1996:89–90]

Power shifted between the chiefs of different districts from the 1500s until the early 1700s, when Kūali‘i achieved control of all of O‘ahu by defeating the Kona chiefs. He then defeated the ‘Ewa chiefs and expanded his control on windward Kaua‘i. Peleihōlani, the heir of Kūali‘i, gained control of O‘ahu about 1740, and later conquered parts of Moloka‘i. He ruled O‘ahu until his death in about 1778 when Kahahana, of the ‘Ewa line of chiefs, was selected as the ruler of O‘ahu (Cordy 2002:24–41). Somewhere between 1883 and 1885, Kahahana was killed by Kahekili of Maui. The subsequent rebellion amongst the chiefs resulted in a near genocide of the monarchy line on O‘ahu. Oral reports also tell of the stream of Hō‘ai‘ai (Hō‘ae‘ae) in the *ahupua‘a* immediately east of Honouliuli, choked with the bodies of the slain (Fornander 1996:224–226). Kahekili and the Maui chiefs retained control of O‘ahu until the 1790s. Kahekili died at Waikīkī in 1794. His son, Kalanikūpule, was defeated the following year at the Battle of Nu‘uanu by Kamehameha (Kamakau 1992:376–377). Thus, the supremacy of the ‘Ewa chiefs came to a final end.

4.1.2 Traditional Agricultural Resources

Various Hawaiian legends and early historical accounts indicate the *ahupua‘a* of Honouliuli was once widely inhabited by pre-Contact populations, including *ali‘i.* This would be attributable, for the most part, to the plentiful marine and estuarine resources available at the coast, along which several sites interpreted as permanent habitations and fishing shrines have been located. Other attractive subsistence-related features of the *ahupua‘a* include irrigated lowlands suitable for

wetland taro cultivation, as well as the lower forest area of the mountain slopes for the procurement of forest resources. Handy and Handy (1972) report the following:

> The lowlands, bisected by ample streams, were ideal terrain for the cultivation of irrigated taro. The hinterland consisted of deep valleys running far back into the Ko‘olau range. Between the valleys were ridges, with steep sides, but a very gradual increase of altitude. The lower parts of the valley sides were excellent for the cultture of yams and bananas. Farther inland grew the *‘awa* for which the area was famous. [Handy and Handy 1972:429]

In addition, breadfruit, coconuts, *wauke* (paper mulberry; *Broussonetia papyrifera*), bananas, and *olonā* (*Touchardia latifolia*) and other plants were grown in the interior. ‘Ewa was known as one of the best areas to grow gourds and was famous for its *māmaki* (*Pipturus*). It was also famous for a rare taro called the *kāī o ‘Ewa*, which was grown in mounds in marshy locations (Handy and Handy 1972:471). The cultivation of this prized and delicious taro led to the saying:

> *Ua ‘ai i ke kāī-koi o ‘Ewa.*
>
> He has eaten the kāī-koi taro of ‘Ewa.
>
> Kāī is O‘ahu’s best eating taro; one who has eaten it will always like it. Said of a youth of a maiden of ‘Ewa, who, like the kāī taro, is not easily forgotten.
>
> [Pukui 1983:305]

Exploitation of the forest resources along the slopes of the Wai‘anae Range—as suggested by E.S. and E.G. Handy—probably acted as a viable subsistence alternative during times of famine:

> The length or depth of the valleys and the gradual slope of the ridges made the inhabited lowlands much more distant from the *wao*, or upland jungle, than was the case on the windward coast. Yet the *wao* here was more extensive, giving greater opportunity to forage for wild foods in famine time. [Handy and Handy 1972:469]

These upper valley slopes may have also been a significant resource for opportunistic quarrying of basalt for the manufacturing of stone tools.

Subsequent to Western Contact in the area, the landscape of the ‘Ewa Plain and Wai‘anae slopes was adversely affected by the removal of the sandalwood and other trees, and the introduction of domesticated animals and new vegetation. Goats, sheep, and cattle were brought to the Hawaiian Islands by Vancouver in the early 1790s and allowed to graze freely about the land for some time after. L.A. Henke reports the existence of a longhorn cattle ranch in Wai‘anae by at least 1840 (Frierson 1972:10). During this time, perhaps as early as 1790, exotic vegetation species were introduced to the area. These typically included vegetation best suited to a terrain disturbed by the logging of sandalwood forest and eroded by animal grazing. The following dates for the introduction of exotic vegetation are given by R. Smith and outlined by Frierson (1972:10–11):

1. ‘early,’ c. 1790: for the establishment of Prickly pear cactus, (*Opuntia tuna), Haole koa, (Leucaena leucocephala)* and Guava (*Psidium guajava)*
2. 1835-1840: Burmuda [*sic*] grass (Cynodon dactylon) and Wire grass (Eleusine indica)
3. 1858: Lantana (*Lantana camara)*

The *kiawe* tree (*Prosopis pallida*) was also introduced during this period, either in 1828 or 1837 (Frierson 1972:11).

4.2 Early Historic Period

4.2.1 Observations of Early Explorers and Visitors

Captain James Cook arrived in the Hawaiian Islands in 1778, and ten years later the first published description of Pearl Harbor appeared. Captain Nathaniel Portlock, observing the coast of Honolulu for Great Britain, recorded the investigation of a “fine, deep bay running well to the northward” around the west point of “King George’s Bay” in his journal (Portlock 1789:74). Portlock’s description matches the entire crescent-shaped shoreline from Barbers Point to Diamond Head.

Captain George Vancouver made three voyages to the Hawaiian Islands between 1792 and 1794. In 1793, the British captain recorded the name of the harbor opening as “O-poo-ro-ah” (Pu‘uloa) and sent several boats across the sand bar to venture into the harbor proper (Vancouver 1798:884). The area known as “Pu‘u-loa” was comprised of the eastern bank at the entrance to Pearl River. George Vancouver anchored off the entrance to West Loch in 1793, and the Hawaiians told him of the area at “a little distance from the sea, the soil is rich, and all the necessaries of life are abundantly produced” (Vancouver 1798:215). Mr. Whitbey, one of Vancouver’s crew, observed, “from the number of houses within the harbour it should seem to be very populous; but the very few inhabitants who made their appearance were an indication of the contrary” (Vancouver 1798:216).

Captain Vancouver sailed by Kalaeloa (Barbers Point) in 1792, and recorded his impression of the small coastal village of Kūalaka‘i and the arid Honouliuli coast:

> The point is low flat land, with a reef round it […] Not far from the S.W. point is a small grove of shabby cocoa-nut trees, and along these shores are a few fishermen’s huts. [Vancouver 1798:1:167]
>
> […] from the commencement of the high land to the westward of Opooroah [Pu‘uloa], was composed of one barren rocky waste, nearly destitute of verdure, cultivation or inhabitants, with little variation all the way to the west point of the island. [Vancouver 1798:2:217]
>
> This tract of land was of some extent but did not seem to be populous, nor to possess any great degree of fertility; although we were told that at a little distance from the sea, the soil is rich, and all necessaries of life are abundantly produced. [Vancouver 1798:3:361–363]

Henry Barber was an English sea captain who traveled around the Hawaiian Islands during 1794 to 1807. Barber is the namesake for the common place name known today as Barbers Point, traditionally Kalaeloa.

> In 1795 he left China in the ship Arthur for the northwest going again by way of Australia. In the following summer he was trading along the Alaskan and British Columbian coast. In Sept. 1796, he left Nootka Sound for Canton via ‘the Island.’ The Arthur called in at Honolulu at the end of October for provisions and re-fittings.

> At 6 p.m. on October 31, 1796, Barber sailed the Arthur out of Honolulu harbor for Kauai to get a supply of yams. Two hours later the brig hit a shoal about an acre in extent with 12 feet of water over it, and close to the breakers. The shoal was probably a little to the westward of Pearl Harbor. But as Judge Howay says, how the skipper steered his brig into such a position is a mystery. [Sterling and Summers 1978:40]

Kamakau recalls the same incident as follows:

> In October, 1796, a ship [*Arthur*, under Henry Barber] went aground at Kalaeloa, Oahu. This ship had visited the island on several occasions during the rule of Ka-lani-ku-pule. This was the first time a foreign ship had grounded on these shores, Kamehameha was on Hawaii, but Young had remained on Oahu. All the men on the ship came ashore at night in their boats. At daylight when the ship was seen ashore Ku-i-helani placed a ban on the property of the ship and took care of the foreigners. Hawaiian divers recovered the valuables, and they were given over to the care of Ku-i-helani, but part were given by Captain Barber to the men who had recovered them. [Kamakau 1992:174]

During the first decades of the nineteenth century, several western visitors described the ‘Ewa landscape near Pearl Harbor. Archibald Campbell, an English sailor, spent some time in Hawai‘i during 1809-1810. He had endured a shipwreck off the Island of Sannack on the northwest coast of America. As a result, both his feet became frostbitten and were amputated. He spent over a year recuperating in the Hawaiian Islands. His narrative is considered noteworthy because it describes life in the ‘Ewa District before the missionaries arrived. During part of his stay, he resided with King Kamehameha I, who granted him 60 acres in Waimano Ahupua‘a in 1809. Campbell described his land:

> In the month of November the king was pleased to grant me about sixty acres of land, situated upon the Wymummee [traditional Hawaiian name for Pearl River, “Waimomi”], or Pearl-water, an inlet of the sea about twelve miles to the west of Hanaroora [Honolulu]. I immediately removed thither; and it being Macaheite time [Makahiki], during which canoes are tabooed, I was carried on men’s shoulders. We passed by footpaths winding through an extensive and fertile plain, the whole of which is in the highest state of cultivation. Every stream was carefully embanked, to supply water for taro beds. Where there was no water, the land was under crops of yams and sweet potatoes. The roads and numerous houses are shaded by cocoa-nut trees, and the sides of the mountains are covered with wood to a great height. We halted two or three times, and were treated by the natives with the utmost hospitality. My farm, called Wymannoo [Waimano], was upon the east side of the river, four or five miles from its mouth. Fifteen people with their families resided upon it, who cultivated the ground as my servants. There were three houses upon the property; but I found it most agreeable to live with one of my neighbours, and get what I wanted from my own land. This person’s name was William Stevenson a native of Borrowstouness. [Campbell 1967:103–104]

Of the Pearl River area, Campbell wrote:

> Wymumme, or Pearl River, lies about seven miles farther to the westward. This inlet extends ten or twelve miles up the country. The entrance is not more than a quarter of a mile wide, and is only navigable for small craft; the depth of water on the bar, at the highest tides, not exceeding seven feet; farther up it is nearly two miles across. There is an isle in it, belonging to Manina, the king’s interpreter, in which he keeps a numerous flock of sheep and goats. [Campbell 1967:114]
>
> The flat land along shore is highly cultivated; taro root, yams, and sweet potatoes, are the most common crops; but taro forms the chief object of their husbandry, being the principal article of food amongst every class of inhabitants. [Campbell 1967:115]

Botanist F.J.F. Meyen visited Hawai‘i in 1831 and writes of the abundant vegetation described by Campbell in the vicinity of Pearl Harbor. His account of large stretches of cultivated land surrounding Pearl Harbor suggests the presence of a viable population settlement in the area.

> At the mouth of the Pearl River the ground has such a slight elevation that at high tide the ocean encroaches far into the river, helping to form small lakes which are so deep, that the long boats from the ocean can penetrate far upstream. All around these water basins the land is extraordinarily low but also exceedingly fertile and nowhere else on the whole island of Oahu are such large and continuous stretches of land cultivated. The taro fields, the banana plantations, the plantations of sugar cane are immeasurable. [Meyen 1981:63]

However, a contrasting picture of ‘Ewa is recorded by the missionary William Ellis in 1823-1824, of the ‘Ewa lands away from the coast:

> The plain of Eva is nearly twenty miles in length, from the Pearl River to Waiarua [Wailua], and in some parts nine or ten miles across. The soil is fertile, and watered by a number of rivulets, which wind their way along the deep water-courses that intersect its surface, and empty themselves into the sea. Though capable of a high state of improvement, a very small portion of it is enclosed or under any kind of culture, and in travelling across it, scarce a habitation is to be seen. [Ellis 1963:7]

4.2.2 Missionaries

The first company of Protestant missionaries from America, part of the American Board of Commissioners of Foreign Missions (ABCFM), arrived in Honolulu in 1820. They quickly established churches in Kona on Hawai‘i, Waimea on Kaua‘i, and Honolulu on O‘ahu. Although the missionaries were based in Honolulu, they traveled around the islands intermittently to preach to rural Native Hawaiians and to check on the progress of English and Bible instruction schools set up by local converts.

In 1828, the missionary Levi Chamberlain (1956:39–40) made a circuit of O‘ahu, stopping wherever there was a large enough population to warrant a sermon or a school visit. In his trek through the ‘Ewa District from Wai‘anae, he stopped at Waimānalo, an *‘ili* in Honouliuli, on the western border of ‘Ewa. At around 11 o’clock the next day, on a Saturday, Chamberlain and his companions set out toward the east, reaching Waikele at three or four o’clock. The group did not stop in Hō‘ae‘ae, suggesting that the population was too small for a school, but Waikele had two schools, an obviously larger population than Hō‘ae‘ae. In fact, Chamberlain decided to stay in

Waikele until the next day, the Sabbath, and preach to the Native Hawaiians who lived there. A crowd of 150 to 200 gathered for the sermon. The next day at six o’clock they set out for the village of Waipi‘o, which had one school. They left Waipi‘o at about 8:30, and walked to Waiawa, where there were two schools. Around ten o’clock, they began their circuit again, stopping only in the *ahupua‘a* of Kalauao in the ‘Ewa District before they reached Moanalua Ahupua‘a in the Kona District. The account does not give much information on the surroundings, but does indicate the relatively populated areas of ‘Ewa, in western Honouliuli, Waikele, Waipi‘o, Waiawa, and Kalauao, and the time it took to travel by foot along the trails across the ‘Ewa District.

The first mission station in ‘Ewa was established in 1834 at Kalua‘aha near Pearl Harbor. Charles Wilkes, of the U.S. Exploring Expedition visited the missionary enclave at Honouliuli town in 1840.

> At Ewa, Mr. Bishop has a large congregation. The village comprises about fifty houses, and the country around is dotted with them […] The natives have made some advance in the arts of civilized life; there is a sugar-mill which, in the season, makes two hundred pounds of sugar a day […] In 1840, the church contained nine hundred members, seven hundred and sixty of whom belonged to Ewa, the remainder to Waianae; but the Catholics have now established themselves at both these places, and it is understood are drawing off many from their attendance on Mr. Bishop’s church. [Wilkes 1970:80–81]

4.2.3 Honouliuli Taro Lands

In early historic times, the population of Honouliuli was concentrated at the western edge of West Loch in the vicinity of Kapapapuhi Point in the “Honouliuli Taro Lands.” This area was clearly a major focus of population due to the abundance of fish and shellfish resources in close proximity to a wide expanse of well-irrigated bottomland suitable for wetland taro cultivation. Dicks et al. (1987:78–79) conclude, on the basis of 19 radiocarbon dates and three volcanic glass dates, that “Agricultural use of the area spans over 1,000 years.”

Undoubtedly, Honouliuli was a locus of habitation for thousands of Hawaiians. Prehistoric population estimates are a matter of some debate but it is worth pointing out that in the earliest mission census (1831-1832) the land of Honouliuli contained 1,026 men, women, and children (Schmitt 1973:19). It is not clear whether this population relates to Honouliuli Village or district but the village probably contained the vast majority of the district’s population. The nature of the reported population structure for Honouliuli (less than 20% children under 12 years of age) and the fact that the population decreased more than 15% in the next four years (Schmitt 1973:22) suggests the pre-Contact population of Honouliuli Village may well have been significantly greater than it was in the 1830s.

4.2.4 The Māhele and the Kuleana Act

During the Māhele of 1848, 99 individual land claims in the *ahupua‘a* of Honouliuli were registered and awarded by King Kamehameha III. No *kuleana* land claims were made for land within the current project area or vicinity. The vast majority of the Land Commission Awards (LCA) were located in Honouliuli near the taro lands of the *‘ili* of Pu‘uloa and the Pu‘uloa Salt Works. The largest award (Royal Patent 6071, LCA 11216, ‘Āpana [parcel] 8) in Honouliuli Ahupua‘a was granted to Miriam Ke‘ahi-Kuni Kekau‘onohi on January 1848 (Native Register

1848). Kekau‘onohi acquired a deed to all unclaimed land within the *ahupua‘a*, including a total of 43,250 acres encompassing the present project area.

Samuel Kamakau relates the following about Kekau‘onohi as a child:

> Kamehameha’s granddaughter, Ke-ahi-Kuni Ke-kau-‘onohi […] was also a tabu chiefess in whose presence the other chiefesses had to prostrate and uncover themselves, and Kamehameha would lie face upward while she sat on his chest. [Kamakau 1992:208–209]

Kekau‘onohi was one of Liholiho’s (Kamehameha II’s) wives, and after his death, she lived with her half-brother, Luanu‘u Kahala‘i‘a, who was governor of Kaua‘i (Kamakau 1992:346). Subsequently, Kekau‘onohi ran away with Queen Ka‘ahumanu’s stepson, Keli‘i-ahonui, and then became the wife of Chief Levi Ha‘alelea (Kamakau 1992:280). Upon her death on 2 June 1851, all her property passed to her husband and his heirs. When Levi Ha‘alelea died, the property went to his surviving wife, who in turn leased it to James Dowsett and John Meek in 1871 for stock running and grazing.

4.2.5 Population Decline

At Contact, the most populous *ahupua‘a* on the island of O‘ahu was Honouliuli, with the majority of the population centered on Pearl Harbor. In 1832, a missionary census of Honouliuli recorded the population as 1,026, which represented 25% of the total ‘Ewa district population of 4,015 (Schmitt 1973:19).

Beginning with the time of Western Contact, however, Hawaiian populations were introduced to many virulent western diseases which began to decimate the native populations. Thus, four years following the 1832 census, the ‘Ewa population had dropped to 3,423 (Schmitt 1973:9, 36), “a decrease of 592 in 4 years” (Ewa Station Reports 1836). Reverend Lowell Smith noted,

> The people of Ewa are a dying people. I have not been able to obtain an exact count of all the deaths & births since the last general meeting. But my impression is that there have been as many as 8 or 10 deaths to one birth. I have heard of but 4 births on Waiawa during the year, & all of these children are dead. I have attended about 20 funerals on that one land, & 16 of these were adults. [Ewa Station Reports 1836]

Between 1848 and 1853, there was a series of epidemics of measles, influenza, and whooping cough that often wiped out whole villages. In 1853, the population of ‘Ewa and Wai‘anae combined was 2,451 people. In 1872, it was 1,671 (Schmitt 1968:71). The inland area of ‘Ewa was probably abandoned by the mid-nineteenth century due to population decline and consolidation of the remaining people in town.

4.3 Mid- to Late 1800s

4.3.1 Ranching in Lower Honouliuli

In 1871, John Coney rented the lands of Honouliuli to James Dowsett and John Meek, who used the land for cattle grazing. In 1877, James Campbell purchased most of Honouliuli Ahupua‘a, except the *‘ili* of Pu‘uloa, for a total of $95,000. He then drove off 32,347 head of cattle belonging to Dowsett, Meek, and James Robinson, and constructed a fence around the outer boundary of his

property (Bordner and Silva 1983:C-12), as shown in Figure 14. He let the land rest for one year and then began to restock the ranch, so that he had 5,500 head after a few years.

In 1881, a medical student providing smallpox vaccinations around the island wrote about Campbell’s property which was called the Honouliuli Ranch.

> I took a ride over the Honouliuli Ranch which is quite romantic. The soil is a deep, reddish loam, up to the highest peaks, and the country is well-grassed. Springs of water abound. The ‘ilima, which grows in endless quantities on the plains of this ranch, is considered excellent for feeding cattle; beside it grows the indigo plant, whose young shoots are also good fodder, of which the cattle are fond. Beneath these grows the manieizie grass, and Spanish clover and native grasses grow in the open; so there is abundant pasturage of various kinds here. As I rode, to the left were towering mountains and gaping gorges; ahead, undulating plains, and to the right, creeks and indentations from the sea. A wide valley of fertile land extends between the Nuuanu Range and the Waianae Mountains and thence to the coast of Waialua. There are many wild goats in this valley, which are left more or less undisturbed because they kill the growth of mimosa bushes, which would otherwise overrun the country and destroy the pasturage for cattle. [Briggs 1926:62–63]

The following excerpts were also written in 1880-1881, describing Honouliuli Ranch:

> Acreage, 43,250, all in pasture, but possessing fertile soils suitable for agriculture; affords grazing for such valuable stock. The length of this estate is no less than 18 miles. It extends to within less than a mile of the sea coast, to the westward of the Pearl River inlet […] There are valuable fisheries attached to this estate […] [Bowser 1880:489]

> From Mr. Campbell’s veranda, looking eastward, you have one of the most splendid sights imaginable. Below the house there are two lochs, or lagoons, covered with water fowl, and celebrated for their plentiful supply of fish, chiefly mullet […] Besides Mr. Campbell’s residence, which is pleasantly situated and surrounded with ornamental and shade trees, there are at Honouliuli two churches and a school house, with a little village of native huts. [Bowser 1880:495]

Most of Campbell’s lands in Honouliuli were used exclusively for cattle ranching. At that time, one planter remarked that “the country was so dry and full of bottomless cracks and fissures that water would all be lost and irrigation impracticable” (Ewa Plantation Company 1923:6–7). In 1879, Campbell brought in a well-driller from California to search the ‘Ewa plains for water, and the well, drilled to a depth of 240 ft near Campbell’s home in ‘Ewa, resulted in “a sheet of pure water flowing like a dome of glass from all sides of the well casing” (*The Legacy of James Campbell* n.d. in Pagliaro 1987:3). Following this discovery, plantation developers and ranchers drilled numerous wells in search of the valuable resource.

4.3.1 Oahu Railway and Land Company (OR&L)

In 1886, Campbell and B.F. Dillingham put together the “Great Land Colonization Scheme,” which was an attempt to sell Honouliuli land to homesteaders (Thrum 1887:74). This homestead idea failed. The failure was attributed to the lack of water and the distance from ‘Ewa to Honolulu. The water problem was solved by the drilling of artesian wells, and Dillingham decided the area

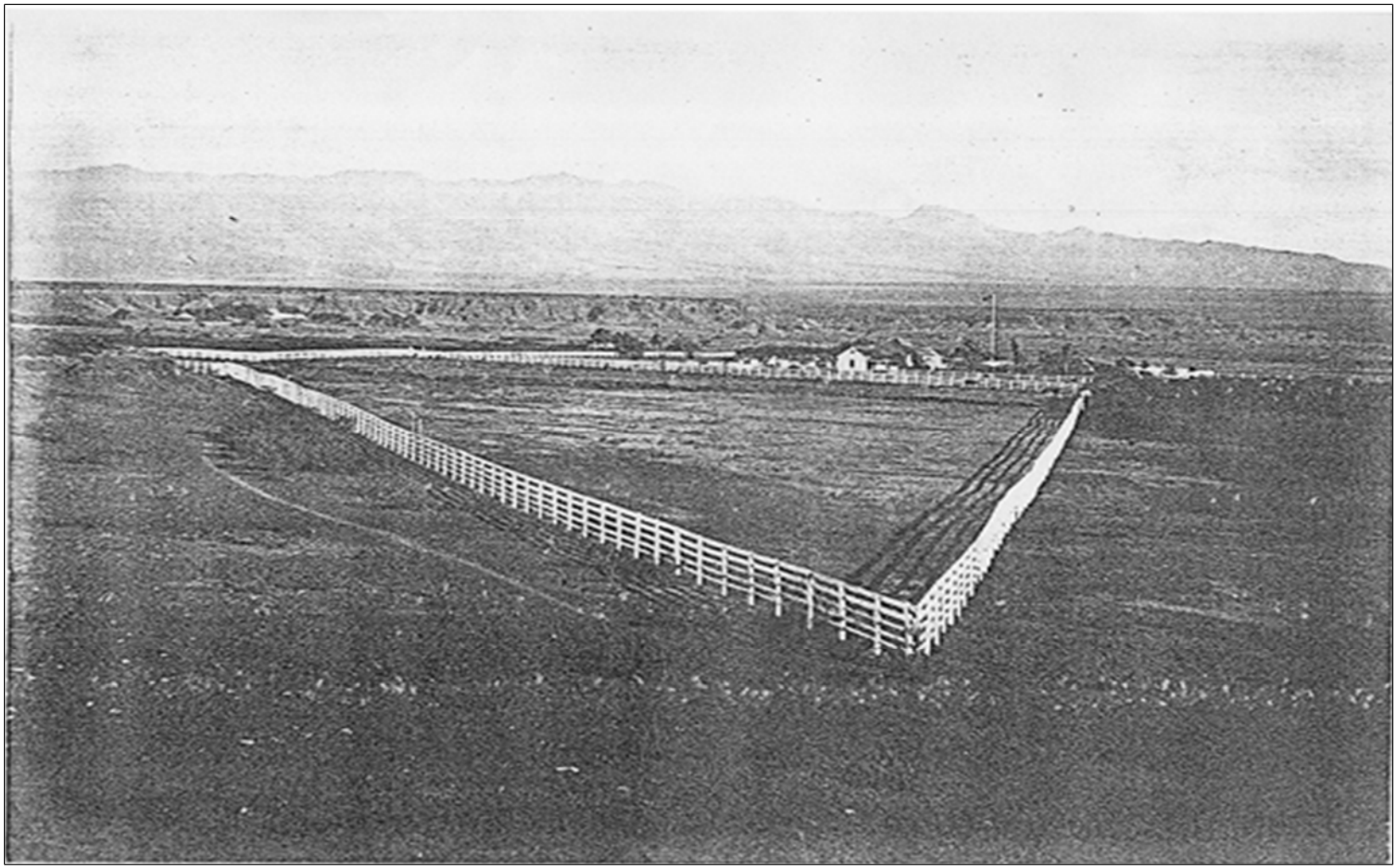


Figure 14. 1880s photograph of James Campbell‘s residence on the ‘Ewa Plain (Hawai‘i State Archives)

could be used instead for large-scale cultivation (Pagliaro 1987:4). The transportation problem was to be solved by the construction of a railroad, which Dillingham soon began to finance under the company name Oahu Railway and Land Company (OR&L).

During the last decade of the nineteenth century, the railroad reached from Honolulu to Pearl City in 1890, Wai‘ānae in 1895, Waialua Plantation in 1898, and Kahuku in 1899 (Kuykendall 1967:III, 100). This railroad line eventually ran across the center of the ‘Ewa Plain at the lower boundary of the sugar fields (Figure 15). To attract business to his new railroad system, Dillingham subleased all land below 200 ft to William Castle, who in turn sublet the area to the newly formed Ewa Plantation Company (Frierson 1972:15). Dillingham’s Honouliuli lands above 200 ft that were suitable for sugarcane cultivation were sublet to the Oahu Sugar Company. Throughout this time, and continuing into modern times, cattle ranching continued in the area, and Honouliuli Ranch, established by Dillingham, was the “fattening” area for the other ranches (Frierson 1972:15).

Operations at the OR&L began to slow down in the 1920s, when electric streetcars were built for public transportation within the city of Honolulu and automobiles began to be used by families for transportation outside the city (Chiddix and Simpson 2004:185). The build-up to World War II turned this decline around, as the U.S. military utilized the OR&L lines to transport materials to build defense projects around the island. Historians have noted that one of the most serious mistakes made by the Japanese in their 1941 attack on Pearl Harbor was their decision not to bomb the railway infrastructure. Soon after the attack, the OR&L operated 24 hours a day, transporting war materials and troops from Honolulu to the new and expanded army, naval, and air bases. The huge navy base at Pearl Harbor had its own rail lines that connected to the OR&L rail lines.

In August 1945, the war ended, and so did OR&L’s heyday as a military transport line.

> She had served her country well and proudly during the war, but operating round-the-clock on what little maintenance could be squeezed in, had taken a prodigious hit on the locomotives and track. Traffic stayed steady for a short time, but soon dropped precipitously as soldiers and sailors went home, military posts were shrunk or razed, and civilians could again get tires, gasoline and new cars. [Chiddix and Simpson 2004:257]

There was no choice but to abandon the OR&L main line, and in 1946 Walter F. Dillingham, son of B.F. Dillingham, wrote:

> The sudden termination of the war with Japan changed not only the character of our transportation, but cut the freight tonnage to a third and the passenger business to a little above the pre-war level. With the increased cost of labor and material and the shrinkage in freight tonnage and passenger travel, it was definite that the road could not be operated as a common carrier. With no prospect of increased tonnage, and the impossibility of increasing rates against truck competition, your management has applied to the Interstate Commerce for authority to abandon its mainline. [Chiddix and Simpson 2004:257]

After the war, most of the 150 miles or more of OR&L track were pried up, locomotives were sold to businesses on the U.S. mainland, and railway cars were scrapped. In 1947, the U.S. Navy took over a section of the OR&L track for their own use, to transport bombs, ammunition, and

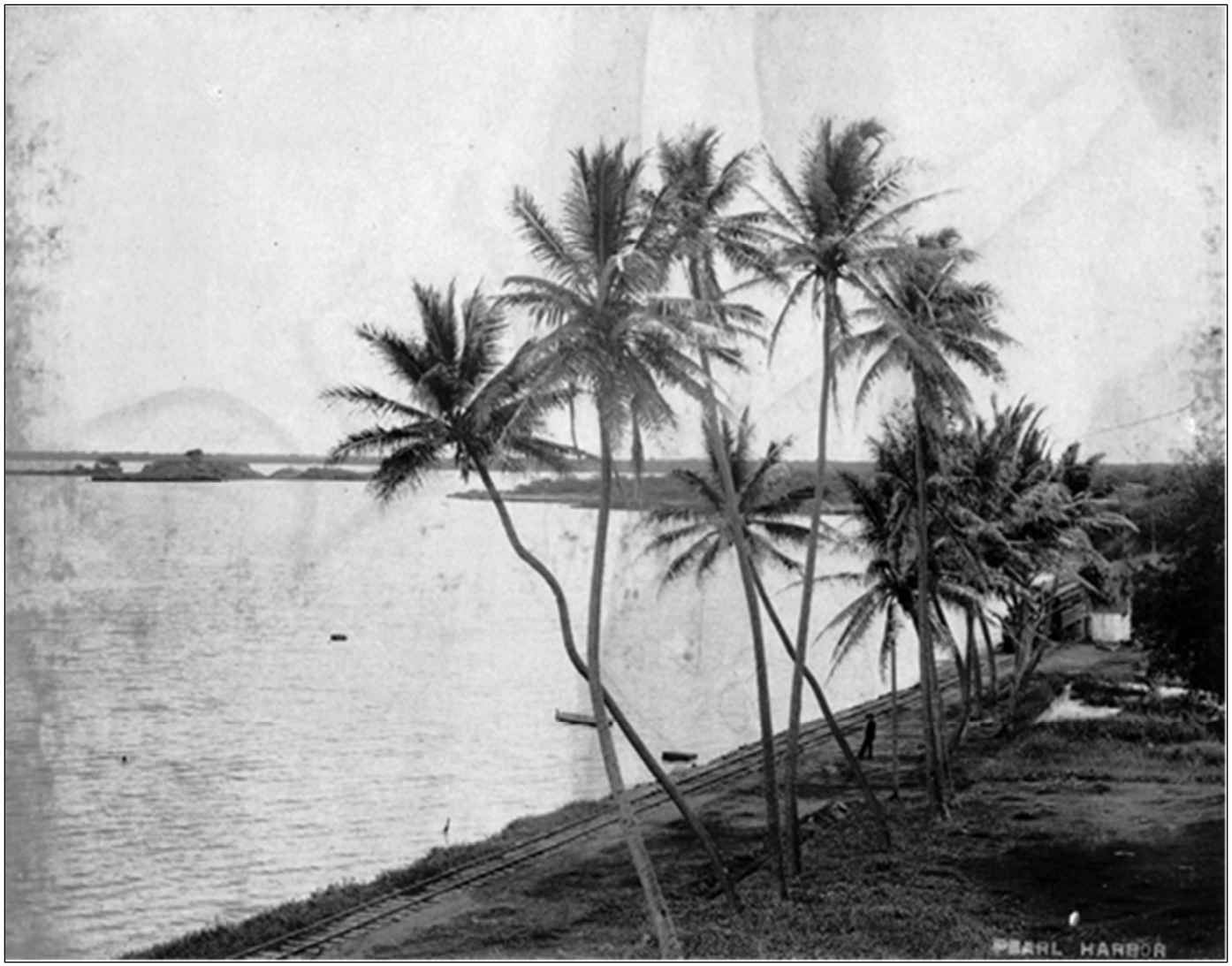


Figure 15. 1890 photograph of Pearl Harbor with OR&L railroad tracks along the coast (Honolulu Advertiser Archives)

torpedoes from the ammunition magazines at Lualualei, West Loch in Pearl Harbor, and Waikele on OR&L’s Wahiawā Branch to Pearl Harbor Naval Base (Treiber 2005:25–26). The track to Waipahu was abandoned in the 1950s, but the line from the magazines in Lualualei to the wharves in West Loch at Pearl Harbor remained open until 1968. Additionally, the still-existing OR&L rail line through Honouliuli has been placed on the National Register of Historic Places (SIHP # 50-80-12-9714).

4.3.1 The Sugar Plantations of ‘Ewa

Although sugarcane was already being grown as long ago as the early 1800s, the industry revealed its economic potential in 1879 when the first artesian well was drilled in ‘Ewa (Ellis 1995:22). The availability of subsurface water resources enabled greater irrigation possibilities for expanding plantations besides the use of water diversions from the surrounding stream systems. This prompted the drilling of many other wells throughout the Hawaiian Islands, thereby commencing the Hawai‘i sugar plantation era. By the early 1900s, all of the main Hawaiian Islands had land devoted to sugarcane production.

Agricultural field systems, railroads, and residential areas in ‘Ewa were developed by three sugarcane companies, the Ewa Plantation Company, located largely in the *ahupua‘a* of Honouliuli and Hō‘ae‘ae in the western section of ‘Ewa; the Oahu Sugar Company, extending in the areas upland of the Ewa Plantation Company in central ‘Ewa, including a portion of the uplands of Waiawa; and the Honolulu Plantation Company, with fields extending through Mānana to Hālawa in the eastern section of ‘Ewa.

4.3.1 The Ewa Plantation Company

The Ewa Plantation Company was incorporated in 1890 for sugarcane cultivation (Figure 16). The first crop, 2,849 tons of sugar, was harvested in 1892. The Ewa Plantation Company was the first all-artesian plantation, and it gave an impressive demonstration of the part artesian wells were to play in the later history of the Hawaiian sugar industry (Kuykendall 1967:69). As a means to generate soil deposition on the coral plain and increase arable land in the lowlands, the Ewa Plantation Company installed ditches running from the lower slopes of the mountain range to the lowlands. When the rainy season began, they plowed ground perpendicular to the slope so that soil would be carried down the drainage ditches into the lower coral plain. After a few years, about 373 acres of coral wasteland were reclaimed in this manner (Immisch 1964:3). By the 1920s, Ewa Plantation Company was generating large profits and was the “richest sugar plantation in the world” (*Paradise of the Pacific*, December 1902:19–22 in Kelly 1985:171). Figure 16 is an aerial shot taken ca. 1925.

During the twentieth century, the Ewa Plantation Company continued to grow and, by the 1930s, encompassed much of the eastern half of Honouliuli Ahupua‘a. This growth impelled the creation of plantation villages to house the growing immigrant labor force working the fields. After the outbreak of World War II, which siphoned off much of the plantation’s manpower, along with the changeover to almost complete reliance on mechanical harvesting in 1938, there was little need for the large multi-racial (Japanese, Chinese, Okinawan, Korean, Portuguese, Spanish, Hawaiian, Filipino, European) labor force that had characterized most of the early history of the plantation. The Oahu Sugar Company took control over the Ewa Plantation lands in 1970 and continued operations until 1995, when they decided to shut down sugarcane production in the combined plantation areas (Dorrance and Morgan 2000:45, 50).

Figure 16. Ewa Plantation Company sugarcane fields, Filipino Camp area, ca. 1925 (University of Hawai‘i at Mānoa)

During the subsequent decades of the twentieth century, sugarcane operations in ‘Ewa phased out and, more recently, former cane lands have been rezoned for residential development. Structures in the area of the former plantation villages have fallen into disrepair or have been demolished. However, portions of the area including Varona Village, Tenney Village, and Renton Village have been designated the ‘Ewa Villages Historic District (State Inventory of Historic Places [SIHP] # 50-80-12-9786), which has been nominated for National Historic Landmark status. The Oahu Sugar Company took control over the Ewa Plantation lands in 1970 and continued operations into the 1990s.

4.3.1 The Oahu Sugar Company and the Waiahole Ditch

In 1889, Benjamin Dillingham organized the OR&L Company which connected the outlying areas of O‘ahu to Honolulu. By 1890, the railroad reached from Honolulu to Pearl City and continued on to Wai‘anae in 1895, to Waialua Plantation in 1898, and to Kahuku in 1899 (Kuykendall 1967:100).

In 1897, B.F. Dillingham established the Oahu Sugar Company (OSC) on 12,000 acres leased from the estates of John Papa ‘Ī‘ī, Bishop, and Robinson. The Oahu Sugar Company had over 900 field workers, composed of 44 Hawaiians, 473 Japanese, 399 Chinese, and 57 Portuguese. The first sugar crop was harvested in 1899, ushering in the sugar plantation era in Waipahu (Ohira 1997).

Prior to commercial sugar cultivation, these lands were described as being “of near desert proportion until water was supplied from drilled artesian wells and the Waiahole Water project” (Condé and Best 1973:313). Dillingham had successfully promoted the Ewa Plantation Company in 1890; the sprawling sugar company was just south of and adjacent to the OSC. Artesian wells had converted those arid ‘Ewa lands into a thriving plantation, and Dillingham recognized the same potential in the northern area.

Water to irrigate the upper cane fields was initially pumped to levels of 500 ft by some of the “largest steam pumps ever manufactured” (Dorrance and Morgan 2000:49). The expense of pumping water to the high elevations of the plantation led to the proposal to transport water from the windward side of the Ko‘olau Mountains. The Waiahole Water Company was formally incorporated in 1913 and was originally a subsidiary of the Oahu Sugar Company. The Waiahole Ditch was designed by engineer Jorgen Jorgensen, with recommendations by engineer J.B. Lippencott and assisted by W.A. Wall. The original system, when completed, included 27 tunnels connecting with 37 stream intakes on the north side of the Ko‘olau, with the main bore through Waiāhole Valley, then connecting it to the 14 tunnels on the southern side of the Ko‘olau at Waiawa, and thence by ditch westward to Honouliuli, covering a total of 13.6 km (Condé and Best 1973:37). Upon its completion in 1916, the Waiahole Ditch was 35 km (21.9 miles) long and cost $2.3 million. The 32 million gallons of daily water enabled the Oahu Sugar Company to grow to “some 20 square miles […] ranging in elevation from 10 ft at the Waipio Peninsula […] to 700 ft at the Waiahole Ditch” (Condé and Best 1973:313). The ditch system, with some modifications, is still in use. It is included on the state inventory of historic places as SIHP # 50-80-09-2268.

This ditch complex first passed through Hō‘ae‘ae, bringing much needed water to the area. Kluegel describes the area:

> West of Waikakalaua Gulch, through Hoaeae and to the upper boundary of Oahu Plantation in Honouliuli, the conduit consists of 12,650 feet of cement-lined ditches, and three redwood pipes 5 feet in diameter, having an aggregate length of 2,830 feet. [Kluegel 1917:96]
>
> The Waiahole Water Co. has taken over from the Oahu Sugar Co. the Ahrens Ditch in Waiawa, the Kipapa Ditch, the Waikakalaua Ditch in Waipio, and the Hoaeae Ditch. Two redwood pipes having a total length of 1,223 feet have been laid across two gulches on the line of Hoaeae Ditch, cutting out 21/4 miles of ditch. The water delivered by the Waiahole System is chiefly used on newly planted cane on land above the lift of the pumps. [Kluegel 1917:107]

The Waiahole Ditch System crossed through the western portion of the present project area.

Dillingham’s *mauka* lands in western Honouliuli that were unsuitable for commercial sugar production remained pasture for grazing livestock. From 1890 to 1892, the Ranch Department of the OR&L Company sought water for their herds of cattle, tapping plantation flumes and searching for alternative sources. Ida Von Holt shared this account of her husband Harry’s (Superintendent of the OR&L Ranch Department) search for water in the foothills of the Wai‘anae Range:

> One of those places is on the old trail to Pālehua, and had evidently been a place of which the Hawaiians had known, for its name is Kalo‘i (the taro patch), and even in dry weather water would be standing in the holes made by the cattle, as they tried to get a drop or two. [Von Holt 1985:136]

The spring was along the upper slopes of the southern face of Kalo‘i Gulch. A second account is given of the discovery of spring water in an area over the ridge on the north side of Kalo‘i Gulch:

> Shouting to the men to come over with their picks and shovels, he [Harry von Holt] soon got them busy clearing away lots of small stones and earth. Almost at once they could see that there were evidences of a paved well, and at about three feet down they came upon a huge flat rock, as large around as two men could span with their arms. Digging the rock loose and lifting it to one side, what was their astonishment to find a clear bubbling spring! [Von Holt 1985:138]

Following the discovery, two old Hawaiians began to explain to Von Holt about the spring:

> Finally he [Harry von Holt] got them to explain that the spring, called ‘Waihuna’ (Hidden Spring) had been one of the principal sources of water for all that country, which was quite heavily populated before the smallpox epidemic of 1840 […] A powerful Kahuna living at the spring had hidden it before he died of the smallpox, and had put a curse on the one who disturbed the stone, that he or she would surely die before a year was out. [Von Holt 1985:138–140]

4.4 1900s

4.4.1 The U.S Military Development of Pearl Harbor

In 1876, the Reciprocity Treaty between the United States and the Kingdom of Hawai‘i concluded with the provision that Hawai‘i would not “lease or relinquish sovereignty to another country or any harbor, etc.” In 1887, the treaty was renewed and amended to allow the United

States “exclusive right to enter the harbor of Pearl River, in the Island of Oahu, and to establish and to maintain there a coaling and repair station for the use of vessels of the United States” (Judd 1971:128).

After Hawai‘i became a territory of the United States in 1899, a Pacific base that could be used as a staging area for the Spanish-American war began to be developed. Early in the twentieth century, the U.S. Government began acquiring the coastal lands of ‘Ewa for development of a naval base at Pearl Harbor. In 1901, the U.S. Congress formally ratified annexation of the Territory of Hawaii, and the first 1,356.01 acres of Pearl Harbor land were transferred to U.S. ownership. The U.S. Navy began a preliminary dredging program in 1901, which created a 30-ft-deep entrance channel measuring 200 ft wide and 3,085 ft long. In 1908, money was appropriated for 5 miles of entrance channel dredged to an additional 35 ft down (Downes 1953) (Figure 17). Funding for the construction of dry docks and other support facilities was also approved in 1908. In 1909, the government appropriated the entire Waipi‘o peninsula from the ‘Ī‘ī estate for the Pearl Harbor Naval Station and Shipyard.

Additional dredging to deepen and widen the channel was conducted in the 1920s. In 1931, the Navy built an ammunition depot at West Loch on a 213-acre parcel it bought from the Campbell Estate. Construction of a new depot in Lualualei Valley and at West Loch Harbor began in 1931.

In the early 1930s, the U.S. Navy leased 700 acres of the Campbell Estate to build Ewa Field in Honouliuli, a base with a mooring mast for Navy dirigibles. Although the mast was completed, the program was abandoned before the *Akron*, the airship designated for the mast, was built. In 1937, 18 miles of roads were built in the coastal Honouliuli area, and in 1939-1940 the U.S. bought 3,500 acres of land in this area (Landrum et al. 1997:62–67), to build several other military camps and installations, including Barbers Point Naval Air Station, at the site of the old mooring mast.

4.4.1 History of Camp Malakole

The wartime history of Camp Malakole (1940–1946) has been well described by Robert H. Albert (1980). The Camp Malakole Military Reservation, also known as the Honouliuli Military Reservation (Malakole Campsite), included 30 hectares (75.01 acres) acquired by the Secretary of War in the late 1930s. In 1939, the area was chosen as a firing range for the Sixty-Fourth Coast Artillery (AA) Regiment, stationed out of Fort Shafter (Albert 1980:303). Under the command of Colonel Charles W. Wing, the regiment cleared the land and set up six batteries along the coast (Bennett 2003:50).

The camp was selected to be the base of the 251st Coast Artillery (Anti-Aircraft) Regiment on 16 September 1940. This camp was to function as a defensive gun and firing position sector for the regiment. Based out of California, this unit was the first National Guard Unit to be ordered outside the continental United States during peace time (Albert 1980:303). By the end of 1940, the soldiers stationed at Camp Malakole spent half the day setting up the field defensive gun and half the day building the camp (Albert 1980:304) (Figure 18 and Figure 19). The camp construction was officially finished in February 1941 (Bennett 2003:55).

The camp was meant to house approximately 2,000 men and included 48 barracks buildings, 12 mess halls, nine magazines and storage houses, five officers’ quarters, seven showers, latrines, dispensary, officers’ mess, headquarters buildings, fire house, post office, regimental day room, movie theater, laundry, car repair shop, gas station, guard houses, and photo lab (Bennett 2003:55).

Figure 17. Dredging in Pearl Harbor ca. 1908 (Hawai‘i State Archives)

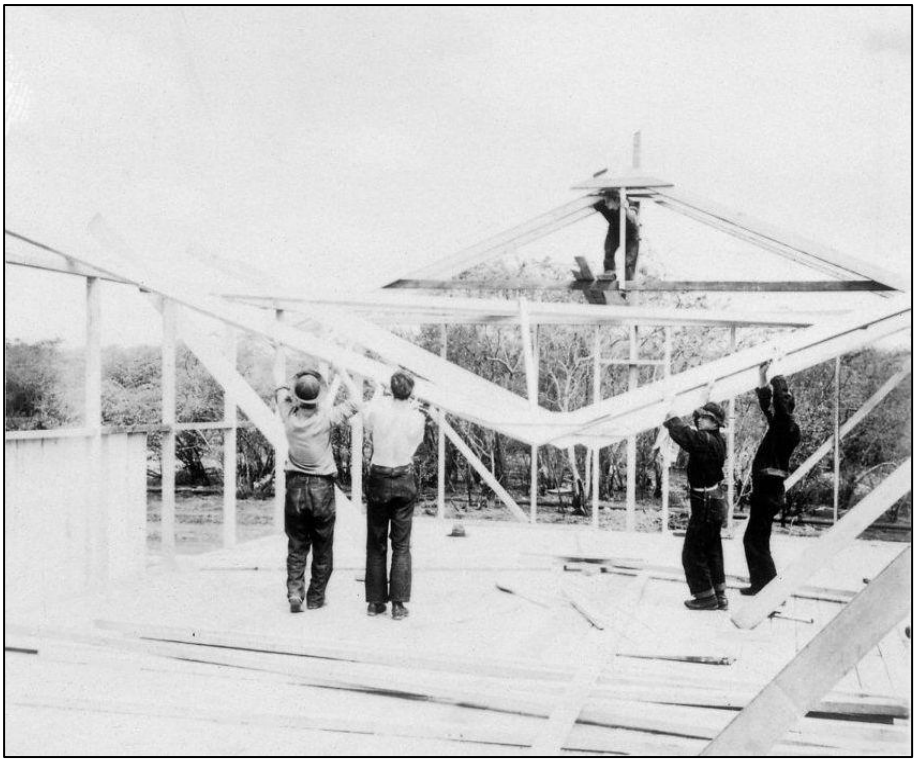


Figure 18. Camp Malakole soldiers raising the barracks roof (Bandel in Albert 1980:336)

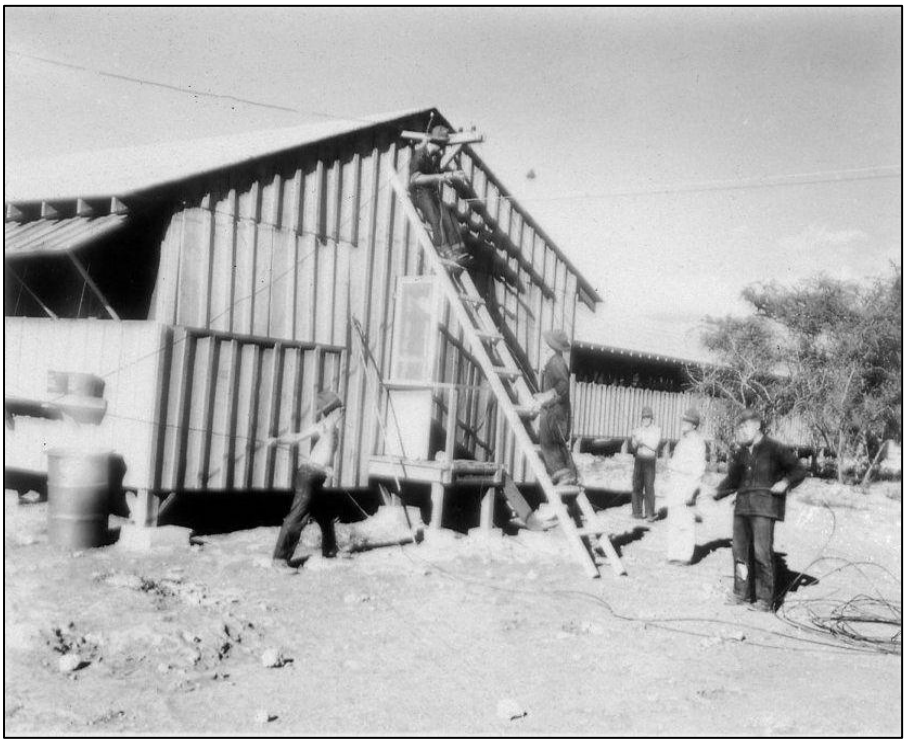


Figure 19. Camp Malakole soldiers wiring the barracks (Bandel in Albert 1980:336)

By 1941, the imminent threat of war was becoming more apparent. During the first half of 1941, the population of the camp grew from 1,200 to 2,400. On 7 December 1941, the soldiers stationed at Camp Malakole had just come back from a week-long island alert and had placed the guns and ammunition in storage bunkers (Albert 1980:304). Nevertheless, a hasty defense effort was able to defend against Japanese dive bombers attacking the camp and the unit is credited with shooting down two Japanese bombers. Three soldiers stationed at Camp Malakole—Sargent Henry Blackwell, Sargent Warren Rassmusen, and Corporal Clyde Brown—were the first American soldiers killed in the attack. They were taking private flying lessons that morning out of John Rodgers Airport (Harding 2013).

In 1942, the Regiment deployed to the Fiji Islands to establish anti-aircraft defense for the airfield there. From there, they participated in campaigns in Guadalcanal, Bougainville, and Luzon in the Philippines (Albert 1980:305).

After the Regiment left in 1942, Camp Malakole became a weapons training school for live-firing ranges of anti-aircraft and anti-tank training. By 1943, the camp became an important staging area for cargo coming into and out of O‘ahu, as well as solider replacement for personnel entering oversea theaters. Service reports from the camp report that over 43,000 troops were billeted and staged through the camp in the final 32 months of war, averaging over 1,100 troops a month (Albert 1980:306). The camp was a strategic tool during the United States’ involvement in the war. It served as an important area for the logistical effort in the war and the main anti-aircraft gunnery school on O‘ahu. After the end of World War II, the camp was abandoned. There is little information available about exactly when or why the camp was abandoned. Due to the construction of the adjacent industrial park and Chevron Oil Refinery, little remains of the camp.

4.4.1 Honouliuli National Monument (Honouliuli Internment Camp)

Following the Japanese Navy’s attack on Pearl Harbor on 7 December 1941, Lieutenant General Walter C. Short of the Army and Joseph Poindexter, Governor of Hawaii, issued a proclamation declaring the Territory of Hawaii under martial law and suspending the writ of *habeas corpus* (the requirement for a person under arrest to be brought before a judge or into court) (U.S. Department of the Interior 2014:6-7). Civilian courts were closed and the military established its own courts with authority over civilians (Kashima 2003:69). While under martial law, the Territory of Hawaii was governed by Army generals Walter Short, Delos Emmons, and Robert C. Richardson, Jr. (U.S. Department of the Interior 2014:6–7).

> The military conducted some 50,000 trials of civilians throughout the islands during the war, with a 99 percent conviction rate in the 22,000 cases on the island of O‘ahu in 1942 and 1943. The average trial lasted five minutes, and legal counsel was seldom at hand once it became common knowledge that the presence of a defense lawyer would ensure a harsh sentence [U.S. Department of the Interior 2014:6–7]

Persons of Japanese and European ancestry in Hawai‘i suspected of disloyalty to the United States were rounded up and imprisoned by the U.S. military and the Federal Bureau of Investigations (FBI) (U.S. Department of the Interior 2014:xii). Most internees were held at the U.S. Immigration Station on O‘ahu prior to being transferred to internment camps on the U.S. mainland (U.S. Department of the Interior 2014:xii).

> The War Department ordered the internment of all individuals who had been identified on the custodial detention list (Kashima 2003, 69). These included leaders in the Japanese community who had significant community influence, were educated, were teachers, or had access to transportation or communications. They included members of the Japanese consulate, and community members who served in an unofficial consular capacity for those wanting to communicate officially with Japan on legal issues of births, deaths, marriage, and other business. They also included Shinto and Buddhist priests, Japanese language teachers, those with radios, and farmers and fishermen with access to boats and other transport. Martial arts instructors, travel agents, those with access to the press, and Kibei (American citizens of Japanese ancestry who had been educated in Japan) were also targeted. In some cases, those arrested were considered ‘guilty by association’ or were identified by informants, some without just cause. [U.S. Department of the Interior 2014:6–7]

In 1943, the Honouliuli Internment Camp was constructed to intern citizens, resident aliens, and prisoners of war. Located in Honouliuli Gulch, east of the project area, the camp was the “last, largest, and longest-used World War II confinement site in Hawai‘i,” holding approximately 320 internees and nearly 4,000 prisoners of war (U.S. Department of the Interior 2014:xiv).

4.4.1 Development in the Vicinity of the Project Area

Much of the *mauka* lands in western Honouliuli, including ridges and deep gulches, were unsuitable for commercial sugar cultivation and remained pastureland for grazing livestock. The Donn 1906 map suggests the present project area was at the edge of sugarcane cultivation at that time (Figure 20). By 1920, however, much of the lands of Honouliuli were used for commercial sugarcane cultivation (Frierson 1972:18).

A 1919 map (Figure 21) shows ditches, reservoirs, roads, and railroad lines downslope of the project area. This map shows an unimproved road alignment just south of the project area, understood as the Pālehua Road, approximating a traditional Hawaiian footpath into the uplands.

A 1922 map (Figure 22) shows the called out Pālehua trail as jogging into the southwest portion of the project area. This 1922 map shows pineapple fields in at least 13 locations among the foothills of the southeast Wai‘anae Range. The nearest of these pineapple fields wrapped around Pu‘u Kapua‘i some 500 m to the northwest. At least six (typically quite small) plantation camps were scattered along the bottom of these foothills with the nearest being about 500 m to the north of the project area. The Kupihau Ranch Station is shown about 2.6 km to the north. The water troughs and tanks shown upslope of the ranch station attest to the cattle operations in the vicinity at that time.

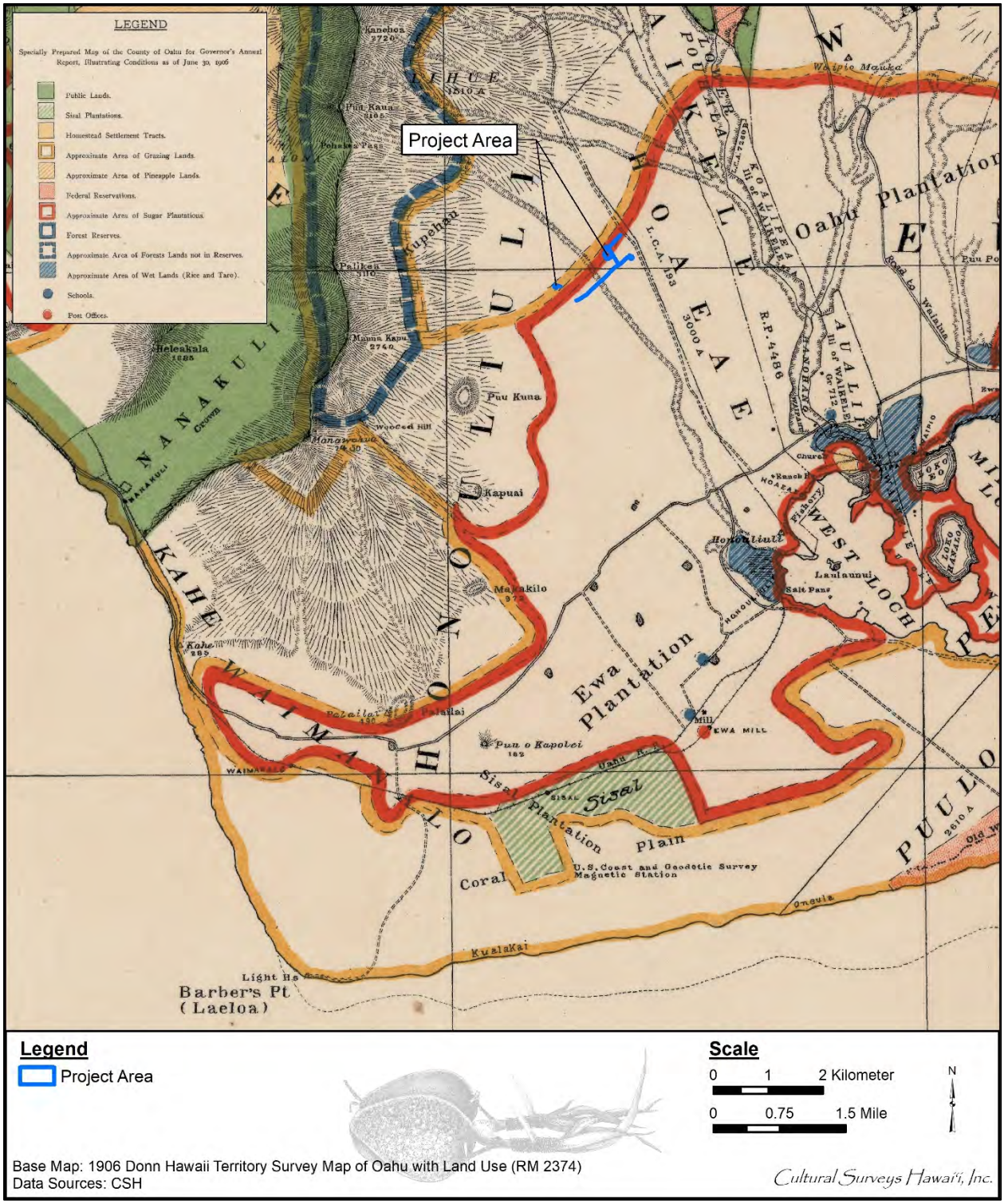


Figure 20. 1906 Donn Hawaii Territory Survey map showing project area

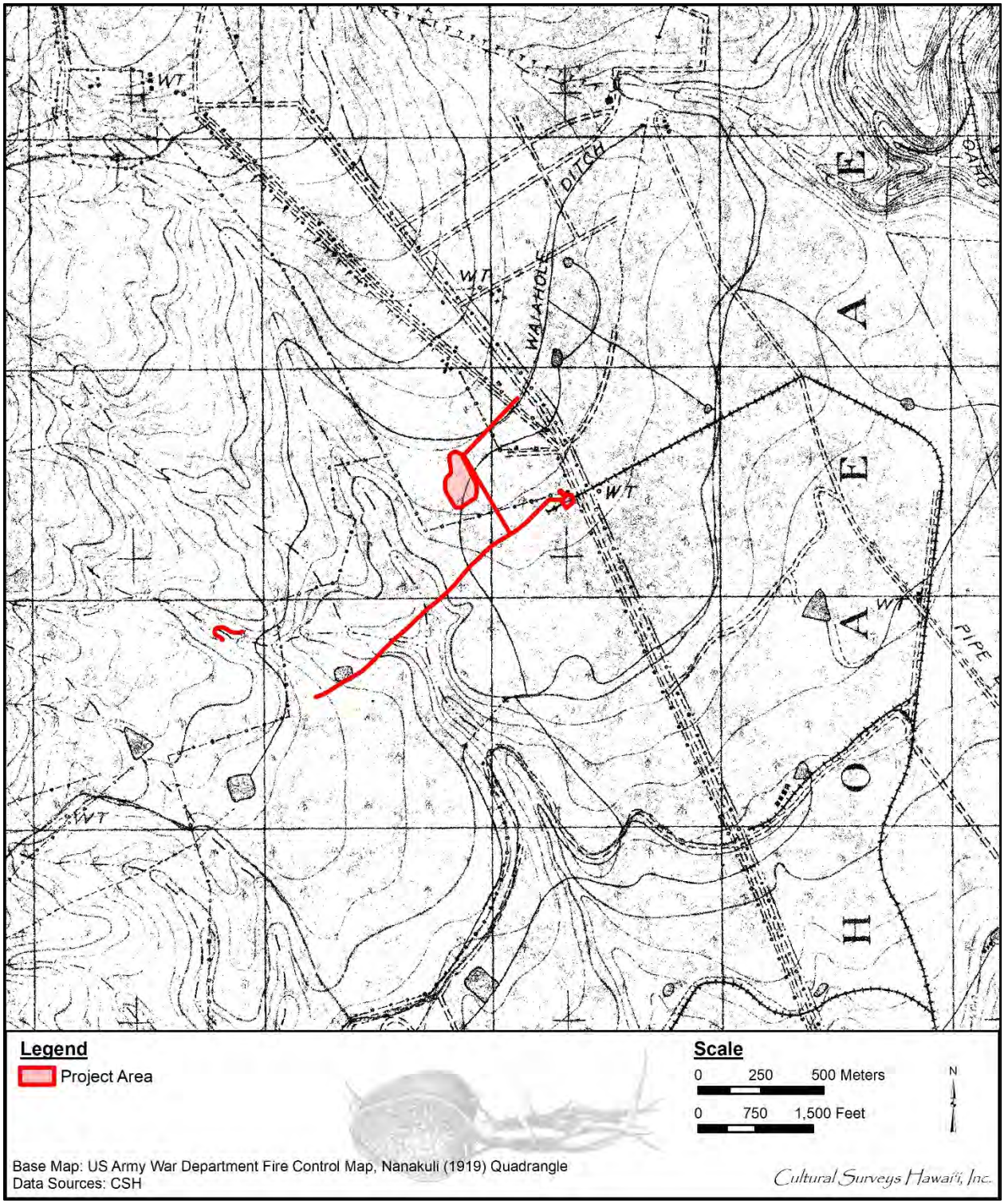


Figure 21. Portion of 1919 U.S. Army War Department fire control map

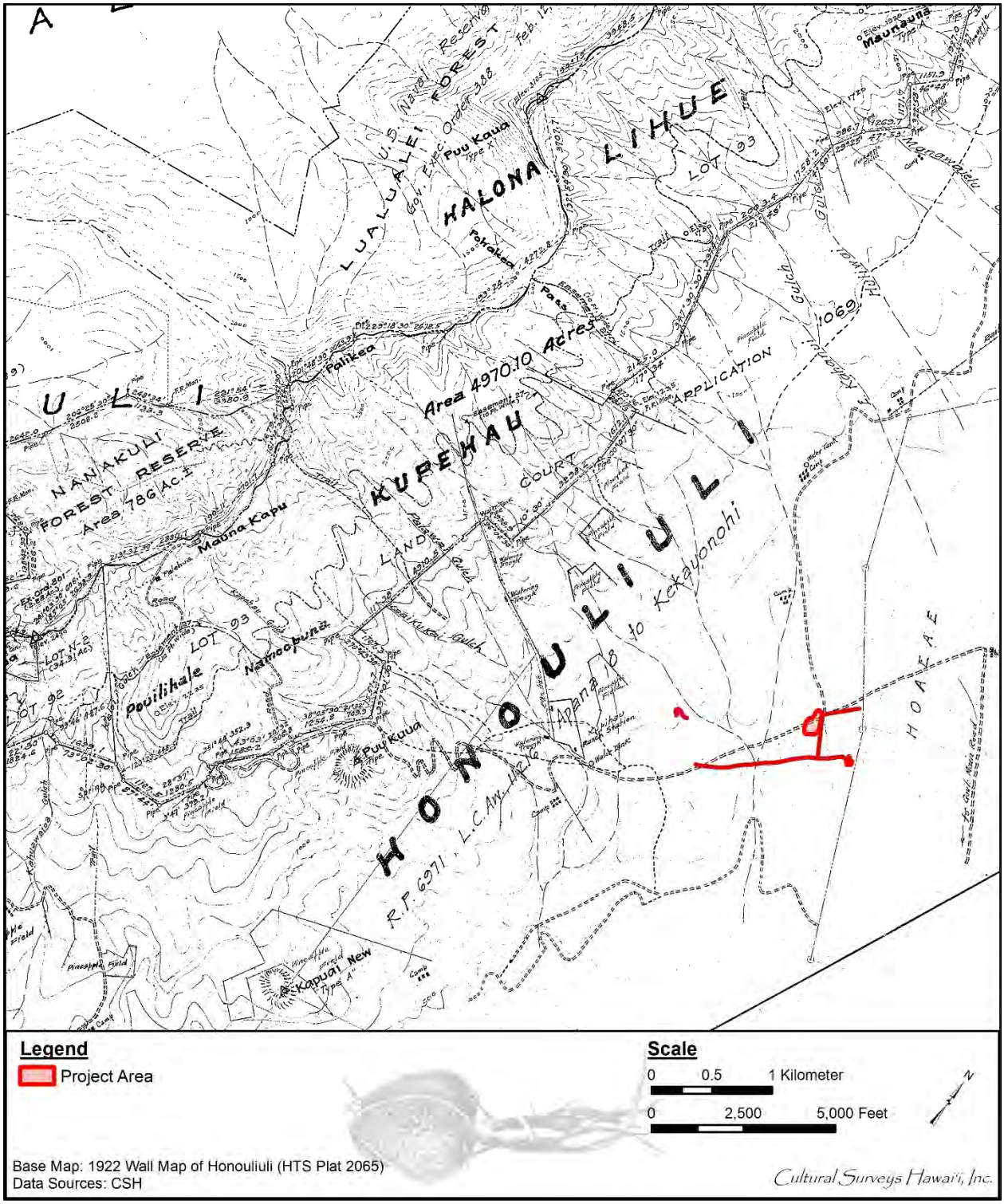


Figure 22. Portion of 1922 Wall map of Honouliuli

Section 5 Previous Archaeological Research

Figure 23 and Table 2 summarize the previous archaeological studies conducted near the project area (within approximately 1 km), and Figure 24 and Table 3 summarize the previously identified historic properties in the vicinity (within approximately 1 km). No historic properties are indicated in the vicinity of the project area in McAllister's (1933) survey of the archaeology of O‘ahu. Two previously identified historic properties (SIHP # 50-80-08-7671:3 relating to Kupehau Road and SIHP # 50-80-09-2268, the Waiahole Ditch) have a particular bearing on the present project area and are discussed further in Section 5.2 below.

5.1 Previous Archaeological Studies in the Vicinity

A brief discussion of prior archaeological studies in the vicinity (within approximately 1 km) of the project area (presented in chronological order) follows.

5.1.1 Barrera 1985

William M. Barrera, Jr. (1985) reported on an archaeological reconnaissance of approximately 692 acres at Village Park, Waipahu (TMK: [1] 9-4-002:001 por.) bounded on the west by Kunia Road, on the south by the Village Park subdivision, on the east by Waikele Gulch, and on the north by sugarcane fields. Barrera (1985:3) reports, "No evidence of past utilization of any kind were observed either in the open fields or in the exposed earthen faces of the irrigation ditches."

5.1.2 Kennedy 1987

Kennedy (1987:2) reports that "no above ground archaeological features (with) little chance of subsurface recovery" for a 20-acre parcel approximately 1 km northeast of the project area. The survey coincided with the cultivation of a sugarcane field that overlaid the project area, thus there was no ground vegetation to inhibit the archaeological survey.

5.1.3 Kennedy 1988

In 1988, Kennedy conducted a 670-acre archaeological walk-through survey of the proposed Royal Kunia, Phase II. This survey was conducted by "a two man survey team covered(ing) the area by automobile along the network of cane haul roads and by foot in the few areas where this was necessary. Visibility was limited by the dense stands of sugarcane"; no archaeological sites were recorded (Kennedy 1988).

5.1.4 Perzinski et al. 2003

In 2003, CSH conducted an archaeological inventory survey (AIS) on approximately 250 acres for a proposed landfill project in Kunia (Perzinski et al. 2003). The project was located in western O‘ahu on the southeastern flank of the Wai‘anae Range, including the ridges and gulches from 800-1,200 ft elevation in the vicinity of Pōhākea Pass. The archaeological inventory survey included a complete surface survey, site identification, mapping, and limited subsurface testing of select archaeological sites. Six archaeological sites were discovered in this area as a result of the survey. Of the six, two were recommended to undergo a process for data recovery, SIHP #s 50-80-09-6458 and -6461. SIHP # -6458 consisted of filled crevices, and SIHP # -6461 consisted of a series of historic roads and, bunkers. SIHP # -6456 is a terrace, mound, and trail; SIHP # -6459

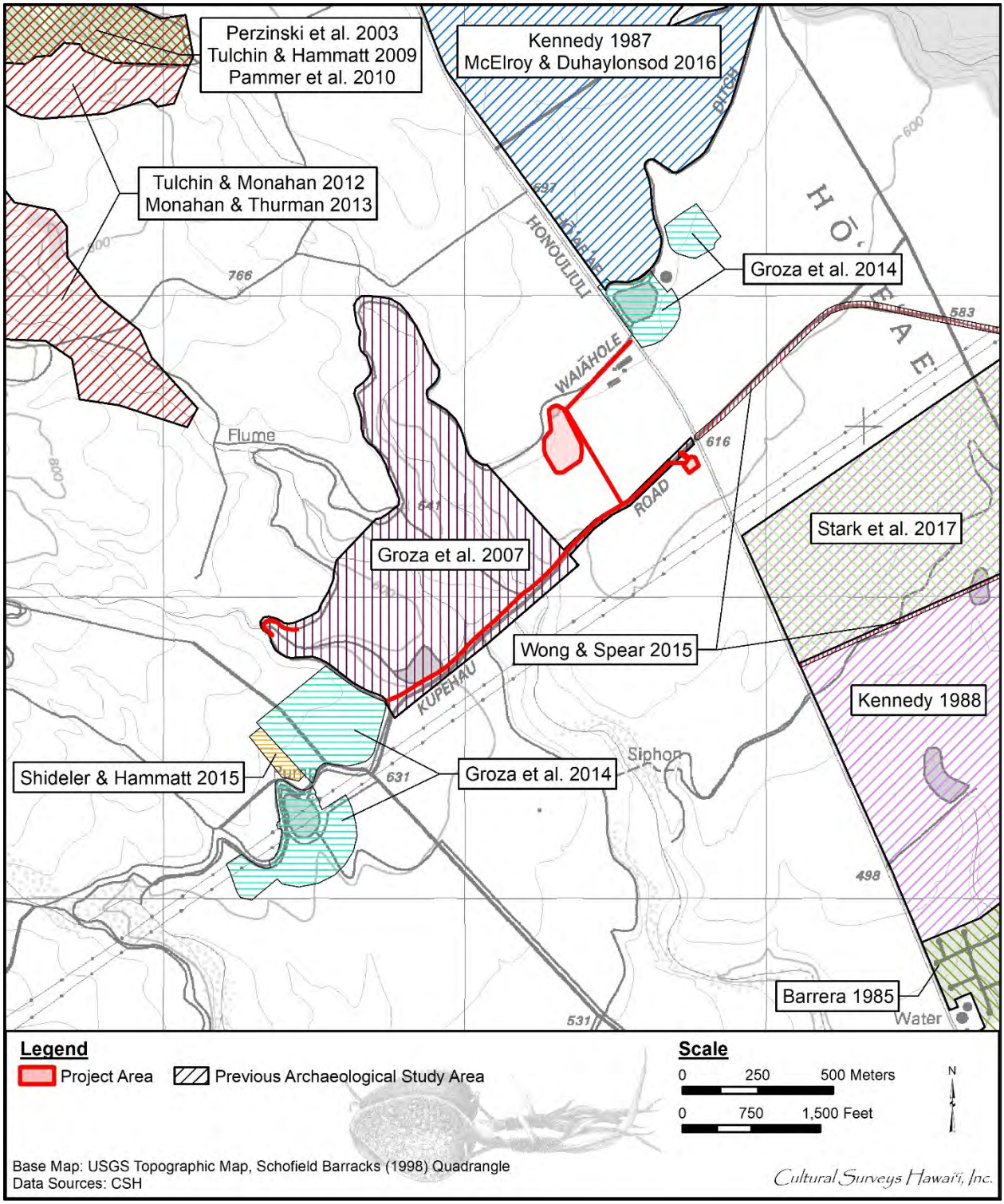


Figure 23. Previous archaeological studies in the vicinity of the project area (Base map: Portion of a 1998 Schofield Barracks USGS topographic quadrangle)

Table 2. Previous archaeological studies in the vicinity of the project area

Reference	Type of Study	Location	Results
Barrera 1985	Archaeological reconnaissance	692 acres at Village Park, Waipahu, bounded on west by Kunia Rd, on south by Village Park subdivision, on east by Waikele Gulch, and on north by sugarcane fields, TMK: [1] 9-4-002:001 por.	Barrera (1985:3) reports, “No evidence of past utilization of any kind were observed either in the open fields or in the exposed earthen faces of the irrigation ditches.”
Kennedy 1987	Archaeological reconnaissance	Hō‘ae‘ae Ahupua‘a; TMK: [1] 9-4-004	No findings
Kennedy 1988	Archaeological pedestrian survey	Royal Kunia, Phase II, TMK: [1] 9-4-002:001	No historic properties identified
Perzinski et al. 2003	Archaeological inventory survey	Kunia Landfill, Honouliuli, TMK: [1] 9-2-004:5 por.	Archaeological sites identified: SIHP #s 50-80-12-6456, -6457, -6458, -6459, -6460, -6461
Groza et al. 2007	Archaeological inventory survey	TMK: [1] 9-2-001:001 por.	Three new plantation infrastructure sites (SIHP #s 50-80-06-6892, -6893, -6894), and Waiahole Ditch (SIHP # 50-80-09-2268)
Tulchin and Hammatt 2009	Site relocation	Proposed Kunia Loa Ridge Farmlands project, TMK: [1] 9- 2-004:005 por.	No new historic properties identified; SIHP #s 50-80-12-6457, -6458, and -6461 identified; new features associated with SIHP # -6461 documented
Pammer et al. 2010	Archaeological inventory survey	TMK: [1] 9-2-004:005 por.	Eight sites including five traditional Hawaiian sites (SIHP #s 50-80-12-6456, -6457, -6458, -7125, -7126) and three historic sites (SIHP #s -6459, -6460, -6461)

Reference	Type of Study	Location	Results
Tulchin and Monahan 2012	Archaeological reconnaissance survey	162-acre project area on eastern side of Wai‘anae Mountain Range, approx. 1.5 km east Hawai‘i Country Club, TMK: [1] 9-2-004:013 por.	Documented 29 new historic properties and identified two additional features at previously identified SIHP # 50-80-08-6459; identified archaeological features representing distinct periods of land use, including pre-Contact traditional Hawaiian habitation and agriculture as well as post-Contact agriculture, ranching, and military activities; observed site types: stacked-stone walls, platforms, terraces, enclosures, and mounds, modified outcrops, petroglyphs, sugarcane infrastructure (i.e., siphon, earthen ditches, etc.), and a military road with stone and mortar culverts and cut earthen storage bays; interpreted site functions included possible burial, ceremonial, habitation, agriculture, transportation, water control, animal husbandry, and land division boundary
Monahan and Thurman 2013	Archaeological inventory survey	Approx. 854-acre Kunia Mauka Loa Ridge C&C Farmlands project area east of Honouliuli Forest Reserve	Identified 60 historic properties including 14 sites loosely categorized as plantation infrastructure, 11 related to ranching activities, and 16 sites interpreted as either pre-Contact or “pre-Contact to early Historic” in nature

Reference	Type of Study	Location	Results
Groza et al. 2014	Archaeological inventory survey	Waiahole Reservoir System – Reservoirs 155 and 225	Waiahole Ditch Irrigation System previously designated as SIHP # 50-80-09-2268 (Goodman and Nees 1991); Reservoirs 155 and 225 addressed as features of Waiahole Ditch Irrigation System; 25 sub-features of Waiahole Ditch identified within project area; 15 sub-features associated with Reservoir 155 and eight sub-features associated with Reservoir 225
Shideler and Hammatt 2015	Archaeological inventory survey (addendum)	Additional 2.8-acre adjacent to Groza et al. 2014 study area, TMK: [1] 9-2-001:001 por.	Addendum to Groza et al. 2014 addressed additional 2.8 acres; identified no additional historic properties
Wong and Spear 2015	Archaeological inventory survey	161-acre Ho‘ohana Solar Farm Project in Kunia, Waikele Ahupua‘a, TMK: [1] 9-4-002:052	Identified one new historic property, SIHP # 50-80-08-7671, a historic road complex comprised of three features: a basalt rock alignment, a basalt block and mortar wall, and paved segments of coral; reported three pre-Contact artifacts (a basalt adze preform and two basalt flakes with polished facets)
McElroy and Duhaylonsod 2016	Archaeological inventory survey (recorded as archaeological assessment in the absence of finds)	New Hope Network Development on 203-acres in Kunia, Hō‘ae‘ae Ahupua‘a, TMK: [1] 9-4-004:009	No historic properties identified; eight test excavations conducted

Reference	Type of Study	Location	Results
Stark et al. 2017	Archaeological inventory survey	150-acre Kunia Agricultural Park project area located immediately east of Kunia Rd, surrounded by large agricultural lots managed by Waikele Farms, with Royal Kunia residential community to south and Kupehau Rd to north	Identified one historic property, SIHP # 50-80-08-7758 consisting of seven features of one remnant site pertaining to former agricultural activity, specifically related to Oahu Sugar Co.; each feature (1–7) represents an activity area relating to contemporaneous agricultural activity; Feature 1 is a retaining wall (linear); Features 2 and 3 are portions of a historic irrigation ditch (linear); Feature 4 is the structural remnant of a headworks feature connecting Features 2 and 3; Feature 5 is a historic lithic workshop relating to production of faced basalt boulders observed in Features 1–4; Features 6 and 7 are former plantation cane haul roads

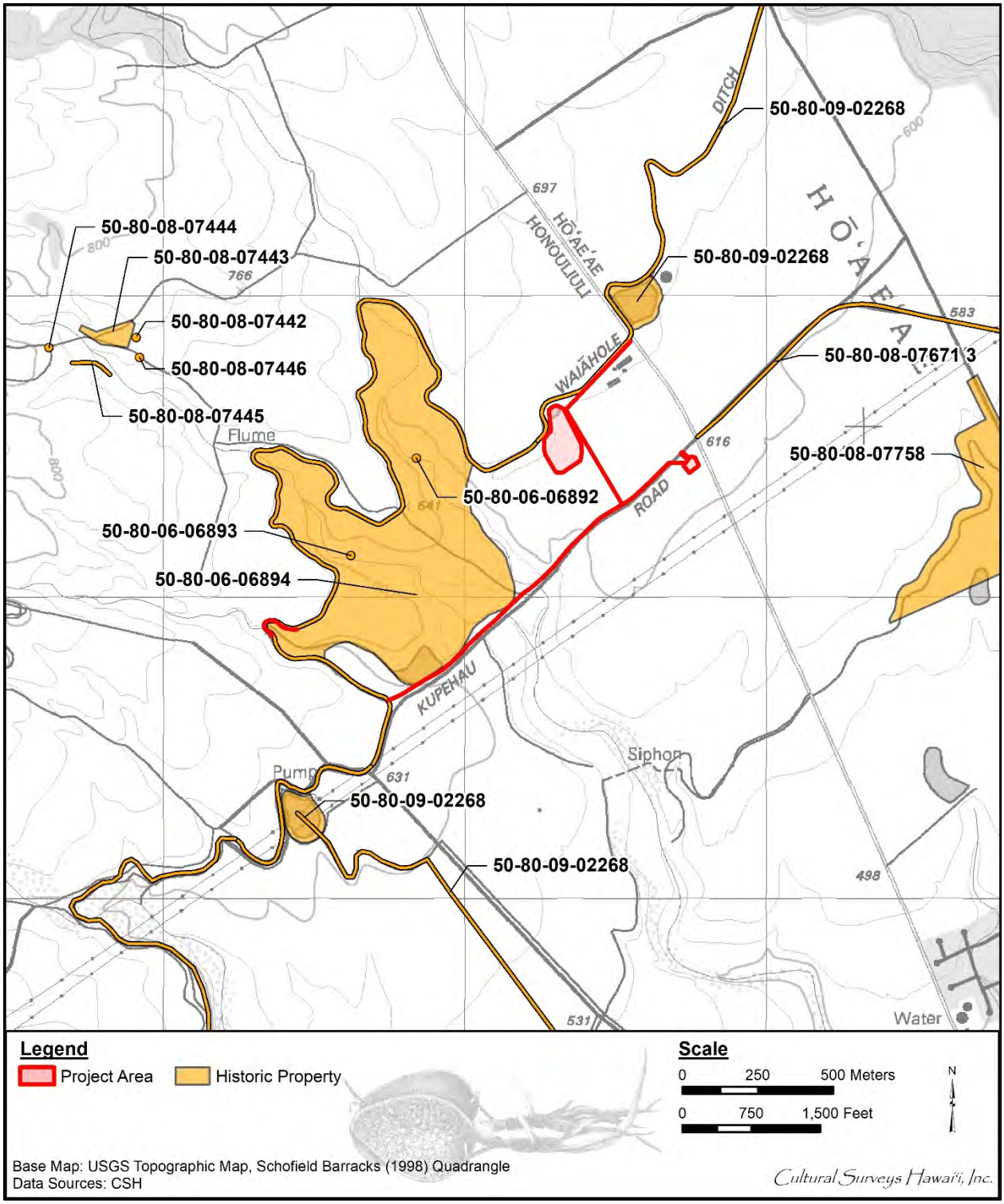


Figure 24. Previously identified historic properties in the vicinity of the project area (Base map: Portion of the 1998 Schofield Barracks USGS topographic quadrangle)

Table 3. Previously identified historic properties in the vicinity of the project area

SIHP # (50-80-)	Description	Comment	Source
06-6892	Rectangular bridge with wall	The date 9.27.1929 is inscribed on the top of the eastern slab wall of the bridge.	Groza et al. 2007
06-6893	Rectangular bridge with wall	No construction date was found on the bridge although it is very similar in appearance and construction to SIHP # -6892.	Groza et al. 2007
06-6894	Oahu Sugar Co. plantation infrastructure	Features A–D are Oahu Sugar Company plantation infrastructure, most of which appear to be related to the Waiahole Ditch. The features include: a U-shaped rock and mortar wall; wooden chutes that extend over the Waiahole Ditch; concrete slab bridges that extend over the Waiahole Ditch; and U-shaped concrete molded flumes and multiple remnants of the flumes.	Groza et al. 2007
08-7442	Concrete flume section	A short concrete flume section dating from the 1960s and functioning to irrigate large, gently sloping areas previously under commercial sugar cane agriculture.	Monahan and Thurman 2013
08-7443	Irrigation complex	An irrigation complex of six designated features built by plantation workers to manage what would have been an extensive irrigation system dating to the 1930s if not a bit earlier.	Monahan and Thurman 2013
08-7444	Concrete and mortared rock sluice gate complex	A heavy-duty water retention and diversion feature built by plantation workers to manage what would have been an extensive irrigation system likely dating to at least the 1930s if not a bit earlier.	Monahan and Thurman 2013
08-7445	Concrete flume section	Dating from the 1960s and functioning to irrigate large, gently sloping areas previously under commercial sugarcane agriculture.	Monahan and Thurman 2013
08-7446	Mortared rock sluice gate	A water retention and diversion feature built by plantation workers to manage what would have been an extensive irrigation system dating to the 1930s if not a bit earlier.	Monahan and Thurman 2013
08-7671:3	Historic road complex	Comprised of three features: 1: a basalt rock alignment, 2: a basalt block and mortar wall, and 3: paved segments of coral	Wong and Spear 2015

SIHP # (50-80-)	Description	Comment	Source
08-7758	Remnant site pertaining to former agricultural activity specifically related to Oahu Sugar Co.	Consisting of seven designated features; each feature (1–7) represents an activity area relating to contemporaneous agricultural activity. Feature 1 is a retaining wall (linear). Feature 2 and Feature 3 are portions of a historic irrigation ditch (linear). Feature 4 is the structural remnant of a headworks feature connecting Feature 2 and Feature 3. Feature 5 is a historic lithic workshop relating to the production of faced basalt boulders observed in Features 1–4 and Feature 6 and Feature 7 are former plantation cane haul roads.	Stark et al. 2017
09-2268	Irrigation Ditch (Waiahole Ditch)	Waiahole Ditch system	Goodman and Nees 1991, Groza et al. 2007, Groza et al. 2014

a U-shaped structure and alignment; and SIHP # -6460 a leveled cobble pavement. One site was recommended for preservation, SIHP # -6457, a possible *heiau* located in the central gulch directly downslope from Pōhākea Pass. The site consisted of an enclosure with a three-tiered retaining terrace and ramp leading into the interior of the enclosure. The walls of the structure were documented to have been up to 2 m in thickness and were well built with chinking, facing, and core filling. Such thick walls are not typical construction for traditionally built houses and a ritual function was suggested.

5.1.5 Groza et al. 2007

In 2007, at the request of PBR Hawai‘i, Inc., CSH (Groza et al. 2007) completed an inventory survey for the Ho‘opili project, Mauka Detention Basin, Honouliuli Ahupua‘a, TMK: [1] 9-2-001:001. The project area is bordered on the north and west by the Waiahole Ditch, on the south by Kupehau Road, and is west of Kunia Road. During the project, the entirety of the 143-acre Mauka Detention Basin was surveyed on foot. The pedestrian survey revealed several sites, one of which consisted of 31 features. All sites identified were associated with water control, the Waiahole Ditch, and the Oahu Sugar Company (Groza et al. 2007): SIHP #s 50-80-06-2268, -6892, -6893, and -6894. Two concrete slab bridges with four to six courses of dressed, faced, rectangular stone were also found. One of the bridges was inscribed with the date 9.27.1929 and the other bridge was similar in appearance. The other sites are identified with the Waihole Ditch and consisted of scattered plantation infrastructure features.

5.1.6 Tulchin and Hammatt 2009

Following on the findings of Perzinski et al. (2003), in 2009, Tulchin and Hammatt conducted a GPS relocation project at the Kunia Loa Ridge Farmlands project to further document SIHP #s 50-80-12-6457, -6458, and -6461 in 2009. No new historic properties were identified, while SIHP #s -6457, -6458, and -6461 were located and new features associated with SIHP # -6461 were documented.

5.1.7 Pammer et al. 2010

In 2010, an archaeological inventory survey was conducted on an approximately 294-acre parcel for a proposed agricultural subdivision including the ridges and gulches from 800-1,200 ft elevation in the vicinity of Pōhākea Pass, approximately 3 km southwest of the project area (Pammer et al. 2010). Several historic properties were identified, with functional types including temporary habitation, agriculture, and transportation: SIHP #s 50-80-12-6456 terrace, mound, and trail; -6457 *heiau* enclosure and associated terraces; -6458 cobble filled crevices; -6459 U-shaped structure and alignment; -6460 leveled cobbles; -6461 historic road improvements; -7125 petroglyph; -7126 mound, and -7351. Radiocarbon dating from samples recovered from the site yielded date ranges of AD 1290-1420 and AD 1510-1810. It was also noted that, with the exception of SIHP #s -6459, -7125 and -7126, all sites were within the gulches in the upslope portion of the study area (Pammer et al. 2010).

5.1.8 Tulchin and Monahan 2012

In 2012, at the request of C&C Farmlands, LLC, Tulchin and Monahan of CSH conducted an archaeological reconnaissance survey for the Kunia Mauka Loa Ridge Farmlands project. The project area was on the eastern side of the Wai‘anae Mountain Range and abutted the eastern edge of the Honouliuli Forest Reserve. Kunia Road is roughly parallel to the project area’s eastern

boundary. Most of the identified archaeological sites were in the northern portion of the project area within and between ‘Ēkaha Nui and Huliwai gulches. The relative absence of sites south of ‘Ēkaha Nui Gulch was attributed to pineapple cultivation which involved extensive grading of ridge tops. A majority of the historic properties identified within ‘Ēkaha Nui Gulch were of historic ranching origin. Archaeological sites identified included SIHP #s 50-80-12-7125, -7126, -7323 through -7327, -7328, -7335 through -7341, -7343, through -7351:

> Identified archaeological features representing distinct periods of land use were observed, including: pre-Contact traditional Hawaiian habitation and agriculture, as well as post-Contact agriculture, ranching, and military activities. Observed site types were stacked-stone walls, platforms, terraces, enclosures, and mounds, modified outcrops, petroglyphs, sugarcane infrastructure (i.e., siphon, earthen ditches, etc.), and a military road with stone and mortar culverts and cut earthen storage bays. Interpreted site functions included the following: possible burial, ceremonial, habitation, agriculture, transportation, water control, animal husbandry, and land division boundary. [Tulchin and Monahan 2012:ii]

5.1.9 Monahan and Thurman 2013

TCP Hawaii, LLC (Monahan and Thurman 2013) reported on an archaeological inventory survey for an approximately 854-acre Kunia Mauka Loa Ridge C&C Farmlands project area east of the Honouliuli Forest Reserve (TMK: [1] 9-2-004). Most of the archival research in the current report is based on the two previous CSH reports on the project area (AIS by Pammer et al. 2010 and archaeological reconnaissance survey by Tulchin and Monahan 2011). It was noted that nearly all the ridges within the project area had been leveled and graded due to historic and modern agriculture, including large-scale pineapple and sugarcane cultivation. An extensive network of dirt roads connecting these agricultural fields had been constructed throughout the project area. Additionally, areas not impacted by agricultural activities have been utilized for ranching or historic military storage. Sixty historic properties were identified including 14 sites that can be loosely categorized as plantation infrastructure, 11 sites that appeared to be related to ranching activities, and 16 sites interpreted as either pre-Contact or “pre-Contact to early Historic” in nature. The latter included two *heiau* complexes (SIHP #s 50-80-08-6457 and -7447), one formal enclosure complex within which a burial was documented (SIHP # -7331), a very large and impressive terraced agricultural and habitation complex with a petroglyph in ‘Ēkaha Nui Gulch (SIHP # -7326), habitations and possible habitations (SIHP #s -6456, -6458, -7325, -7340 and -7454) and several possible burial sites.

5.1.10 Groza et al. 2014

CSH (Groza et al. 2014) carried out an archaeological inventory survey addressing an approximately 61.3-acre (24.8-ha) project area adjacent to the southwest of the present project area. The study notes that the Waiahole Ditch Irrigation System was previously designated as SIHP # 50-80-09-2268 (Goodman and Nees 1991). The primary foci of the project were Reservoir 155 (southwest of the present project area) and Reservoir 225 on the east side of Kunia Road that are both addressed as features of the Waiahole Ditch Irrigation System. Twenty-five water control sub-features of the Waiahole Ditch (SIHP # 50-80-09-2268) were identified within their project area. Fifteen of the sub-features are associated with Reservoir 155 and eight of the sub-features

are associated with Reservoir 225. These included walls, pipes, spillways, inlets, siphons, water sluices and the two reservoir excavations and retaining walls.

5.1.11 Shideler and Hammatt 2015

This CSH (Shideler and Hammatt 2015) addendum to the Groza et al. 2014 AIS addressed an additional 2.8 acres immediately north of Reservoir 155 but identified no additional historic properties.

5.1.12 Wong and Spear 2015

Scientific Consultant Services, Inc. (Wong and Spear 2015) carried out an archaeological inventory survey for a 161-acre Ho‘ohana Solar Farm project in Kunia, Waikele Ahupua‘a (TMK: [1] 9-4-002:052). The project area included the alignments of two long roads (Kupehau Road and a roughly parallel road to the south) extending west of the main project area and connecting with Kunia Road. One new historic property was identified, SIHP # 50-80-08-7671, a historic road complex comprised of three features: a basalt rock alignment, a basalt block and mortar wall, and paved segments of coral and modern crushed basalt gravel. With the exception of three pre-Contact artifacts (a basalt adze preform and two basalt flakes with polished facets) collected during the surface survey, the materials from the subsurface testing are comprised of both historic and modern cultural materials. The study noted that much of the project area had been mechanically impacted and subjected to modern modifications due to agricultural activity as evidenced through mechanical scarring on basalt cobbles and basalt boulders in a large push pile, pieces of mortared ditch sections, agricultural irrigation systems, and active, wooden telephone posts along the north/northwest side of the project area.

5.1.13 McElroy and Duhaylonsod 2016

Keala Pono Archaeological Consulting LLC (McElroy and Duhaylonsod 2016) carried out an archaeological inventory survey (recorded as an archaeological assessment in the absence of finds) for the New Hope Network Development on 203-acres in Kunia, adjacent to the east side of Kunia Road, in Hō‘ae‘ae Ahupua‘a (TMK: [1] 9-4-004:009). Eight test excavations were conducted. No historic properties were identified. It was concluded that the entire property had been disturbed by previous and current agricultural use.

5.1.14 Stark et al. 2017

CSH (Stark et al. 2017) prepared an AIS report for a 150-acre Kunia Agricultural Park project in Hō‘ae‘ae Ahupua‘a (TMK: [1] 9-4-002:080). The study identified one historic property, SIHP # 50-80-08-7758 consisting of seven features of one remnant site pertaining to former agricultural activity, specifically related to the Oahu Sugar Company. Each feature (1–7) represents an activity area relating to contemporaneous agricultural activity. Feature 1 is a retaining wall (linear). Features 2 and 3 are portions of a historic irrigation ditch (linear). Feature 4 is the structural remnant of a headworks feature connecting Features 2 and 3. Feature 5 is a historic lithic workshop relating to the production of faced basalt boulders observed in Features 1–4 and Features 6 and 7 are former plantation cane haul roads.

5.2 Previously Identified Historic Properties

5.2.1 SIHP # 50-80-08-7671, a historic road complex including Kupehau Road

Wong and Spear (2015) identified SIHP # 50-80-08-7671 as a historic road complex comprised of three features, including Feature 1, a concrete and basalt rock alignment; Feature 2, a concrete pipe bordered by a mortar and basalt block wall to the northwest and angular basalt cobbles and boulders to the southeast; and Feature 3, portions of a historic plantation road and former railway route. Their designated SIHP # -7671: Feature 3 corresponds to Kupehau Road within their project area (east of Kunia Road). They note that their designated SIHP # -7671 Feature 3 road alignment is depicted on a 1927 USGS map that appears to show a plantation railroad spur extending along this alignment. They document ferrous spikes along the portion of designated Feature 3 commensurate with former use as a railroad line. They assess SIHP # -7671 as significant under Criterion d (only) as outlined in HAR §13-275-6 for having yielded information about prior historic land use, particularly in association with former plantation agriculture in the area (Wong and Spear 2015:54) but recommended no further archaeological work on the basis that “what remains are remnant plantation features that have been adequately documented, and that little potential exists to encounter intact subsurface cultural deposits.”

The Wong and Spear (2015) designated SIHP # -7671:3 is clearly that portion of Kupehau Road within their project area (east of Kunia Road). However, the 1928/1929 USGS topographic map (Figure 25) indicates that at that time the road and railroad crossed Kunia Road along the Kupehau Road alignment within the present project area. By logical extension, that portion of the Kupehau Road alignment within the present project area may be regarded as part of SIHP # -7671:3.

5.2.2 SIHP # 50-80-09-2268, Waiahole Ditch

The Waiahole Ditch, designated SIHP # 50-80-09-2268, has been the subject of several archaeological studies along portions of its approximately 22-mile length (Figure 26). The present project area connects with the Waiahole Ditch at: 1) “Ditch Connection Site 1” (see Figure 4 and Figure 5), “Ditch Connection Site 2” (see Figure 4 and Figure 8), and at the hairpin turn site (see Figure 4 and Figure 9). While these are understood to involve very minor changes to the Waiahole Ditch, they would arguably have a small effect on SIHP # -2268.

SIHP # 50-80-09-2268, the Waiahole Ditch System, has a long history of significance evaluation (Table 4).

- The Bishop Museum Public Archaeology Section Applied Research Group (Goodman and Nees 1991) conducted archaeological reconnaissance and inventory surveys of 3,600 acres in the uplands of Waiawa Ahupua‘a, and touched on the Waiahole Ditch (SIHP # 50-80-09-2268) as it crossed their project area (Goodman and Nees 1991:64). The only discussion of significance is in their statement: “The significance of the following sites has been realized through field and archival research and no further work is recommended: State Sites […] 2268; B4-15 (the Waiahole Ditch)” (Goodman and Nees 1991:137). Thus, while the Waiahole Ditch is assigned with an SIHP #, there is really no discussion of significance of the Waiahole Ditch in the Goodman and Nees (1991) study.

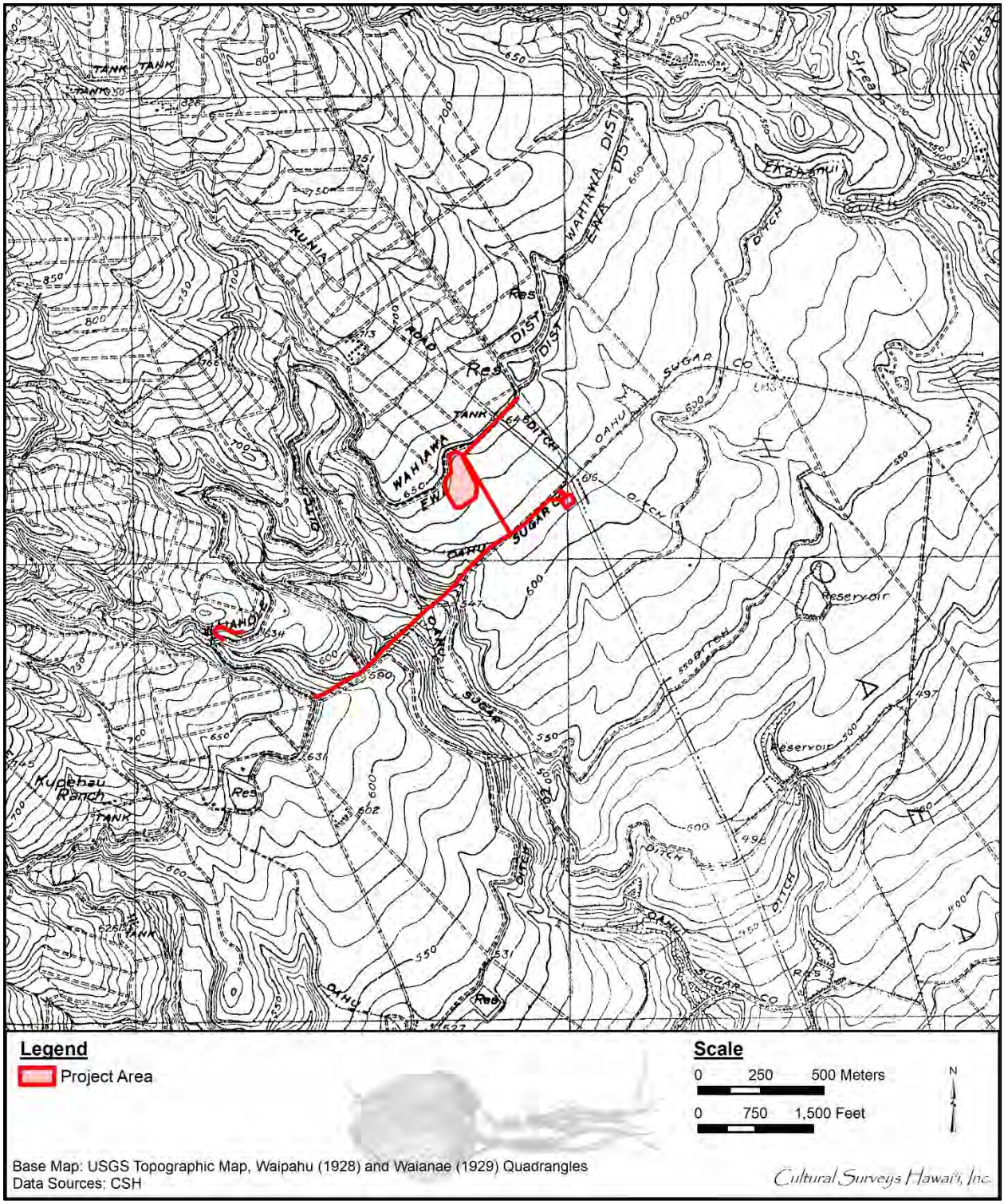


Figure 25. Portion of the 1928 Waipahu and 1929 Waianae USGS topographic quadrangles showing the project area

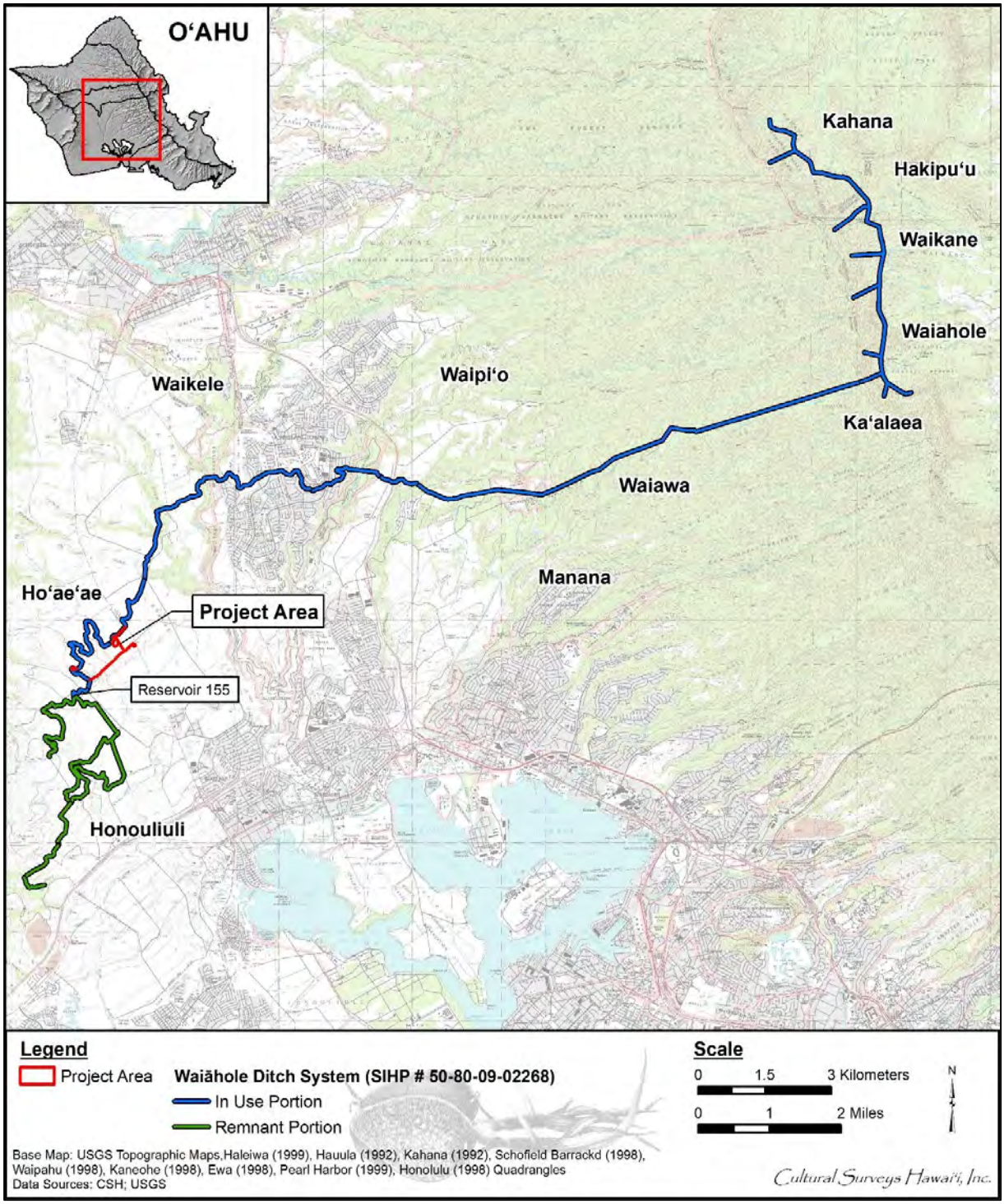


Figure 26. Figure showing the relationship of the Waiahole Ditch (SIHP # 50-80-09-2268) to the present project area (base map: portions of the 1999 Haleiwa, 1992 Hauula, 1992 Kahana, 1998 Schofield Barracks, 1998 Waipahu, 1998 Kaneohe, 1998 Ewa, 1999 Pearl Harbor, and 1998 Honolulu USGS quadrangle maps)

Table 4. Significance evaluations for portions of the Waiahole Ditch

Study or Review*	General Location	Evaluation in terms of HAR criteria	Evaluation in terms of NRHP/HRHP criteria
Goodman and Nees 1991	3,600 acres in uplands of Waiawa Ahupua‘a	Significance not evaluated: “significance […] has been realized through field and archival research and no further work is recommended”	
Hammatt et al. 1996	1,339 acres within portions of Waipio and Waiawa Ahupua‘a	Significance not evaluated: “If the portion of the Waiahole Ditch which crosses the two parcels of the project area is ever to be impacted by future development, the State Historic Preservation Division should be notified beforehand, so that appropriate mitigative measures, if necessary, can be established.”	
Dega et al. 1998	Proposed University of Hawai‘i West O‘ahu Campus project	Significance not evaluated: “The Waiahole Ditch System has previously been assessed as significant” (refers to Goodman and Nees 1991)	
Tulchin and Hammatt 2004	86-acres at Pālehua in Makakilo	Not evaluated under HAR criteria	Significant under NRHP and HRHP Criteria A and D
Tulchin et al. 2009	Koa Ridge project	HAR significance not evaluated	Significant under NRHP and HRHP Criteria A, C, and D
SHPD acceptance letter for Tulchin et al. 2009	Koa Ridge project	SHPD acceptance letter for this study makes no reference to site significance.	
Hunkin and Hammatt 2009	Makakilo Dr Extension project	HAR significance not evaluated	Significant under NRHP and HRHP Criteria A, C, and D
SHPD review letter for Hunkin and Hammatt 2009	Makakilo Dr Extension project	HAR significance not evaluated	Significant under NRHP and HRHP Criteria A, B, and D
Shideler and Hammatt 2018	Koa Ridge project	HAR significance not evaluated	Evaluated integrity; supports significance assessment made in Tulchin et al. 2009 as significant under NRHP and HRHP Criteria A, C, and D

Study or Review*	General Location	Evaluation in terms of HAR criteria	Evaluation in terms of NRHP/HRHP criteria
SHPD review letter for Shideler and Hammatt 2018	Koa Ridge project	Assessed as significant pursuant to HAR §13-284-6 Criteria a, c, and d	NRHP and HRHP significance not addressed
Zapor et al. 2018	Makakilo Dr Extension project	Assessed as significant pursuant to HAR §13-275-6, under Criteria a, c, and d	Evaluated for listing on the NRHP and HRHP pursuant to 36 CFR 60.4 and HAR §13-198-8

*These studies were quite far afield from the present project area and thus are not depicted on Figure 23

- A Hammatt et al. (1996) archaeological inventory survey of 1,339 acres of Castle & Cooke lands within portions of Waipio and Waiawa Ahupua‘a discusses that portion of the Waiahole Ditch within the Koa Ridge area west of the H-2 Freeway. At the time of that study, it was anticipated that a portion of the ditch (which conveyed large volumes of water of significant import) would not be impacted. While the significance of the Waiahole Ditch was noted, the significance was not formally evaluated. It was simply asserted that “If the portion of the Waiahole Ditch which crosses the two parcels of the project area is ever to be impacted by future development, the State Historic Preservation Division should be notified beforehand, so that appropriate mitigative measures, if necessary, can be established” (Hammatt et al. 1996:55).
- The Dega et al. study (1998:22) asserts, “The Waiahole Ditch System has previously been assessed as significant (see Goodman and Nees 1991).” The Dega et al. study offers no further discussion of the significance of the Waiahole Ditch System (and avoids any substantive comment regarding the conclusion of the referenced Goodman and Nees 1991 study).
- A Tulchin and Hammatt 2004 AIS of an approximately 86-acre proposed Pālehua Community Association project identified a portion of the Waiahole Ditch System. SIHP # 50-80-09-2268 was evaluated as significant under National Register of Historic Places (NRHP) and Hawai‘i Register of Historic Places (HRHP) Criteria A and D (Tulchin and Hammatt 2004:65).
- The Tulchin et al. (2009:66–68) archaeological inventory survey addresses that portion of the Waiahole Ditch within the Koa Ridge project area east of the H-2 Freeway crossing a small northern tributary gulch of Pānakauahi Gulch. Two features have been designated for the Waiahole Ditch during the Koa Ridge project (but without any letter or numeric designations): one for the main ditch including both the open ditch and Pānakauahi siphon and one feature designation including two 1-m long basalt boulder support walls.

  The 2009 archaeological inventory survey provides the following assessment of significance:

  > SIHP # 50-80-09-2268 is assessed as significant under Criterion A (associated with events that have made an important contribution to the broad patterns of our history), Criterion C (embody the distinctive characteristics of a type period or method of construction), and Criterion D (have yielded, or may be likely to yield information important in prehistory or history) of the National and Hawai‘i Registers of Historic Places evaluation criteria. [Tulchin et al. 2009:66]

  The integrity of SIHP # 50-80-09-2268, Waiahole Ditch was not assessed at the time of identification (Hammatt et al. 1996:47–50; Tulchin et al. 2009:89–91). The SHPD acceptance letter for this study dated 10 February 2009 (LOG NO. 2009.0605, DOC. NO. 0902WT21) makes no reference to historic property significance.
- An archaeological inventory survey for a Makakilo Drive Extension project (Hunkin and Hammatt 2009) discusses a portion of the Waiahole Ditch and concludes, “The SIHP # 50-80-09-2268 alignment continues to be significant under criteria A, C, and D” with reference to the criteria established for the NRHP and HRHP (Hunkin and Hammatt 2009:65).

- The SHPD acceptance letter for this AIS dated 18 August 2009 (LOG NO. 2008.3209, DOC. NO. 0908NM28) asserts that SIHP # 50-80-09-2268, the Waiahole Ditch System is eligible for listing on the NRHP and HRHP under Criteria A, B, and D (the AIS declares significance under Criteria A, C, and D and the acceptance letter specifies A, B, and D).
- A preservation plan for the Koa Ridge project (Shideler and Hammatt 2018) addressed a portion of the SIHP # 50-80-09-2268, Waiahole Ditch System. The report evaluated the significance of the Waiahole Ditch System as follows:

  > SIHP # -7046 is evaluated as possessing integrity of location, design, materials, and workmanship. The setting is evaluated as lacking integrity as the character of the place as a locus of agriculture has been lost and the vegetation is much different. The feeling of agricultural life of the historic property has been lost. The historic property has lost its association with the events and activities of agriculture.
  >
  > The relationship of the historic property to the local history of agriculture and the integrity of location, design, materials, and workmanship is evaluated as supporting the site significance assessment made in 2009. [Shideler and Hammatt 2018:20]

  So while not spelled out per se in the 2018 preservation plan, the preservation plan supports the significance assessment made in 2009 “assessed as significant under Criterion A […] Criterion C […] and Criterion D of the NRHP and HRHP evaluation criteria.”

  The SHPD acceptance letter for this preservation plan dated 28 February 2018 (Log No. 2018.00220, Doc. No. 1802JA04) asserts slightly differently that “Site 2268 retains integrity of location, design, materials, and workmanship and is assessed as significant under HAR §13-284-6 Criteria a, c, and d.”
- A supplemental archaeological inventory survey for the Makakilo Drive Extension project (Zapor et al. 2018) further documented previously identified components of the Waiahole Ditch and documented one newly identified feature. Zapor et al. (2018) assess the ditch as significant pursuant to HAR §13-275-6, under Criteria a, c, and d.

SIHP # 50-80-09-2268 is assessed as significant under HAR §13-275-6 Criteria a, c, and d. The historic property has yielded information on the agricultural history of the area and contributed greatly to the development and evolution of the ‘Ewa Plain throughout its history. The portions of the Waiahole Ditch within the present project area retain integrity of location, design, materials, and workmanship. The proposed project is regarded as routine maintenance, will have minimal impact on the Waiahole Ditch, and is not likely to diminish the integrity of this historic property.

5.3 Background Summary and Predictive Model

The historical background research summarized in this study and the review of previous archaeological studies indicates a low probability of traditional Hawaiian or early historic sites. Two historic properties are present in the present project area: a westward extension of SIHP # 50-80-08-7671:3 Kupehau Road which was a plantation road (and at one time, for part of the stretch in the project area, a plantation railway alignment; see the 1928/1929 USGS topographic map Figure 25) and small portions of the Waiahole Ditch, designated SIHP # 50-80-09-2268.

Section 6 Community Consultation

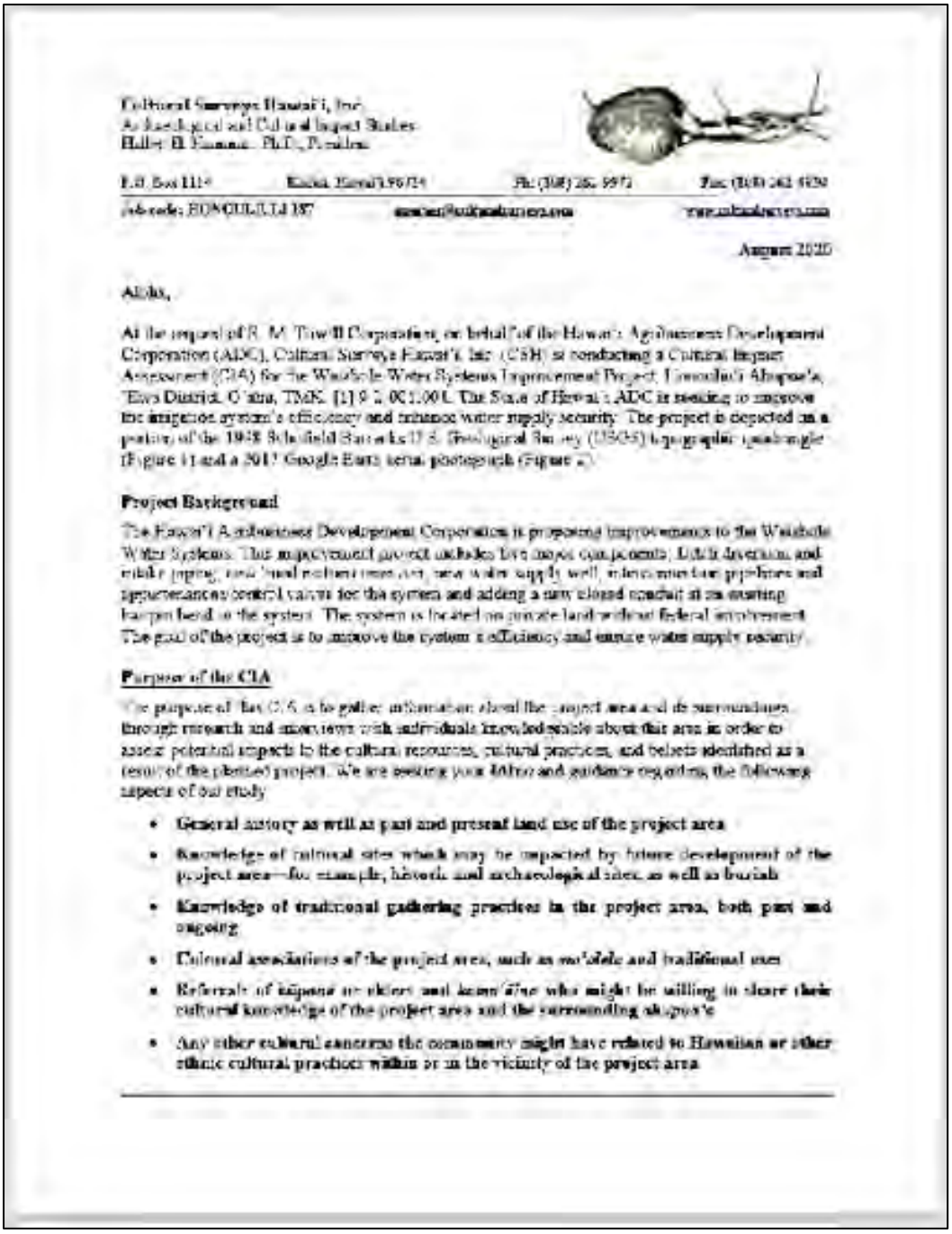
6.1 Introduction

Throughout the course of this assessment, an effort was made to contact and consult with NHOs, agencies, and community members including descendants of the area, in order to identify individuals with cultural expertise and/or knowledge of the *ahupua‘a* of Honouliuli. CSH initiated its outreach effort in August 2020 through letters, email, telephone calls, and in-person contact. CSH completed the community consultation in October 2020.

6.2 Community Contact Letter

Letters (Figure 27 and Figure 28) along with a map and an aerial photograph were mailed with the following text:

> Cultural Surveys Hawai‘i Inc. (CSH) is conducting a Cultural Impact Assessment (CIA) for the R. M. Towill Corporation, on behalf of the Hawai‘i Agribusiness Development Corporation (ADC), Cultural Surveys Hawai‘i, Inc. (CSH) is conducting a Cultural Impact Assessment (CIA) for the Waiahole Water Systems Improvement Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMK: [1] 9-2-001:001. This proposed improvement project includes five major components: Ditch diversion and intake piping, new lined earthen reservoir, new water supply well, interconnection pipelines and appurtenances/control valves for the system and adding a new closed conduit at an existing hairpin bend in the system. The goal of the project is to improve the system’s efficiency and ensure water supply security. We would like to reach out to the community of Honouliuli, in particular, cultural and lineal descendants of this *ahupua‘a*, and kindly ask for your valuable *mana‘o* regarding the project area.
>
> Project Description
>
> This proposed improvement project includes five major components: Ditch diversion and intake piping, new lined earthen reservoir, new water supply well, interconnection pipelines and appurtenances/control valves for the system and adding a new closed conduit at an existing hairpin bend in the system. The goal of the project is to improve the system’s efficiency and ensure water supply security.
>
> Cultural Impact Assessment
>
> The purpose of this CIA is to gather information about the project area and its surroundings through research and interviews with individuals knowledgeable about this area in order to assess potential impacts to the cultural resources, cultural practices, and beliefs identified as a result of the planned project. We are seeking your *kōkua* and guidance regarding the following aspects of our study:



Cultural Surveys Hawai'i, Inc.
Archaeological and Cultural Impact Studies
Hallett H. Hammatt, Ph.D., President

P.O. Box 1114 Kailua, Hawai'i 96734 Ph: (808) 262-9972 Fax: (808) 262-4950

Job code: HONOULIULI 187 [illegible] [illegible]

August 2020

Aloha,

At the request of R. M. Towill Corporation, on behalf of the Hawai'i Agriculture Development Corporation (ADC), Cultural Surveys Hawai'i, Inc. (CSH) is conducting a Cultural Impact Assessment (CIA) for the Waiāhole Water Systems Improvement Project, Honouliuli Ahupua'a, 'Ewa District, O'ahu, TMK: [1] 9-2-001:020. The State of Hawai'i ADC is seeking to improve the irrigation system's efficiency and enhance water supply security. The project is depicted on a portion of the 1928 Schofield Barracks U.S. Geological Survey (USGS) topographic quadrangle (Figure 1) and a 2017 Google Earth aerial photograph (Figure 2).

Project Background

The Hawai'i Agriculture Development Corporation is proposing improvements to the Waiāhole Water Systems. The improvement project includes five major components: ditch diversion and ditch piping, new "mud-pulsed" [illegible], new water supply well, interconnection pipelines and appurtenances, control valves for the system and adding a new closed conduit at an existing lateral feed to the system. The system is located on private land without federal involvement. The goal of the project is to improve the system's efficiency and ensure water supply security.

Purpose of the CIA

The purpose of the CIA is to gather information about the project area and its surroundings through research and interviews with individuals knowledgeable about that area in order to assess potential impacts to the cultural resources, cultural practices, and beliefs identified as a result of the planned project. We are seeking your kōkua and guidance regarding the following aspects of our study:

- General history as well as past and present land use of the project area
- Knowledge of cultural sites which may be impacted by future development of the project area—for example, historic and archaeological sites, as well as burials
- Knowledge of traditional gathering practices in the project area, both past and ongoing
- Cultural associations of the project area, such as *wai'olelo* and traditional uses
- Referrals of kūpuna or elders and *kama'āina* who might be willing to share their cultural knowledge of the project area and the surrounding ahupua'a
- Any other cultural concerns the community might have related to Hawaiian or other ethnic cultural practices within or in the vicinity of the project area

Figure 27. First page of community contact letter

HONOULIULI 187 - CIA, Waiahole Water Systems Improvement Project

Page 2

If you contribute to this effort and with your permission, we would like to use your name in the report to give you proper credit.

Due to the current situation with COVID-19, CSH has temporarily halted in-person consultation as a necessary precaution. We are available to speak with you over the phone, by video chat, or you may also submit a written statement regarding the project, project area, and/or your knowledge of the area. If you prefer to submit a written statement, CSH is able to provide a questionnaire that you may use as a guideline or you may answer the questionnaire directly. Please choose what is convenient for you, though the questionnaire is not necessary. A pre-stamped envelope will be provided to send your statement back to us.

In practicing social distancing, we are working primarily from home and are available at any time through email. If you would prefer to meet in-person, we can schedule a date to meet with you after the safer-at-home order has been lifted. Your patience, understanding, and cooperation is greatly appreciated, and we pray for the safety of you and your loved ones.

If you are interested in participating in this study, please contact Nani Parker by email at nparker@culturalsurveys.com or by phone at (808) 262-9972.

Mahalo nui loa,

Nani Parker
Cultural Researcher

Figure 28. Second page of community contact letter

- General history and present and past land use of the Project area, and Area of Potential Effect as noted in Figures 1 and 2.
- Knowledge of cultural sites- for example, historic sites, archaeological sites, and burials.
- Knowledge of traditional gathering practices in the Project area, both past and ongoing.
- Cultural associations of the Project area, such as legends and traditional uses.
- Referrals of kūpuna (elders) and kama‘āina (Native born) who might be willing to share their cultural knowledge of the Project area and the surrounding ahupua‘a (land division usually extending from the uplands to the sea).
- Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the Project area.

This CIA investigation may also be used to support the National Historic Preservation Act Section 106 and the NEPA consultation, but does not, in itself, satisfy the cultural consultation requirements of either Section 106 or NEPA and a future letter will be sent for this process.

**Official limits of the project are contingent upon results of the traffic analysis and may be adjusted.*

6.3 Community Contact Table

Table 5 contains names, affiliations, dates of contact, and comments from NHOs, individuals, organizations, and agencies contacted for this project. Results are presented below in alphabetical order.

Table 5. Community consultation table

Name	Affiliation	Outreach
Abrigo, Scott	President, Kapolei Community Development Corporation	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Aila, William	Interim Chair of Hawaiian Homes Commission/ Director of Department of Hawaiian Homelands	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Akau, Randal H.	Cultural practitioner	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020

Name	Affiliation	Outreach
Alaka‘i, Robert	Cultural practitioner	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Barbieto, Leda	Raised in Ewa Plantation (Banana /Varona Camp)	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Barbieto, Pio	Raised in Ewa Plantation (Banana /Varona Camp)	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Basham, Leilani	Associate Professor of Hawaiian-Pacific Studies, University of Hawai‘i (UHMA)	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Berg, Tom	Former Councilman, District 1	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020; replied to CSH 23 October 2020 with a 20-page statement regarding threatened habitats of *pueo* and bats in project area; statement summarized and added to report
Bond, John	‘Ewa Historian, Kanehili Cultural Hui	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Caceras, Mana Kaleilani	OIBC Representative for ‘Ewa	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Cayan, Phyllis	Intake Specialist SHPD	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Cordy, Ross	Professor of Hawaiian-Pacific Studies, University of Hawai‘i (UHWO)	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020

Name	Affiliation	Outreach
Cullen, Ty J.K.	Representative, House District 39	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
DaMate, Leimana	Executive Director, DLNR-Aha Moku	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Daniels, Sheri-Ann	Executive Director, Papa Ola Lokahi	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
De Santos, Kahulu	Cultural Advisor, Aulani, A Disney Resort and Spa	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Eaton, Ku‘uwainani	Hoakalei Cultural Foundation	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Farden, Hailama	President, Association of Hawaiian Civic Clubs	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Faulkner, Kirsten	Executive Director, Historic Hawai‘i Foundation	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Feiteira, Blossom	President	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Friends of Honouliuli	Local community charity organization	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Hanohano, Anolani	Kānehili Hawaiian Homestead	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020

Name	Affiliation	Outreach
Holt Takamine, Victoria	Executive Director, PA‘I Foundation	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Hussey, Sylvia	Ka Pouhana of OHA	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020 Ms. Hussey replied to CSH 22 October 2020 and requested consultation packet be emailed to OHA compliance offices; CSH forwarded OHA the packet on 22 October 2020; OHA confirmed receipt
Gabbard, Mike	Senatorial District 20	Letters and figures sent via USPS 26 August 2020 CSH spoke with a representative from Sen. Gabbard’s office 19 October 2020; they had no information to contribute but asked to be kept informed on project progress.
Kai, G. Umi	President, ‘Aha Kāne	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Kaleikini, Ali‘ikaua	Cultural descendant	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Kaleikini, Hāloa	Cultural descendant	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Kaleikini, Kala	Cultural Descendant	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Kaleikini, Mahi‘aimoku	Cultural descendant	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020

Name	Affiliation	Outreach
Kaleikini, Moehonua	Cultural descendant	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Kaleikini, No‘eau	Cultural descendant	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Kaleikini, Tuahine	Cultural descendant	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Kane, Shad	‘Ewa Moku Representative, Aha Moku; Kalaeloa Heritage and Legacy Foundation	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Kauahi, R. Kaiulani Vincent	Culture and Arts Coordinator, Dept. Parks and Recreation	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Kauhane, Michelle	President, Kaupe‘a Homestead Association	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Keala, Jalna	Association of Hawaiian Civic Clubs	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Keaulana, Ha‘a	Cultural Advisor at Four Seasons Resort at Ko`olina	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Keli‘inoi, Kalahikiola	Cultural descendant	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Keli‘inoi, Kilinahe	Cultural descendant	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020

Name	Affiliation	Outreach
Kruse, Kehaulani	Outrigger Enterprises, Cultural Advisor	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Legal, Jack	Chair, Makakilo/Kapolei/ Honokai Hale Neighborhood Board No. 34	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Lewis, Joe Kūhiō	Chief Executive Officer, Council of Native Hawaiian Advancement	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Lidstone, Miki‘ala	Executive Director, Ulu A‘e Learning Center, Hālau ‘o Kaululaua‘e	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Lilomaiva-Doktor, Sa‘iliemanu	Professor of Humanities/Hawaiian-Pacific Studies, University of Hawai‘i (UHWO)	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Lyman, Melissa	President, Kalaeloa Heritage and Legacy Foundation	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
McKeague, Kawika	Director of Cultural Planning, G70 International	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Medeiros, Pōhai	PIKO Program Advisor, University of Hawai‘i West O‘ahu	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Nahulu-Mahelona, Moani	Social Studies Department, Kapolei HS	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
National Park Service Honouliuli National Monument	Organization documenting internment camps during World War II	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020

Name	Affiliation	Outreach
O’Connell, Eugene	Project Coordinator, The Makua Group	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Paglinawan, Lynette	Kumu Hula at UHWO	Letters and figures sent via USPS 26 August 2020 Ms. Paglinawan emailed CSH on 8 September 2020 and gave a written statement regarding her position on the project. Ms. Paglinawan was mailed a physical copy of Authorization and Release form on 10 October 2020.
Paik, Linda Kaleo	Cultural practitioner/ Secretary/Treasurer for Koa Ike Cultural Specialist; Former History and Culture, SHPD, ‘Aha Wahine Aha Moku Committee, Kona District, Oahu	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Paishon, Jr., Frank	Raised in Tenney Village	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Patterson, Kaleo	Native Hawaiian Church; Pacific Justice & Reconciliation Center	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Puahala, Roth	Past-President, Ke One O Kakuhihewa	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Ramos, Rodolfo	President, Ewa Villages Community Association; Chair of ‘Ewa Task Force	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Saul, Melissa	Associate Specialist, Title III PIKO Project Director, University of Hawai‘i West O‘ahu	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020

Name	Affiliation	Outreach
Schaedel, Homelani	President, Malu‘ōhai Residents Association	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Serrao, Marleen Kau‘i	Pelekikena, ‘Ewa-Pu‘uloa Hawaiian Civic Club	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Shibuya, Barbara	Kama‘āina of ‘Ewa, member of the Shibuya Dayanan Family	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Silva, Adrian Nakea	Chairman, Hui Huliau, Inc.	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Soong, Melvin	President, The I Mua Group	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Suganuma, La‘akea	President, Royal Hawaiian Academy of Traditional Arts and Nā Lei Ali‘i Kawananakoa	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Swinney, Shirley S.	Founder, Kapolei Community Development Corporation; Hawaii Community Development Authority	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Tiffany, Nettie	Kahu for Lanikohonua	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Williams-Solomon, Leilani	President, Native Hawaiian Chamber of Commerce	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Wong-Kalu, Hinaleimoana	OIBC Chair	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020

Name	Affiliation	Outreach
Woode, Napali	Native Hawaiian Economic Alliance	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Wond, Kanani	Vice President, Kaupe‘a Homestead Association	Letters and figures sent via USPS 26 August 2020 Second round of letters and figures sent via USPS 20 October 2020
Yee, Christian	*Kama‘āina*, familiar with *wahi pana* and *mo‘olelo*	Letters and figures sent via USPS 26 August 2020 Mr. Yee replied to CSH on 1 October 2020 to set up an interview. CSH phone interviewed Mr. Yee on 5 October 2020. Mr. Yee approved the CSH summary of his interview 24 October 2020.

6.4 *Kama‘aina* Interviews

The authors and researchers of this report extend our deep appreciation to everyone who took the time to speak and share their *mana‘o* and *‘ike* with CSH, whether in interviews or brief consultations. We request that if these interviews are used in future documents, the words of contributors be reproduced accurately and in no way altered, and that if large excerpts from interviews are used, report preparers obtain the express written consent of the interviewee/s.

6.4.1 Christian Kaimanu Yee

CSH interview Mr. Christian Yee on 5 October 2020. Mr. Yee was “made in ‘Ewa Beach, [but] born in England.” His father was a fireman for the United States Air Force stationed at Lakenheath Air Force Base (AFB) in England when Mr. Yee was born in 1980. His mother is a second-generation Filipina from ‘Ewa Beach. Mr. Yee lived in England until 1983 when his father got stationed at Nelles AFB in Las Vegas. In 1985, his family returned to Hawai‘i and moved to ‘Ewa Beach where he lived until 1986. After being honorably discharged from the military, Mr. Yee’s father worked for a trucking company. His father would take him on “drives” where they would visit cultural sites including *heiau* and Kūkaniloko, the sacred birthstones where the highest ranking *ali‘i* were born (Sterling and Summers 1978:139). He said that he gains most of his knowledge about these sites from the book *Sites of O‘ahu* by Sterling and Summers.

Mr. Yee’s grandparents lived in ‘Ewa, and his family lived with them when he was little. He recalls that when he was growing up in ‘Ewa, many remnants of the plantation era were still around. Mr. Yee recalled that across from Renton Road where they lived his mother worked on the plantation across the street. He stated that the plantation grew different types of plants and had multiple green houses. They went from the Honolulu side of Fort Weaver all the way down to ‘Ewa gentry side. He recalls watching his mother drive a forklift at the plantation and being proud of her. He also mentioned there was an abandoned house near the nursery, and all the kids of the

neighborhood knew not to go inside because there were old missiles inside the house and they didn’t know if they were active or not. They never knew where the missiles came from but assumed they must have come from Pearl Harbor.

Mr. Yee shared with CSH multiple *mo‘olelo* from the Honouliuli area. He recalled the legend that the district of Līhu‘e on Kaua‘i got its name from Līhu‘e in O‘ahu, because it was famous for being the birthplace of the *Lo Ali‘i*, the highest ranking secret chiefs.

Mr. Yee shared the importance of trails to the *ahupua‘a* of Honouliuli noting that trails leading to Wai‘anae and the North Shore pass through Honouliuli. He pointed out that the “north shore trail” traverses a portion of the eastern boundary of the *ahupua‘a* between Honouliuli and Hō‘ae‘ae Ahupua‘a before branching off and leading to Pōhākea Pass and traversing through the Wai‘anae Mountain Range to Lualualei Ahupua‘a in the *moku* of Wai‘anae. He knows there are many trails that connect from the Waianae district into the ‘Ewa plains and onward into Waialua. The most famous of these is Pōhākea Pass, which was a famous pathway mentioned in the tale of Palila. Palila possessed a supernatural war club that he could throw a long distance and fly along the club’s path as he held on to the end of it. According to *mo‘olelo*, Palila used his supernatural war club to carry himself from Ka‘ena Point at Wai‘anae, east across the *moku* of ‘Ewa, landing in a number of places in Honouliuli including Pōhākea Pass, the peaks of Manuauna and Kānehoa, and the plain of Keahumoa (Fornander 1918:5[1]:142–143).

Mr. Yee added that Pōhākea Pass is associated with the goddess Hi‘iakaikapoliopele, sister of volcano goddess Pele, and her epic journey across the Hawaiian Islands. Mr. Yee noted that from Pōhākea Pass, Hi‘iaka could see the entire *moku* of ‘Ewa.

> Hi‘iaka actually stands there and sees the whole *moku* of ‘Ewa and pointed it out cause she stood there and seen Leilono from there. She stands at Pōhākea Pass and defines the entire *moku* of ‘Ewa at that moment.
>
> When Hi‘iaka disembarked from her canoe with her *wahine maumau* and her lover, she went *mauka* and walked through Pōhākea Pass.

Mr. Yee told CSH about the *ahupua‘a* marker near the ‘Ewa offramp, which he said he has been looking for but has yet to find its exact location. This *ahupua‘a* marker is mentioned in *Hi‘iakaikapoliopele*, when she looks across the ‘Ewa plain she could see the marker and on to Moanalua, and the red hill found there. This hill is where the legendary *‘ulu* (breadfruit tree) of the afterlife is said to be. Mr. Yee noted the area where the ‘Ewa by Gentry subdivision is located was once the site of the largest grove of *wiliwili* trees on the island of O‘ahu.

Traditional accounts (Kamakau 1991a:47–49) associate the *ao kuewa* with a grove of *wiliwili* trees on the plains of Kaupe‘a in Honouliuli.

> When a man who had no rightful place in the ‘aumakua [family or personal gods] realm (kanaka kuleana ‘ole) died, his soul would wander about and stray amongst the underbrush on the plain of Kama‘oma‘o on Maui, or in the wiliwili grove of Kaupe‘a on Oahu.
>
> On the plain of Kaupe‘a beside Pu‘uloa [Pearl Harbor], wandering souls could go to catch moths (pulelehua) and spiders (nanana). However, wandering souls could

> not go far in the places mentioned earlier before they would be found catching spiders by ‘aumakua souls, and be helped to escape […] [Kamakau 1991a:47–49]

According to legend, the spirits were tested by having to climb this breadfruit tree when they died. Mr. Yee shared that if the spirits tried to climb this tree and the branch broke, they would be trapped to forever wander in the *wiliwili* grove in ‘Ewa. However, if the branch did not break, their *‘aumakua* would guide them into the afterlife.

Mr. Yee also discussed Kūali‘i, a “celebrated chief […] noted for his strength and bravery” who defeated the chiefs of Ko‘olauloa on the plains of Keahumoa (Fornander 1917b:4[2]:364). When the chiefs of Ko‘olauloa and their army of twelve hundred arrived in Honouliuli, they were outnumbered by Kūali‘i’s army of twelve thousand, however, the battle was averted when a *mele* in honor of Kūali‘i was chanted and the chief of Ko‘olauloa ceded the districts of Ko‘olauloa, Ko‘olaupoko, Waialua and Wai‘anae to Kūali‘i (Fornander 1917:4[2]:400).

Mr. Yee stressed the importance of two brothers, Kapa‘ahulani and Kamaka‘aulani, who were on opposing sides of the battle. According to the *mo‘olelo*, Kapa‘ahulani and Kamaka‘aulani composed the *mele* in honor of Kūali‘i and devised a plan in which Kapa‘ahulani would go to Waialua where the chief of Ko‘olauloa was residing and urge him to make war on Kūali‘i, and Kamaka‘aulani would take Kūali‘i and “conceal yourselves in the bushes” at the place where the battle is to be fought (Fornander 1917:4[2]:366). When the forces of Ko‘olauloa arrived in Honouliuli at the location which the brothers had agreed upon, Kapa‘ahulani told the chief of Ko‘olauloa that their army was surrounded, and stated that “I will chant my prayer, and if it should be acceptable this morning, we will be saved” (Fornander 1917:4[2]:368). As Kapa‘ahulani chanted the *mele* which he had composed in honor of Kūali‘i, Kamaka‘aulani convinced Kūali‘i to delay the battle (Fornander 1917:4[2]:380). When the chant was finished the “two armies came together and the battle was declared off” (Fornander 1917:4[2]:400).

Mr. Yee discussed the hill of Pu‘uokapolei, sharing that during the summer solstice, the sun sets over Pu‘uokapolei. He noted that the pathway of the sun aligns a *heiau* located on Pu‘uokapolei with Papa‘ena‘ena Heiau located in the *ahupua‘a* of Waikīkī.

> Pu‘uokapolei. Supposedly, that has an alignment with a heiau where, is it Papa‘ena‘ena Heiau, I think it lines up with that, or if there was another heiau. […] ‘Ōlelo Hawai‘i class […] they go there, that class goes there on one of the solstices or something like that and they chant for the sunset because the sun sets on Pu‘uokapolei at a certain time, as viewed from Papa‘ena‘ena Heiau […]

Sterling and Summers also state that Pu‘uokapolei was used by ancient Hawaiians as an astronomical marker to designate the seasons, noting that the annual season of Kau, which is marked by a high-sun period and corresponds with warmer temperatures and steady trade winds, begins when the sun sets over Pu‘uokapolei.

Mr. Yee suggested CSH reach out to Shad Kane regarding the Honouliuli area *mo‘olelo* and history. He references the coral *heiau* that can be found at Mr. Kane’s Heritage Park, which is the only coral structure found of this unique building type outside Tahiti. The coral slabs from the *heiau* trail cross Honouliuli from Kalailoa Heritage park all the way to Barbers Point.

Another interesting historical legend Mr. Yee shared pertains to the *makai* side of Honouliuli. According to historical accounts, Moku‘ume‘ume (Ford Island) was the place where chiefs and

chiefesses would be linked together. The *ali‘i* women would have just returned from the Halawa Heiau, famous for its healing powers regarding birth and other female-related issues. Once these women were healed and arrived at Moku‘ume‘ume, they were ready to be linked together with a chief and bear royal children. Currently, there is an old fort that can be found on Moku‘ume‘ume that is said to hide a legendary Hawaiian cave. Mr. Yee believes this legendary cave could currently be used by the military to hide weapons. Through his research, Mr. Yee believes it is the green bunker that sits over the cave, and wonders whether reaching out to the military would lead toward learning the truth. Another legendary cave is Pohukaina Cave, the legendary underwater entrance from West Loch that leads upward into the mountains.

Mr. Yee spoke of the bombing of Pearl Harbor and the existence of Japanese “midget submarines” that the Japanese deployed on 7 December 1942. New historical information has found that one of the three mini submarines launched actually made it into Pearl Harbor and sank an American ship. The mini submarine has since been found in West Loch when the harbor was dredged.

Lastly, Mr. Yee made it a point to mention that Honouliuli was the infamous location of the Japanese internment camp that existed during World War II.

6.4.2 Lynette Paglianawan

Ms. Paglinawan replied to CSH on 8 September 2020 with a letter describing her thoughts on the project area:

> I have had your mail since Sept 2 sitting on my desk.
> The immediate focus on this part of what is a larger plan for expansion development in the Honouliuli area requiring more water from the Waiahole water ditch concerns me. Though not explicitly stated but is implied in your first paragraph There appears to be consequential negative impact to take more water out of what is flowing now for the residents, small farmers and other businesses use in the Koolaupoko and Koolauloa Districts. The reservoir expansion is a huge increase and implies more development yet to come.
> As a long time resident over 40 years in Kahaluu and knowing my husband grew up in Waiahole with a long connection with farmers along the Windward coast and with aina based programs that promote family sustainable agriculture use the idea of diverting water for new development projects on the leeward side will certainly reduce flow to accommodate needs for this eventual development. I cannot in all conscious provide input that appears to lend support to what is happening.
> Nani, I am sorry but I am not able to participate with your company at this time in view of my interests to protect and keep the Windward side ‘country’.
>
> My regrets
> Lynette Paglinawan

6.4.3 Written Testimony from Tom Berg

Tom Berg, former City Councilman, provided CSH with written testimony on 23 October 2020 regarding the proposed Waiahole water systems improvement project. Mr. Berg’s entire testimony is included in Appendix A.

Mr. Berg stated that the project has been “proposed on a pueo (owl) foraging and breeding ecosystem.” The *pueo* (Hawaiian short-eared owl, Asio flammeus sandwichensis) are found on all of the main Hawaiian islands and are listed by the State of Hawai‘i as endangered on the island of O‘ahu (DLNR 2005). The Department of Land and Natural Resources (DLNR) states that *pueo* are most commonly found in “open habitats such as grasslands, shrublands, and montane parklands, including urban areas and those actively managed for conservation” (DLNR 2005).

Mr. Berg noted records indicate that per earliest colonial contact, the *pueo* is most abundant on the slopes from Pu‘ukapuai to West Loch, in the area where the project is slated. He added that “Hunehune Gulch, Kaloi Gulch, and Honouliuli Gulch are migratory routes used by the pueo to go from mountain to sea to court, mate, forage, and raise their brood.” He noted *pueo* are not forest dwellers, preferring “scrub, open fields/dirt landscapes with some grass.” He stated that the proposed project will “encroach on prime pueo habitat-considered to be graded A+—‘a ten (10)’—when it comes to the degree of pueo habitat in use on this project site.”

Mr. Berg added that the *pueo* has “a direct connection to Native Hawaiian family lineage in Ewa Beach;” the *pueo* is the *‘aumakua* for the Michael Lee family and their accounts, which go back over seven generations, are documented at the State Archives Building in Honolulu.

Mr. Berg also stated that the project site is “inhabited by the ōpe‘ape‘a [Hawaiian hoary bat, Lasiurus cinereus semotus] at various times of the seasons,” noting that in 1910, the State of Hawai‘i documented *‘ōpe‘ape‘a* within a half-mile of the project area. *‘Ōpe‘ape‘a* is “the only land mammal native to the Hawaiian archipelago” and is found on all of the main Hawaiian islands except for Ni‘ihau (DLNR 2005:3-13). DLNR states *‘ōpe‘ape‘a* have been

> found roosting in ‘ōhi‘a (Metrosideros polymorpha), pu hala (Pandanus tectorius), coconut palms (Cocos nucifera), kukui (Aleurites moluccana), kiawe (Proscopis pallida), avocado (Persea americana), shower trees (Cassie javanica), pūkiawe (Styphelia tameiameiae), and fern clumps; they are suspected to roost in Eucalyptus (Eucalyptus spp.) and Sugi pine (Cyrptomeria japonica) stands. [DLNR 2005]

Mr. Berg stated his concern that the “property in question will not receive the proper protocol to conclude no endangered species inhabit the area.” He asked “what protocol will be deployed to determine if the population of both the pueo and ‘ōpe‘ape‘a are served by habitat on the property?” He discussed five points which he felt need to be addressed:

> 1. Who will look for the pueo and ‘ōpe‘ape‘a on the land? What is their expertise and qualifications as observers?
>
> 2. Did the observation to inventory for the species transpire before sunrise and after the sunset periods when the ‘ōpe‘ape‘a and pueo are most active and can be recorded?
>
> 3. Did the observer conduct the biological survey whereby the inventory for the species was repeated year-round over the wet and dry seasons?
>
> 4. What tools were used—visual aids in the field—techniques to identify the species while observing/conducting the inventory?
>
> 5. Was the inventory to assess and survey for pueo and ‘ōpe‘ape‘a done completely on foot or was a vehicle used?

Mr. Berg stated that to properly account for the *pueo* and *‘ōpe‘ape‘a*, the DLNR and United States Fish and Wildlife Service (USFWS) have developed a protocol that states inventory surveys should “be executed over the changing seasons year-round.” However, Mr. Berg noted that “this practice, to deploy the protocol year-round, is not being done in either the EA [Environmental Assessment] and or EIS [Environmental Impact Statement] review processes.” He added his opinion that surveys must be “undertaken after sunset and before the sunrise periods.”

Mr. Berg discussed the recent population distribution survey for *pueo* on the island of O‘ahu that included the University of Hawai‘i West O‘ahu (UHWO) Makai Segment. The survey, conducted between 31 December 2017 and early August 2018, concluded no *pueo* or its habitat existed on the UHWO property, however, Mr. Berg notes that *pueo* inhabit the property “throughout the months of late August, through September, October, November, and vacate late December.” He added that had the survey been conducted year-round, the survey would have “reported a pueo ecosystem thriving on the property and many Native Hawaiians’ ‘aumakua would be protected rather than purged from the property.”

In his statement, Mr. Berg provided links to videos of *pueo* observed on the UHWO property. He noted that despite these videos, UHWO, University of Hawai‘i (UH) Board of Regents, DLNR, and the Attorney General have stated the *pueo* “did not and have not ever existed there.” He stated that this claim is “a violation of the law—HRS [Hawai‘i Revised Statutes] Ch. 343 that protects endangered species and their habitat.”

He added that Governor Ige’s Administration’s claim that “absolutely no pueo used UHWO property” is in his opinion, “not only patently false–but a deliberate act of Administrative Bias, Institutional Prejudice—and a willful act of Malice—to cause direct harm to an endangered species—a 100% violation of Article XII, Section VII of Hawaii’s State Constitution that protects Native Hawaiian Religious and Cultural Practices and their ‘aumakua.” To justify his claims, Mr. Berg provided the links to the following videos hosted on YouTube: Mike Lee: The Willful Indifference / Pueo Habitat @ UHWO p.1 [https://www.youtube.com/watch?v=7z8-7u3Q0Bo] and Mike Lee: Willful Indifference @ UHWO p.2 [https://www.youtube.com/watch?v=Db46xPfazVQ]. He added that “pueo extirpated from UHWO Hunehune and Kaloi Gulches—headed mauka for refuge—they can’t go east–can’t go west–can’t go south–so they went north up the gulches as this was their only option–and they need the slopes where these solar farm(s) are to be placed to have habitat for the pueo to forage–of course, only if the pueo has been determined as present via an adequate survey performed for the property —.”

Mr. Berg also expressed his concern for the possible negative aspects of light at an adjacent parcel. He expressed concern that a solar panel may reflect neighboring lighting operations into “the flight patterns of migrating birds and the ‘ōpe‘ape‘a and pueo in particular need to be addressed.”

Mr. Berg also recommended inquiring with Dr. Melissa Price and Dr. Javier Cotin of the Project Pueo Biologist Team and DLNR’s Division of Forestry and Wildlife (DOFAW) Biologist Afsheen Siddiqi regarding *pueo* protocol. He made note that “this Pueo team approved of the FEIS [Final Environmental Impact Statement] (2007) for 500-acres of property known as UHWO—saying no pueo are there—.” He added that “these pueo experts had no objections to the FEIS protocol used at UHWO” in which, according to Mr. Berg, the “observer only looked for a few hours TOTAL

over a period of two days within a week during the month of April when the pueo are not here……and to cover 500-acres—."

He noted that in the FEIS for UHWO (PBR Hawaii 2006), DLNR stated in writing "that was a thorough inventory process to search for pueo–satisfactory." He also characterized the DLNR evaluation as, "That's good enough of a look for us–only 3-4 hours of observation need take place to determine on 500-acres if pueo are on the property or not."

Mr. Berg added that surveyors for the FEIS "looked mid-morning hour–not before sunrise or at sunset when pueo are active—but mid morning when that bird ain't to be seen." He noted,

> These Project Pueo experts know that pueo do not have a defined breeding season–and are plot hoppers–and will deploy a foraging ecology–a breeding ecology–at different times of the seasons–and hence, these experts have stated that it is prudent to have the biological survey for pueo be conducted year round. […] These same pueo experts will also state observation needs to take place at sunset and sunrise–if to be a proper protocol deployed.

Mr. Berg questions "if that will be done on this solar property? Year round observation?" He recommends that "a thorough and complete protocol is adopted to repeat the inventory exercise for pueo and ‘ōpe‘ape‘a over the course of a calendar year would be in order so the project does not inadvertently contribute to more endangered species habitat loss."

6.5 Summary of *Kama‘āina* Interviews

Based on reviewed and approved summaries of interviews with Tom Berg, Christian Kaimanu Yee, and Lynette Paglinawan, the following is a synthesis of findings within Honouliuli Ahupua‘a.

CSH spoke with Mr. Christian Kaimanu Yee on 5 October 2020 to share his extensive *‘ike* of *wahi pana* and *mo‘olelo* associated with the *ahupua‘a* of Honouliuli. Mr. Yee discussed several *wahi pana* in the *ahupua‘a* of Honouliuli including Pōhakea Pass, Pu‘uokapolei, a *wiliwili* grove and a *pōhaku* known as Pe‘ekāua on the plains of Kaupe‘a, and a *heiau* and trail located at Kalaeloa Heritage Park.

Mr. Yee noted the importance of trails to the *ahupua‘a* of Honouliuli pointing out that trails leading to Wai‘anae and the North Shore pass through Honouliuli. He stated the "north shore trail" travels along the boundary between Honouliuli and Hō‘ae‘ae Ahupua‘a before branching off and leading to Pōhākea Pass where it continues through the Wai‘anae Mountain Range to Lualualei Ahupua‘a in the *moku* of Wai‘anae. Mr. Yee added that Pōhākea Pass is associated with the goddess Hi‘iakaikapoliopele and her epic journey across the Hawaiian Islands, as well as the famous warrior, Palila, who Mr. Yee referred to as the "Hawaiian Thor."

Mr. Yee also discussed the *‘ili* of Līhu‘e which was associated with a class of chiefs known as the *lo ali‘i*. He shared the *mo‘olelo* of Kelea, a chiefess of Maui, who was kidnapped and brought to O‘ahu to marry Lō Lale, a *lo ali‘i* from Līhu‘e in Honouliuli (Kamakau 1991b:46).

He also discussed Kūali‘i, a chief who defeated the chiefs of Ko‘olauloa on the plains of Keahumoa (Fornander 1917:364) when a *mele* in honor of Kūali‘i was chanted and the chief of Ko‘olauloa ceded the districts of Ko‘olauloa, Ko‘olaupoko, Waialua, and Wai‘anae to Kūali‘i

(Fornander 1917:400). He noted that the *mele* in honor of Kūali‘i was composed by Kapa‘ahulani and Kamaka‘aulani, two brothers who were on opposing sides of the battle.

In written testimony provided to CSH on 23 October 2020, Mr. Berg stated that the project has been “proposed on a pueo (owl) foraging and breeding ecosystem.” He noted records indicate that per earliest colonial contact, the *pueo* is most abundant on the slopes from Pu‘u Kapua‘i to West Loch, adding that “Hunehune Gulch, Kaloi Gulch, and Honouliuli Gulch are migratory routes used by the pueo to go from mountain to sea to court, mate, forage, and raise their brood.” He stated the proposed project will “encroach on prime pueo habitat-considered to be graded A+—‘a ten (10)’—when it comes to the degree of pueo habitat in use on this project site.” Mr. Berg stated the project site is also “inhabited by the ōpe‘ape‘a at various times of the seasons,” noting that in 1910, the State of Hawai‘i documented *‘ōpe‘ape‘a* within a half-mile of the project area.

Mr. Berg also stated that the *pueo* has “a direct connection to Native Hawaiian family lineage in Ewa Beach,” noting the *pueo* is the *‘aumakua* for the Michael Lee family and their accounts, which go back over seven generations, are documented at the State Archives Building in Honolulu.

Mr. Berg stated his concern that the “property in question will not receive the proper protocol to conclude no endangered species inhabit the area.” He recommended that “a thorough and complete protocol is adopted to repeat the inventory exercise for pueo and ‘ōpe‘ape‘a over the course of a calendar year would be in order so the project does not inadvertently contribute to more endangered species habitat loss.” He added that “this practice, to deploy the protocol year-round, is not being done in either the EA and or EIS review processes.” Mr. Berg also recommended consulting with Dr. Melissa Price and Dr. Javier Cotin of the Project Pueo Biologist Team and DOFAW Biologist Afsheen Siddiqi regarding *pueo* protocol.

Mr. Berg also expressed his concern for the possible negative aspects of neighboring lighting operations at an adjacent parcel which may reflect off a solar panel into “the flight patterns of migrating birds and the *‘ōpe‘ape‘a* and *pueo* in particular need to be addressed.”

In written testimony provided to CSH 8 September 2020, Ms. Lynette Paglinawan shared her concerns regarding additional water being taken from residents and small farmers to use in other districts. She believes that reservoir expansion is a sign of future development to come. Her final statement is to protect the Windward side and to keep it “country.”

Section 7 Traditional Cultural Practices

Timothy R. Pauketat succinctly describes the importance of traditions, especially regarding the active manifestation of one’s culture or aspects thereof. According to Pauketat,

> People have always had traditions, practiced traditions, resisted traditions, or created traditions […] Power, plurality, and human agency are all a part of how traditions come about. Traditions do not simply exist without people and their struggles involved every step of the way. [Pauketat 2001:1]

It is understood that traditional practices are developed within the group, in this case, within the Hawaiian culture. These traditions are meant to mark or represent aspects of Hawaiian culture that have been practiced since ancient times. As with most human constructs, traditions are evolving and prone to change resulting from multiple influences, including modernization as well as other cultures. It is well known that within Hawai‘i, a “broader ‘local’ multicultural perspective exists” (Kawelu 2015:3). While this “local” multicultural culture is deservedly celebrated, it must be noted that it has often come into contact with “traditional Hawaiian culture.” This contact between cultures and traditions has undoubtedly resulted in numerous cultural entanglements. These cultural entanglements have prompted questions regarding the legitimacy of newly evolved traditional practices. The influences of “local” culture are well noted throughout this section and understood to represent survivance or “the active sense of presence, the continuance of native stories, not a mere reaction, or a survivable name. Native survivance stories are renunciations of dominance, tragedy and victimry” (Vizenor 1999:vii). Acknowledgement of these “local” influences helps inform nuanced understandings of entanglement and of a “living [Hawaiian] contemporary culture” (Kawelu 2015:3). This section strives to articulate traditional Hawaiian cultural practices within the *ahupua‘a* in ancient times, and the aspects of these traditional practices that continue to be practiced today; however, this section also challenges “tropes of authenticity” (Cipolla 2013) and acknowledges the multicultural influences and entanglements that may “change” or “create” a tradition.

This section integrates information from Sections 3–6 in examining cultural resources and practices identified within or in proximity of the project area in the broader context of the encompassing Honouliuli landscape. Excerpts from interviews are incorporated throughout this section where applicable.

7.1 Gathering of Plant and Aquatic Resources

Lying in the lee of the Wai‘anae Mountain Range, Honouliuli is one of the driest areas of O‘ahu with most of the area averaging about 550 mm (22 inches) of rain on the coastal and inland region of the *ahupua‘a* and about 1,200 mm (39 inches) in the northern region up into the Wai‘anae Mountain Range (Giambelluca et. al. 2013). Despite the relative lack of rainfall in this area, there exists a traditional rain name associated with the *ahupua‘a* of Honouliuli. This rain, known as the Nāulu, is described as a sudden shower and is more commonly associated with other notoriously dry locations, such as Kawaihae, Hawai‘i and Ni‘ihau (Akana and Gonzalez 2015:187). The general lack of distinctive, traditional rain names is indicative of historic environmental conditions within the *ahupua‘a*. Due to these conditions, *maka‘āinana* living within the *ahupua‘a* were forced to modify or utilize freshwater resources in innovative ways.

No natural streams are located in the vicinity of the project area. However, fresh water remains available below the surface of Honouliuli. Dissolution “pit caves” (Mylroie and Carew 1995) or “sink holes” would accumulate water within them via a subterranean water or karst system; this water also contained nutrient-rich sediment that allowed for the cultivation of significant plant resources such as *kalo*, *kī*, and *noni*. McAllister (1933) documented examples of traditional agricultural activity in Honouliuli, writing that the *kama‘āina* of the *ahupua‘a* utilized the soil on the floor of caves for cultivation. At the time of his survey in 1930 both *mai‘a* (bananas) and *kō* (sugarcane) were still being cultivated within these pits.

The lowlands fronting the west loch of Pearl Harbor (Kaihuopala‘ai) were suitable for the cultivation of the traditional Hawaiian staple crop, *kalo*. The production (and consumption) of *kalo* was vitally important to many communities of Native Hawaiians living in ‘Ewa. Captain James King, visiting Hawai‘i in 1779, noted that “the natives of these islands are, in general, above the middle size and well made; they walk very gracefully, run nimbly and are capable of bearing great fatigue” (Shintani 1993:10). Accordingly, the high level of physical activity and physical fitness described by Captain King was a normal part of Hawaiian life and was largely attributable to the availability of plant and food resources such as *kalo*, *‘uala* (sweet potato; Ipomoea batatas), *niu*, *mai‘a*, *limu* (seaweed), and *i‘a* (fish). Besides the observed contributions to stamina and health, *kalo* was also a revered staple food, believed to have derived from the first-born son of Wakea and Papa.

> […] the supreme god Kane in the form of Wakea (a form associated with the earth) produced two sequential offspring: the first became kalo (taro) plant, the second became Hāloa, the ancestor of man […] thus, in kinship terms, the taro is the elder brother and the senior branch of the family tree, mankind belongs to the junior branch, stemming from the younger brother.’ [Trask 2012:75]

‘Ewa was also famous for a rare taro called the “kāī o ‘Ewa,” which was grown in mounds in marshy locations (Handy and Handy 1972:471). The cultivation of this prized and delicious taro led to the saying, “*Ua ‘ai i ke kāī-koi o ‘Ewa*, He has eaten the Kāī-koi taro of ‘Ewa” (Pukui 1983:305).

Traditional Hawaiian diets were also supplemented with ocean-based proteins. Native Hawaiians historically fished the reefs, farmed fishponds, and utilized the freshwater springs in the *ahupua‘a* of Honouliuli. The lochs of Pearl Harbor were ideal for the construction of fishponds and fish traps. References to the abundance of ocean resources can be found within *mo‘olelo*, *wahi pana*, and *‘ōlelo no‘eau* associated with Honouliuli Ahupua‘a.

The *mo‘olelo* “Legend of the Children” describes the coastal area of Kūalaka‘i as being plentiful in fish. Clark (1977:74) and Pukui et al. (1974:119) describe *kūalaka‘i* as a type of sea cucumber (Tethys) that squirts purple fluid when squeezed. The *‘ōlelo no‘eau*, “*Kai a hali a ka makani*,” translates to “the fish fetched by the wind” which describes the migration of the *‘anae* that travels from the leeward coast to the windward coast of O‘ahu.

Interviewee Christian Kaimanu Yee noted that the site of one of the oldest fishing encampments on the island of O‘ahu was discovered at Ko‘olina. Ross Cordy (2002:13–14) discussed evidence of early settlement at “sites on the arid western fringe of the ‘Ewa Plain in today’s Ko Olina

Resort," which included "fishbone, shellfish, bird bone (flightless goose, etc.), early types of one-piece bone and pearlshell fishhooks, and basalt adze blanks" which date back to AD 145-600.

7.2 Faunal Resources

The *pueo* (Asio flammeus sandwichensis or short-eared owl), which is endemic to Hawai‘i, is found on all of the main Hawaiian islands and is listed by the State of Hawai‘i as endangered on the island of O‘ahu (DLNR 2005). The DLNR states that *pueo* are most commonly found in "open habitats such as grasslands, shrublands, and montane parklands, including urban areas and those actively managed for conservation" (DLNR 2005).

In written testimony provided to CSH via email on 23 October 2020, Mr. Tom Berg stated that the project has been "proposed on a *pueo* (owl) foraging and breeding ecosystem." He noted that historic records indicate the *pueo* is most abundant on the slopes from Pu‘u Kapua‘i to West Loch. He added that "Hunehune Gulch, Kaloi Gulch, and Honouliuli Gulch are migratory routes used by the *pueo* to go from mountain to sea to court, mate, forage, and raise their brood." He also stated the proposed project will "encroach on prime pueo habitat-considered to be graded A+—‘a ten (10)'—when it comes to the degree of pueo habitat in use on this project site."

The *pueo* is one of the most important *‘aumākua* gods and ancestral deities of the family (Valeri 1985:19, 21). Mr. Berg noted the *pueo* has "a direct connection to Native Hawaiian family lineage in Ewa Beach," noting that the *pueo* is the *‘aumakua* for the Michael Lee family and their accounts, which go back over seven generations, are documented at the State Archives Building in Honolulu.

Mr. Berg also stated that the project site is "inhabited by the ōpe‘ape‘a [Hawaiian hoary bat, Lasiurus cinereus semotus] at various times of the seasons," noting that in 1910, the State of Hawai‘i documented *‘ōpe‘ape‘a* within a half-mile of the project area. "The only land mammal native to the Hawaiian archipelago," *‘ōpe‘ape‘a* are found on all of the main Hawaiian islands except for Ni‘ihau (DLNR 2005:3-13) and have been

> found roosting in ‘ōhi‘a (Metrosideros polymorpha), pu hala (Pandanus tectorius), coconut palms (Cocos nucifera), kukui (Aleurites moluccana), kiawe (Proscopis pallida), avocado (Persea americana), shower trees (Cassie javanica), pūkiawe (Styphelia tameiameiae), and fern clumps; they are suspected to roost in Eucalyptus (Eucalyptus spp.) and Sugi pine (Cyrptomeria japonica) stands. [DLNR 2005]

The *‘ōpe‘ape‘a* was listed as an endangered species under the Endangered Species Conservation Act of 1969.

7.3 *Nā Wahi Pana*

There exist a myriad of cultural sites or *wahi pana* for ‘Ewa Moku, however, for the *ahupua‘a* of Honouliuli trails, plains, and temples were of particular importance.

Trails were and continue to be valuable resources for Native Hawaiian culture and life ways. In the past, trails were well used for travel within the *ahupua‘a*, between *mauka* and *makai* and laterally between *ahupua‘a*. A historical trail system existed in O‘ahu extending from Honolulu to Wai‘anae. A cross-*ahupua‘a* (east-west) trail that bordered Pearl Harbor passed through Honouliuli north of Pu‘uokapolei and continued along the coast to Wai‘anae. Mr. Yee pointed out that the "north shore trail," which branches off the cross-*ahupua‘a* trail, traverses a portion of the

eastern boundary of the *ahupua‘a* between Honouliuli and Hō‘ae‘ae Ahupua‘a before branching off and leading to Pōhākea Pass and traversing through the Wai‘anae Mountain Range to Lualualei Ahupua‘a in the *moku* of Wai‘anae.

Mr. Yee noted that Pōhākea Pass is associated with the goddess Hi‘iakaikapoliopele, sister of volcano goddess Pele, and her epic journey across the Hawaiian Islands. He noted that from Pōhākea Pass, Hi‘iaka could see the entire *moku* of ‘Ewa. From Pōhākea Pass, Hi‘iaka also saw her traveling companions, Lohi‘au and Wahine‘ōma‘o, as they traveled by canoe to the harbor of Kou (Honolulu) (Ho‘oulumahiehie 2008b:260). She also saw that her *aikāne*, Hōpoe, had “died in the fires of her elder sister Pele” as she “gazed towards Hawai‘i” from Pōhākea Pass (Ho‘oulumahiehie 2008b:260).

Mr. Yee also noted that Pōhākea Pass is associated with the famous warrior, Palila, who could throw his supernatural war club a long distance and fly along the club’s path as he held on to the end of it. According to the *mo‘olelo*, Palila used his supernatural war club to carry himself from Ka‘ena Point at Wai‘anae, before landing at Pōhākea Pass and continuing east across ‘Ewa Moku.

Mr. Yee stated the *‘ili* of Līhu‘e, which is located in the northern region of Honouliuli Ahupua‘a, was associated with a class of chiefs known as the *lo ali‘i*. Mr. Yee noted the “*lo ali‘i* were the highest ranking chiefs but then they were hidden so they were like the poorest at the same time.” He also discussed the *mo‘olelo* of Kelea, a chiefess of Maui, who was kidnapped and brought to O‘ahu to marry Lō Lale, a *lo ali‘i* from Līhu‘e in Honouliuli (Kamakau 1991b:46).

The ‘Ewa coastal plain was also a place of spiritual significance as it was associated with the *ao kuewa*, the realm of the homeless souls. According to Samuel Kamakau, there existed three spirit realms, the *ao kuewa*, *ao ‘aumakua*, and *ke ao o milu*. Upon death, the spirits of the recently deceased was said to leave the body and then proceed toward a *leina* where they would leap into Pō, the world of the unseen (Handy and Pukui 1972:146). The spirit was guided to and over the *leina* and into Pō by their *‘aumakua* (Handy and Pukui 1972:146), however, if the soul of the deceased had no place in the *‘aumakua* realm, or was abandoned by an *‘aumakua*, they were destined to wander the *wiliwili* grove of Kaupe‘a until such time that they were rescued by their *‘aumakua*. Mr. Yee also noted largest grove of *wiliwili* trees on the island of O‘ahu was once located in the area where the ‘Ewa by Gentry subdivision is now. Fornander (1919:6[2]:292) states that Pu‘uokapolei may have been a *leina*, jumping off point associated with the wandering souls who roamed the plains of Kaupe‘a and Kānehili, *makai* of the hill.

Pu‘uokapolei was also known to be the home of Kamapua‘a’s grandmother, Kamaunuaniho, (Nakuina 1904:50). After conquering the majority of O‘ahu, he established his grandmother as queen (Pukui et al. 1974:203). There was once a large rock shelter on the *makai* side said to have been the residence of Kamapua‘a and his grandmother (McAllister 1933:108). Another account (*Ka Loea Kālai‘āina*, 13 January 1900 in Sterling and Summers 1978:34) stated that Kekele‘aikū, the older brother of Kamapua‘a, also lived on Pu‘uokapolei.

The plain of Pukaua is also located near Pu‘uokapolei, northwest of the project area. Two distinct *mo‘olelo* are connected with this cultural site. The first of these two stories was presented within a 13 January 1900 edition of *Ka Loea Kālai‘āina* which states that two old women with supernatural powers were heading to their home to Pukaua following an evening of fishing at the village of Kualaka‘i. As the sun began to rise, the women hid to avoid being seen and their bodies

turned to stone. The second *mo‘olelo* involves Hi‘iaka, and was spread across several daily editions of *Ka Hōkū o Hawai‘i* from February 1927. According to the *mo‘olelo*, the two women were *mo‘o*. The women saw Hi‘iaka as she journeyed toward the ‘Ewa coast. They were afraid that Hi‘iaka would kill them, so they transformed into their lizard form and hid from Hi‘iaka (*Ka Hōkū o Hawai‘i*, 15 February 1927, translated in Maly 1997:19). This stone was known as “Pe‘e-kāua,” which translates to “we two hidden.” Mr. Yee also discussed the plain of Pukaua, mentioning that “there was those two ladies who were down by the archery, that’s two *pōhaku*, the lizards in the Hi‘iaka story.”

Mr. Yee also discussed Kūali‘i, a “celebrated chief […] noted for his strength and bravery” who defeated the chiefs of Ko‘olauloa on the plains of Keahumoa (Fornander 1917:4[2]:364). Mr. Yee stressed the importance of two brothers, Kapa‘ahulani and Kamaka‘aulani, who were on opposing sides of the battle. According to the *mo‘olelo*, Kapa‘ahulani and Kamaka‘aulani composed the *mele* in honor of Kūali‘i and devised a plan in which Kapa‘ahulani would urge the chief of Ko‘olauloa to make war on Kūali‘i, and Kamaka‘aulani would take Kūali‘i and “conceal yourselves in the bushes” at the place where the battle is to be fought (Fornander 1917:4[2]:366). When the forces of Ko‘olauloa arrived in Honouliuli, their army of twelve hundred were outnumbered by Kūali‘i’s army of twelve thousand, however, the battle was averted when the *mele*, which was composed by Kapa‘ahulani and Kamaka‘aulani in honor of Kūali‘i was chanted and the chief of Ko‘olauloa surrendered, ceding the districts of Ko‘olauloa, Ko‘olaupoko, Waialua and Wai‘anae to Kūali‘i (Fornander 1917:4[2]:400).

Kūalaka‘i is the name of an ancient fishing village located on the southwestern side of Honouliuli Ahupua‘a, southwest of the project area. Kūalaka‘i is mentioned in the “Legend of the Children” which foretells the breaking of the eating *kapu* by the *ali‘i* (*Ka Loea Kālai‘āina*, 22 July 1899:15; translation in Sterling and Summers 1978:7). This area was also once the site of a spring called Hoaka-lei (“lei reflection”), where according to *mo‘olelo*, Hi‘iaka picked *lehua* and saw her reflection in the water (Pukui et al. 1974:119).

Kalaeloa is an area located at the southwestern point of O‘ahu. Kalaeloa Point was the home of Uhu Makaikai, a *kupua* who could take the form of a man or a giant parrotfish (*uhu).* He is mentioned in several legends concerning the hero Kawelo and with Kawelo’s struggles with ‘Aikanaka, the ruling chief of Kaua‘i (Hawaiian Ethnological Notes, Bishop Museum Vol. II:114, translation in Sterling and Summers 1978:41).

Cultural practices within Honouliuli of late have been inspired by traditional understandings of caring for natural and cultural resources. The Kalaeloa Heritage and Legacy Foundation has adopted practices wherein the community can *mālama* (care for) cultural sites, and in turn benefit from the knowledge inherent in such sites. Previously documented cultural sites within the Kalaeloa Heritage Park are actively cared for while also the subject of numerous university-level studies. These sites have been established as important centers for an *‘āina*-based education. Mr. Yee recalled visiting Kalaeloa Heritage Park where he observed a *heiau* which was partially underground and built using upright coral stones. He also observed a trail marked by upright coral slabs which “supposedly led all the way to another *heiau* that was by Laulaunui Island” near the West Loch of Pu‘uloa (Pearl Harbor).

7.4 Religious Practice

Several *heiau* stood in Honouliuli Ahupua‘a including Pu‘uokapolei Heiau, Pu‘u Ku‘ua Heiau, and two unidentified *heiau* located at the foot of Pu‘u Kanehoa and Pu‘u Kuina, respectively. Each year, a ceremony commemorating the changing of the seasons is still observed in the beginning of May at Waikīkī and Honouliuli. Sam ‘Ohukani‘ōhi‘a Gon III, Na Wa‘a Lalani Kahuna O Pu‘u Koholā, and the late Kumu Hula John Keola Lake’s *hula hālau* perform *oli* and *hula* during the ceremony (Genz et al. 2012). The ceremony occurs at Pu‘uokapolei Heiau which is oriented so that it views the setting of the sun behind Pu‘ula‘ila‘i farther west, and maintains a line of sight extending eastward from Pu‘ula‘ila‘i toward Papa‘ena‘ena Heiau located in Waikīkī. Mr. Yee also noted that during the summer solstice, the sun sets over Pu‘uokapolei, adding that the pathway of the sun aligns a *heiau* located on Pu‘uokapolei with Papa‘ena‘ena Heiau.

7.5 Burials

‘Ewa was famous for the many limestone caves formed in the uplifted coral, called the “Ewa Karst.” In traditional Hawaiian times, the areas of exposed coral outcrop were undoubtedly more extensive. Where not covered by alluvium or stockpiled material, this Pleistocene limestone outcrop has characteristic dissolution “pit caves” (Mylroie and Carew 1995). The caves of Pu‘uloa were sometimes also used as burial caves. Following the death of Keali‘iahonui, son of Kaua‘i’s last king, Kaumuali‘i, in 1849, his body was buried in Pu‘uloa (Alexander 1907:27). Burials have been encountered in the coastal areas of the *ahupua‘a*, however, no burials have been encountered within the project area nor within the vicinity of the project area.

Section 8 Results and Analysis

CSH undertook this CIA at the request of R.M. Towill Corporation, on behalf of the ADC. The research broadly covered the entire *ahupua‘a* of Honouliuli, including the current project area.

8.1 Results of Background Research

Background research for this study yielded the following results, presented in approximate chronological order:

1. Honouliuli is the largest *ahupua‘a* in the *moku* of ‘Ewa. Honouliuli translates literally as “dark water,” “dark bay,” or “blue harbor,” and thus is named for the waters of Pearl Harbor which marks the eastern boundary of the *ahupua‘a* (Jarrett 1930:22). Another source translates Honouliuli as “The blue bays or inlets” (*Saturday Press*, 11 August 1883). Honouliuli appears in the “Mo‘olelo of Lepeamoa,” the chicken-girl of Pālama, where Honouliuli is the name of the husband of the chiefess Kapālama, and grandfather of Lepeamoa (Westervelt 1923:164–184).
2. Generally, Honouliuli was described as very hot and dry. Evidence for drought-like conditions is further supported by the relative lack of traditional rain names associated with Honouliuli Ahupua‘a. The Nāulu rain is the only known associated rain name for Honouliuli. Due to the lack of rainwater, freshwater resources were accessed via a karstic system.
3. In traditional Hawaiian times, the areas of exposed coral (Pleistocene limestone) outcrop were undoubtedly more extensive. According to McAllister (1933), holes and pits in the coral were generally accessed for water while larger pits, often containing soil, were used for cultivation. McAllister additionally remarked that at the time of his 1930s survey *mai‘a* (banana; *Musaceae*) and *kō* (sugarcane; *Saccharum officinarum*) were being cultivated within the pit caves (sinkholes) (McAllister 1933:109).
4. The traditional *ka‘ao* associated with the area speak of the *akua* brothers, Kāne and Kanaloa. It was their supernatural feat of hurling *pōhaku* across the island that determined the boundaries of land divisions (Sterling and Summers 1987:1). Additional *mo‘olelo* speak of Hi‘iaka and her travels across the plains of ‘Ewa. In particular, the *wahi pana* of Kaupe‘a (located south of the current project area) is described. Kamakau describes Kaupe‘a as a wide plain where a grove of *wiliwili* (*Erythrina sandwicensis*) stands (Kamakau 1991a:47). This plain is an *ao kuewa*, a realm belonging to homeless souls. In general, the *kama‘āina* of both Honouliuli Ahupua‘a and ‘Ewa District made a point to avoid this place.
5. Pu‘uokapolei is a prominent hill located on the ‘Ewa coastal plain that was the primary landmark for travelers on the trail running from Pearl Harbor to Wai‘anae. A *heiau* was once on the summit of the hill, however, by the time of McAllister’s survey of O‘ahu it had been destroyed (McAllister 1933:108). The hill was also used as a point of solar reference or as a place for celestial observations of the winter and summer solstice. A

ceremony at a *heiau* on Pu‘uokapolei provides a vantage point to capture the sun setting directly behind Pu‘ula‘ila‘i, a peak farther west in the Wai‘anae Range. A coinciding ceremony at Kūpalaha Heiau in Waikīkī captures the same essence as the sun sets behind Pu‘uokapolei.

6. Additional *heiau* located within Honouliuli included Pu‘u Ku‘ua located at Palikea, in addition to two unidentified *heiau*. These two unidentified *heiau* are located at the foot of Pu‘u Kanehoa and Pu‘u Kuina, respectively.

7. In later historic times, a network of trails encircled and crossed the Wai‘anae Range, allowing passage from West Loch to the Honouliuli lowlands, past Pu‘uokapolei and Waimānalo Gulch to the Wai‘anae coast and onward circumscribing the shoreline of O‘ahu (‘Ī‘ī 1959:96–98). The main trail along the south shore of O‘ahu would have been approximately 1.5 km to the southeast. A main trail extending up the central valley of O‘ahu would have been approximately 3 km to the east. The 1825 Malden map shows a trail extending from the main trail along the south shore of O‘ahu into the uplands in the Pālehua area as passing just a couple hundred meters to the southwest of the project area.

8. The rich resources of Pu‘uloa—the fisheries in the lochs, the shoreline fishponds, the numerous springs, and the irrigated lands along the streams—made ‘Ewa a prize for competing chiefs. ‘Ewa Moku was also a political center and home to many chiefs in its day. Oral accounts of *ali‘i* recorded by Hawaiian historian Samuel Kamakau date back to at least the twelfth century. *Ali‘i* associated with Honouliuli and greater ‘Ewa Moku included Kākuhihewa, Keaunui, Lakona, Mā‘ilikūkahi, and Kahahana.

9. In early historic times, the population of Honouliuli was concentrated at the western edge of West Loch in the vicinity of Kapapapuhi Point in the “Honouliuli Taro Lands.” This area was clearly a major focus of population due to the abundance of fish and shellfish resources in close proximity to a wide expanse of well-irrigated bottomland suitable for wetland taro cultivation.

10. Early foreign accounts describe the southwest coast of O‘ahu, including Honouliuli Ahupua‘a, as an area “a little distance from the sea, the soil is rich and all the necessaries of life are abundantly produced” (Vancouver 1798:215). A sailor among Vancouver’s crew observed, however, that “from the number of houses within the harbour it should seem to be very populous; but the very few inhabitants who made their appearance were an indication of the contrary” (Vancouver 1798:216).

11. Following the Māhele of 1848, 99 individual land claims in the *ahupua‘a* of Honouliuli were registered and awarded by King Kamehameha III. No *kuleana* land claims were made for land within the current project area or vicinity. The vast majority of the LCA parcels were located in Honouliuli near the taro lands of the *‘ili* of Pu‘uloa and the Pu‘uloa Salt Works. The largest award (Royal Patent 6071, LCA 11216, ‘Āpana 8) in Honouliuli Ahupua‘a was granted to Miriam Ke‘ahi-Kuni Kekau‘onohi on January 1848 (Native Register 1848) who acquired a deed to all unclaimed land within the *ahupua‘a*, including the present project area.

12. Beginning with the time of Western Contact, however, Hawaiian populations were introduced to many virulent western diseases which began to decimate the native populations. Thus, four years following the 1832 census, the ‘Ewa population had dropped to 3,423 (Schmitt 1973:9, 36), “a decrease of 592 in 4 years” (Ewa Station Reports 1836). Between 1848 and 1853, there was a series of epidemics of measles, influenza, and whooping cough that often wiped out whole villages.
13. With the increasing foreign interests on O‘ahu Island during the last half of the nineteenth century, an array of agricultural enterprises was attempted. In 1871, John Coney rented the lands of Honouliuli to James Dowsett and John Meek, who used the land for cattle grazing. In 1877, James Campbell purchased most of Honouliuli Ahupua‘a for a total of $95,000.
14. By 1889, the Ewa Plantation Company was established and lands throughout Honouliuli were designated for sugarcane cultivation. Sugar production exploded with the successful drilling of an artesian well by James Campbell on the ‘Ewa Plain. Campbell’s first well was named Waianiani (“crystal waters”) by the *kama‘āina* of Honouliuli (Nellist 1925). By 1930, Ewa Plantation had drilled 70 artesian wells to irrigate cane lands; artesian wells provided fresh water to Honouliuli for nearly 60 years (Ho‘okuleana 2014).
15. In 1897, B.F. Dillingham established the Oahu Sugar Company on 12,000 acres leased from the estates of John Papa ‘Ī‘ī, Bishop, and Robinson. The Oahu Sugar Company had over 900 field workers, composed of 44 Hawaiians, 473 Japanese, 399 Chinese, and 57 Portuguese. The first sugar crop was harvested in 1899, ushering in the sugar plantation era in Waipahu (Ohira 1997). Prior to commercial sugar cultivation, these lands were described as being “of near desert proportion until water was supplied from drilled artesian wells and the Waiahole Water project” (Condé and Best 1973:313).
16. The Waiahole Water Company was formally incorporated in 1913 and was originally a subsidiary of the Oahu Sugar Company. The Waiahole Ditch was designed by engineer Jorgen Jorgensen, with recommendations by engineer J.B. Lippencott and assisted by W.A. Wall. Upon its completion in 1916, the Waiahole Ditch was 35 km (21.9 miles) long and cost $2.3 million. The 32 million gallons of daily water enabled the Oahu Sugar Company to grow to “some 20 square miles […] ranging in elevation from 10 ft at the Waipio Peninsula […] to 700 ft at the Waiahole Ditch” (Condé and Best 1973:313). The ditch system is included on the state inventory of archaeological sites as SIHP # 50-80-09-2268. The Waiahole Ditch System crossed through the western portion of the present project area.
17. The early twentieth century saw the lands of Honouliuli heavily utilized by both civilians and the U.S. military for transportation. The U.S. Government began acquiring the coastal lands of ‘Ewa for development of a naval base at Pearl Harbor. In 1901, the U.S. Congress formally ratified annexation of the Territory of Hawaii, and the first 1,356.01 acres of Pearl Harbor land were transferred to U.S. ownership.

18. In 1937, 18 miles of roads were built in the coastal Honouliuli area, and in 1939-1940 the U.S. bought 3,500 acres of land in this area (Landrum et al. 1997:62–67), to build several other military camps and installations, including Barbers Point Naval Air Station.

19. Following the Japanese Navy’s attack on Pearl Harbor on 7 December 1941, the Territory of Hawaii was declared under martial law and the writ of *habeas corpus* (the requirement for a person under arrest to be brought before a judge or into court) was suspended (U.S. Department of the Interior 2014:6–7). Persons of Japanese and European ancestry in Hawai‘i suspected of disloyalty to the United States were rounded up and imprisoned by the U.S. military and the FBI (U.S. Department of the Interior 2014:xii). In 1943, the Honouliuli Internment Camp was constructed to intern citizens, resident aliens, and prisoners of war. Located in Honouliuli Gulch, east of the project area, the camp was the “last, largest, and longest-used World War II confinement site in Hawai‘i,” holding approximately 320 internees and nearly 4,000 prisoners of war (U.S. Department of the Interior 2014:xiv).

8.2 Results of Community Consultations

CSH attempted to contact Hawaiian organizations, agencies, and community members as well as cultural and lineal descendants in order to identify individuals with cultural expertise and/or knowledge of the project area and vicinity. Community outreach letters were sent to a total of 71 individuals and groups; four responded, two provided written testimony, and one *kama‘āina* and/or *kūpuna* spoke with CSH for a phone interview. Consultation was received from community members as follows:

1. Christian Kaimanu Yee, *kama‘āina* and knowledgeable of *mo‘olelo* and *wahi pana*
2. Tom Berg, former Councilman, District 1
3. Lynette Paglinawan, cultural practitioner; educator, teaches a course on Native Hawaiian Healing at University of Hawai‘i West O‘ahu

8.3 Impacts and Recommendations

Based on information gathered from the community consultation, participants voiced and framed their concerns in a cultural context.

1. Mr. Tom Berg stated that the project has been “proposed on a pueo (owl) foraging and breeding ecosystem.” He noted records indicate that per earliest colonial contact, the *pueo* is most abundant on the slopes from Pu‘u Kapua‘i to West Loch, in the area where the project is slated. He added that “Hunehune Gulch, Kaloi Gulch, and Honouliuli Gulch are migratory routes used by the pueo to go from mountain to sea to court, mate, forage, and raise their brood.” He stated the proposed project will “encroach on prime pueo habitat-considered to be graded A+—‘a ten (10)’—when it comes to the degree of pueo habitat in use on this project site.”
2. Mr. Berg added that the *pueo* has “a direct connection to Native Hawaiian family lineage in Ewa Beach,” noting the *pueo* is the *‘aumakua* for the Michael Lee family and their

accounts, which go back over seven generations, are documented at the State Archives Building in Honolulu.

3. Mr. Berg also stated that the project site is “inhabited by the ōpe‘ape‘a at various times of the seasons,” noting that in 1910, the State of Hawai‘i documented *‘ōpe‘ape‘a* within a half-mile of the project area.
4. Mr. Berg stated his concern that the “property in question will not receive the proper protocol to conclude no endangered species inhabit the area.” He recommended that “a thorough and complete protocol is adopted to repeat the inventory exercise for pueo and ‘ōpe‘ape‘a over the course of a calendar year would be in order so the project does not inadvertently contribute to more endangered species habitat loss.” He also recommended consulting with Dr. Melissa Price and Dr. Javier Cotin of the Project Pueo Biologist Team and DLNR’s Division of Forestry and Wildlife (DOFAW) Biologist Afsheen Siddiqi regarding *pueo* protocol.
5. Mr. Berg also expressed his concern over the possible negative aspects of light at an adjacent parcel. He expressed concern that a solar panel may be reflecting neighboring lighting operations into “the flight patterns of migrating birds and the ‘ōpe‘ape‘a and pueo in particular need to be addressed.”
6. Ms. Lynette Paglinawan shared that she is concerned about more water being required from the Waiahole water ditch for development expansion. She stated there would be a negative impact from taking water away from residents, small farmers, and other businesses. Her final statement concludes that her interests are to protect and keep the Windward side “country” and to only support *‘aina*-based programs that promote family sustainable agriculture.
7. Project construction workers and all other personnel involved in the construction and related activities of the project should be informed of the possibility of inadvertent cultural finds, including human remains. In the event that any potential historic properties are identified during construction activities, all activities will cease and the SHPD will be notified pursuant to HAR §13-280-3. In the event that *iwi kūpuna* (Native Hawaiian skeletal remains) are identified, all earth moving activities in the area will stop, the area will be cordoned off, and the SHPD and Police Department will be notified pursuant to HAR §13-300-40. In addition, in the event of an inadvertent discovery of human remains, the completion of a burial treatment plan, in compliance with HAR §13-300 and HRS §6E-43, is recommended.
8. In the event that *iwi kūpuna* and/or cultural finds are encountered during construction, project proponents should consult with cultural and lineal descendants of the area to develop a reinterment plan and cultural preservation plan for proper cultural protocol, curation, and long-term maintenance.

8.4 *Ka Pa‘akai* Analysis

In Ka Pa‘akai vs Land Use Commission, 94 Hawai‘i (2000) the Court held the following analysis also be conducted:

1. The identity and scope of valued cultural, historical, or natural resources in the project area, including the extent to which traditional and customary native Hawaiian rights are exercised in the project area;
2. The extent to which those resources—including traditional and customary native Hawaiian rights—will be affected or impaired by the proposed action.

Based on information gathered from the cultural and historical background, and community consultation of the CIA for this project, no culturally significant resources were identified within the project area. At present, there is no documentation or testimony indicating traditional or customary Native Hawaiian rights are currently being exercised “for subsistence, cultural and religious purposes and possessed by *ahupua‘a* tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778” (Hawai‘i State Constitution, Article XII, Section 7) within the project area. While no cultural resources, practices, or beliefs were identified as currently existing within the project area, Honouliuli Ahupua‘a maintains a rich cultural history in the exercise of traditional or customary Native Hawaiian rights within the project *ahupua‘a*.

Honouliuli Ahupua‘a is the largest *ahupua‘a* in the *moku* of ‘Ewa (and on the island of O‘ahu). The environment of Honouliuli is very hot and dry. These environmental limitations forced ingenuity and innovation. *Kama‘āina* of Honouliuli used agricultural sinkholes that accumulated water within them via a subterranean water or karst system; this water also contained nutrient-rich sediment allowing plants such as *kalo, kī,* and *noni* to survive.

The post-Contact period brought numerous changes to the *ahupua‘a* of Honouliuli. Traditional agricultural was rapidly replaced by large-scale commercial ventures. The discovery of artesian water beneath the ‘Ewa plains by James Campbell in 1879 led to the establishment of sugarcane plantations in Honouliuli including the Oahu Sugar Company. Extensive *mauka* lands in northern Honouliuli, including ridges and deep gulches, were unsuitable for commercial sugar cultivation and remained pasture land for grazing livestock. The Donn 1906 map suggests the present project area was at the *mauka* edge of sugarcane cultivation at that time (see Figure 20). By 1920, however, commercial sugarcane cultivation had expanded into the uplands including the present project area (Frierson 1972:18).

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APPENDIX C

Comment Letters and Responses

From:	R M Towill Corporation
To:	Brian Takeda
Subject:	Fw: Attn: Mr. Brian Takeda - EA Preassessment for Waiahole Water System Improvements Project
Date:	Friday, January 22, 2021 12:38:39 PM

From: Seto, Joanna L <joanna.seto@doh.hawaii.gov>
Sent: Friday, January 22, 2021 11:03 AM
To: rmtowill@hawaii.rr.com <rmtowill@hawaii.rr.com>
Subject: Attn: Mr. Brian Takeda - EA Preassessment for Waiahole Water System Improvements Project

CAUTION: External Email

Aloha Mr. Takeda,

Mahalo for the January 4, 2021 letter regarding the Waiahole Water System Improvements Project in Kunia, Ewa, Oahu. The Department of Health, Safe Drinking Water Branch (SDWB) has updated our standard comments and will no longer be responding directly to requests for comments on the following documents (Pre-consultation, Early Consultation, Preparation Notice, Draft, Final, Addendums, and/or Supplements):

- Environmental Impact Statements (EIS)
- Environmental Assessments (EA)
- Conservation District Use Applications (CDUA)
- Drinking Water Operator Certification
- Source Water Assessment and Protection
- Underground Injection Control (UIC) Wells

Please download the SDWBStdCmts2020.docx – signed.pdf for our standard comments regarding your project's responsibilities to maintain drinking water quality and any necessary permitting. The SDWB will not provide direct responses to these requests. Agencies and/or project coordinators may download and use this memo as the SDWB's official comments.

Mahalo,
Joanna

Joanna L. Seto, P.E.
Engineering Program Manager
Safe Drinking Water Branch | State of Hawaii, Department of Health
Uluakupu Building 4 | 2385 Waimano Home Road, Suite 110 | Pearl City, HI 96782-1400
Phone: (808) 586-4259
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DAVID Y. IGE
GOVERNOR OF HAWAII

ELIZABETH A. CHAR, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
SAFE DRINKING WATER BRANCH
ULUAKUPU BLDG. 4
2385 WAIMANO HOME ROAD, SUITE 110
PEARL CITY, HI 96782

In reply, please refer to:
File: SDWB
SDWBStdCmts2020.docx

November 27, 2020

MEMORANDUM

TO: AGENCIES AND PROJECT OWNERS

FROM: JOANNA L. SETO, P.E., CHIEF
Safe Drinking Water Branch

SUBJECT: SAFE DRINKING WATER BRANCH STANDARD PROJECT COMMENTS

This memo is provided for your information and sharing. You are encouraged to share this memo with your project partners, team members, and appropriate personnel.

The Department of Health (DOH), Safe Drinking Water Branch (SDWB) will no longer be responding directly to requests for comments on the following documents (Pre-consultation, Early Consultation, Preparation Notice, Draft, Final, Addendums, and/or Supplements):

- Environmental Impact Statements (EIS)
- Environmental Assessments (EA)
- Conservation District Use Applications (CDUA)
- Drinking Water Operator Certification
- Source Water Assessment and Protection
- Underground Injection Control (UIC) Wells

For agencies or project owners requiring DOH-SDWB comments for one or more of these documents, please utilize the DOH-SDWB Standard Comments below regarding your project's responsibilities to maintain drinking water quality and any necessary permitting. DOH-SDWB Standard Comments are also available on the DOH-SDWB website located at: https://health.hawaii.gov/sdwb/.

DOH-SDWB Standard Comments

The following information is for agencies and/or project owners who are seeking comments regarding environmental compliance for their projects in the areas of: 1) Public Water Systems; 2) Underground Injection Control; 3) Groundwater Protection, and 4) Drinking Water State Revolving Fund with the Hawaii Administrative Rules (HAR), Chapters 11-19, 11-20, 11-21, 11-23, 11-23A, 11-25, and 11-65. You may be responsible for fulfilling additional requirements related to our program.

1. Public Water System Supervision
   a. Federal and state regulations define a public water system as a system that regularly serves an average of 25 or more individuals at least 60 days per year or has at least 15 service connections providing water for human consumption. All public water system owners and operators are required to comply with Hawaii Administrative Rules (HAR), Title 11, Chapter 20, "Rules Relating to Public Water Systems."
   b. All new public water systems are required to demonstrate and meet minimum capacity requirements prior to their establishment. This requirement involves demonstration that the system will have satisfactory technical, managerial, and financial capacity to enable the system to comply with safe drinking water standards and requirements.
   c. Projects that propose development of new sources of drinking water serving or proposed to serve a public water system must comply with the terms of HAR 11-20-29, entitled "Use of new sources of raw water for public water systems." This section requires that all new public water system sources be approved by the Director of Health (Director) prior to its use. Such approval is based primarily upon the submission of a satisfactory engineering report, which addresses the requirements set in HAR Section 11-20-29.
   d. The engineering report must identify all potential sources of contamination and evaluate alternative control measures, which could be implemented to reduce or eliminate the potential for contamination, including treatment of the water source. In addition, water quality analyses for all regulated contaminants, performed by a laboratory certified by the DOH State Laboratories Division (https://health.hawaii.gov/sdwb/approvedlablist/), must be submitted as part of the report to demonstrate compliance with all drinking water standards. Additional parameters may be required by the Director for this submittal or additional tests required upon his or her review of the information submitted.
   e. All sources of public water systems must undergo a source water assessment, which will delineate a source water protection area. This process is preliminary to the creation of a source water protection plan for that source and activities which will take place to protect the drinking water source.
   f. Projects proposing to develop new public water systems or proposing substantial modifications to existing public water systems must receive approval by the Director prior to construction of the proposed system or modification. These projects include treatment, storage, and distribution systems of public water systems. The approval authority for projects owned and operated by a County Board or Department of Water or Water Supply has been delegated to them.

g. All public water systems must be operated by certified distribution system and water treatment plant operators as defined by HAR Chapter 11-25, entitled "Rules Relating to Certification of Public Water System Operators."

h. All projects which propose the use of dual water systems or the use of a non- potable water system in proximity to an existing drinking water system to meet irrigation or other needs must be carefully designed and operated these systems to prevent the cross-connection of these systems and prevent the possibility of backflow of water from the non-potable system to the drinking water system. The two (2) systems must be clearly labeled and physically separated by air gaps or reduced pressure principle backflow prevention devices to avoid contaminating the drinking water supply. In addition, backflow devices must be tested annually to assure their proper operation. Further, all non-potable spigots and irrigated areas should be clearly labeled with warning signs to prevent the inadvertent consumption on non-potable water. Compliance with HAR Chapter 11-21, entitled "Cross-Connection and Backflow Control" is also required.

i. All projects which propose the establishment of a potentially contaminating activity (as identified in the Hawai`i Source Water Assessment Plan) within the source water protection area of an existing source of water for a public water supply should address this potential and activities that will be implemented to prevent or reduce the potential for contamination of the drinking water source.

For further information concerning the application of capacity, new source approval, operator certification, source water assessment, backflow/cross-connection prevention or other regulated public water system programs, please contact the Safe Drinking Water Branch Engineering Section at (808) 586-4258 or email sdwb@doh.hawaii.gov.

2. Underground Injection Control (UIC) Program

a. Injection wells used for the subsurface disposal of wastewater, sewage effluent, or surface runoff are subject to environmental regulation and permitting under HAR Chapter 11-23 entitled "Underground Injection Control." The DOH's approval must be first obtained before any injection well construction commences. A UIC permit must be issued before any injection well operation occurs.

b. Authorization to use an injection well is granted when a UIC permit is issued to the injection well facility. The UIC permit contains discharge and operation limitations, monitoring and reporting requirements, and other facility management and operational conditions. A complete UIC permit application form found at https://eha-cloud.doh.hawaii.gov/epermit/Home/9034789e-2918-4f30-82a2-9a5940e467f2 is needed to apply for a UIC permit.

c. A UIC permit can have a valid duration of up to five (5) years. Permit renewal is needed to keep an expiring permit valid for another term.

d. The UIC line delineates the extent of our underground sources of drinking water and is used to define areas where certain types of injection wells are prohibited. The UIC line is plotted on official UIC maps available for review at SDWB or by contacting the UIC program. Online interpretations of the UIC line maps exists and should be used with

caution as they are not the official maps. One website hosting an interpretation of the UIC line map is at the following: https://geoportal.hawaii.gov/datasets/4597dde2703a4e539f51588531e48101_20

e. If your project involves the construction of an injection well, you must first obtain the DOH's written approval to construct the injection well before any construction commences. The primary purpose of HAR, Chapter 11-23 is to protect underground sources of drinking water from injection well contamination. Written approval is obtained by filing an application for a UIC permit. You may submit your permit application via electronic filing (preferred method) through the DOH website at http://eha_cloud.hawaii.gov/epermit or submit a hard copy permit application to:

   Safe Drinking Water Branch
   Uluakupu Bldg. 4
   2385 Waimano Home Road, Suite 110
   Pearl City, Hawaii 96782-1400

f. Areas mauka of the UIC line are considered to overlie underground sources of drinking water. Therefore, no new subclass A injection wells, such as sewage injection wells that receive greater than 1,000 gallons per day, will be allowed to be constructed.

g. New sewage injection wells have been further prohibited effective July 5, 2018. Hawaii Revised Statutes 340E-2(e) states *"The director shall promulgate regulations establishing an underground injection control program. Such program shall prohibit any underground injection which is not authorized by a permit issued by the director; provided that the director shall not issue permits for the construction of sewage wastewater injection wells unless alternative wastewater disposal options are not available, feasible, or practical;"*

h. New storm water drainage injection well construction must be sited beyond one-quarter mile of a drinking water well. If you intend to construct a drinking water well, be careful to site all drainage injection wells at least one-quarter mile away from the drinking water source well.

For further information about the UIC permit and the UIC Program, please contact UIC staff at (808) 586-4258 or email at sdwb@doh.hawaii.gov.

3. Drinking Water State Revolving Fund Program

The Drinking Water State Revolving Fund (DWSRF) is a federally-capitalized loan program that provides low interest loans to regulated community water systems in the State of Hawaii for their drinking water infrastructure projects. If you would like more information regarding DWSRF eligibility, financing options, etc., you may visit the DWSRF website at https://health.hawaii.gov/sdwb/drinking-water-state-revolving-fund/ or contact Ms. Joan Corrigan at joan.corrigan@doh.hawaii.gov.

4. Private Water Wells

   a. **WARNING!** As the owner of a privately-owned well, you should **NOT** assume that water from your well is safe for consumption. It is your responsibility to make sure that your well water is safe to drink. The only way to do this is to have your well regularly tested for bacteriological and chemical contaminants.

   b. There are no regulations controlling water quality in private wells serving individual residences as there are for public water systems (public or privately-owned utilities supplying water to 25 or more people or 15 service connections). In other words, there are no enforceable limits for contaminants and no requirements for regular testing. Private wells are often found in rural areas, where many activities such as onsite wastewater disposal can contaminate the ground water.

   c. U.S. Environmental Protection Agency (EPA) Recommendations: The EPA recommends that private well owners test their well water each year for such contaminants as Total Coliform bacteria, Nitrates, as well as any other contaminants that may be of concern in your area. More frequent testing may be appropriate if you suspect a problem. EPA also suggests that you consider testing for pesticides, organic chemicals, and heavy metals before using it for the first time. Please refer to the EPA website on Private Drinking Water Wells at http://www.epa.gov/privatewells.

   d. Other Contaminants: Water testing can be very expensive. It is important that you spend time to identify what other potential contaminants may be of concern. Please refer to the EPA website on Private Drinking Water Wells for more information. Be aware of what and how you use and dispose of household and garden chemicals. Also determine the location of nearby septic tanks or cesspools, and agricultural or industrial activities in the area. General information on known chemical contamination of ground water in Hawaii can be found at the DOH website http://health.hawaii.gov/sdwb/groundwater-contamination-viewer.

   e. Laboratories: Whenever possible, utilize a laboratory that is certified or approved for the specific drinking water tests and carefully follow their instructions for collecting, storing, and transporting the samples. Be sure to ask the lab to use EPA approved methods for drinking water analysis. A list of Drinking Water Laboratories Certified or Approved by the Hawaii Department of Health, State Laboratories Division can be found at https://health.hawaii.gov/sdwb/approvedlablist/. As lab certification status changes constantly, confirm their status when you contact the lab. Please note that the list is limited to currently regulated contaminants in public water systems.

   f. Results: Once the lab provides you with the test results, you will be in a better position to determine if your well water is safe to drink or what contaminant you need to treat for. Generally, you should compare the results with Federal (https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations) and State (http://health.hawaii.gov/sdwb/files/2014/07/MCL-Fct-2014-07-10.pdf) Maximum Contaminant Level (MCL) drinking water standards. Where your test results are greater than the Federal or State maximum contaminant levels, your well water should be considered as unsafe for consumption.

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

February 01, 2021

LD 0018

Brian Takeda, Planning Project Manager
R.M. Towill Corporation
2024 North King Street, Suite 200 *Via email: rmtowill@hawaii.rr.com*
Honolulu, HI 96819-3470

Dear Brian:

SUBJECT: **Environmental Assessment Pre-Assessment Consultation for Waiahole Water System Improvements Project Kunia, 'Ewa, Island of Oahu, Hawaii TMK: (1) 9-4-003:001; 9-2-001:020; and 9-2-004:006**

Thank you for the opportunity to review and comment on the subject project. The Land Division of the Department of Land and Natural Resources (DLNR) distributed copies of your request to various DLNR divisions, as indicated on the attached, for their review and comment.

Attached are responses received from our (a) Engineering Division, and (b) Land Division, Oahu District. Should you have any questions, please feel free to contact Barbara Lee via email at barbara.j.lee@hawaii.gov. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

Attachments

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

January 20, 2021

LD 0018

MEMORANDUM

FROM:

~~TO:~~ **DLNR Agencies:**
_X_ Div. of Aquatic Resources *(via email: kendall.l.tucker@hawaii.gov)*
__ Div. of Boating & Ocean Recreation
_X_ Engineering Division *(via email: DLNR.Engr@hawaii.gov)*
_X_ Div. of Forestry & Wildlife *(via email: Rubyrosa.T.Terrago@hawaii.gov)*
__ Div. of State Parks
_X_ Commission on Water Resource Management *(via email: DLNR.CWRM@hawaii.gov)*
__ Office of Conservation & Coastal Lands
_X_ Land Division – Oahu District *(via email: DLNR.Land@hawaii.gov)*

TO:

~~FROM:~~ Russell Y. Tsuji, Land Administrator *Russell Tsuji*

SUBJECT: **Environmental Assessment Preassessment for Waiahole Water System Improvements Project**

LOCATION: Kunia, ‘Ewa, Island of Oahu, Hawaii
TMK: (1) 9-4-003:001’ 9-2-001:020; and 9-2-004:006

APPLICANT: **R.M. Towill Corporation on behalf of State of Hawaii Agribusiness Development Corporation**

Transmitted for your review and comment is information on the above-referenced project. Please review the attached information and submit any comments by the extended internal deadline of **February 05, 2021** to the Land Division at DLNR.Land@hawaii.gov, also copied to barbara.j.lee@hawaii.gov and darlene.k.nakamura@hawaii.gov. Any responses received prior to the end of January will be forwarded to the applicant to meet their original deadline.

If no response is received by the above extended due date, we will assume your agency has no comments at this time. If you have any questions, please contact Barbara Lee at barbara.j.lee@hawaii.gov. Thank you.

( ) We have no objections.
( ) We have no comments.
( ) We have no additional comments.
(✓) Comments are attached.

Signed: _____
Print Name: Carty S. Chang, Chief Engineer
Division: Engineering Division
Date: Jan 29, 2021

Attachments
Cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/Russell Y. Tsuji
Ref: Environmental Assessment Preassessment for Waiahole Water System Improvements Project
Location: Kunia, Ewa, Island of Oahu, Hawaii
TMK(s): (1) 9-4-003:001; 9-2-001:020; and 9-2-004:006
Applicant: R.M. Towill Corporation on behalf of State of Hawaii Agribusiness Development Corporation

COMMENTS

The rules and regulations of the National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR), are in effect when development falls within a Special Flood Hazard Area (high risk areas). State projects are required to comply with 44CFR regulations as stipulated in Section 60.12. Be advised that 44CFR reflects the minimum standards as set forth by the NFIP. Local community flood ordinances may stipulate higher standards that can be more restrictive and would take precedence over the minimum NFIP standards.

The owner of the project property and/or their representative is responsible to research the Flood Hazard Zone designation for the project. Flood Hazard Zones are designated on FEMA's Flood Insurance Rate Maps (FIRM), which can be viewed on our Flood Hazard Assessment Tool (FHAT) (http://gis.hawaiinfip.org/FHAT).

If there are questions regarding the local flood ordinances, please contact the applicable County NFIP coordinating agency below:

- Oahu: City and County of Honolulu, Department of Planning and Permitting (808) 768-8098.
- Hawaii Island: County of Hawaii, Department of Public Works (808) 961-8327.
- Maui/Molokai/Lanai County of Maui, Department of Planning (808) 270-7253.
- Kauai: County of Kauai, Department of Public Works (808) 241-4896.

The applicant should include water demands and infrastructure required to meet project needs. Please note that all State projects requiring water service from their local Department/Board of Water Supply system will be required to pay a resource development charge, in addition to Water Facilities Charges for transmission and daily storage.

The applicant is required to provide water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update projections.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: Jan 29, 2021

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

January 20, 2021

LD 0018

MEMORANDUM

TO: **DLNR Agencies:**
_X_ Div. of Aquatic Resources *(via email: kendall.l.tucker@hawaii.gov)*
__ Div. of Boating & Ocean Recreation
_X_ Engineering Division *(via email: DLNR.Engr@hawaii.gov)*
_X_ Div. of Forestry & Wildlife *(via email: Rubyrosa.T.Terrago@hawaii.gov)*
__ Div. of State Parks
_X_ Commission on Water Resource Management *(via email: DLNR.CWRM@hawaii.gov)*
__ Office of Conservation & Coastal Lands
_X_ Land Division – Oahu District *(via email: DLNR.Land@hawaii.gov)*

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

SUBJECT: **Environmental Assessment Preassessment for Waiahole Water System Improvements Project**

LOCATION: Kunia, 'Ewa, Island of Oahu, Hawaii
TMK: (1) 9-4-003:001' 9-2-001:020; and 9-2-004:006

APPLICANT: **R.M. Towill Corporation on behalf of State of Hawaii Agribusiness Development Corporation**

Transmitted for your review and comment is information on the above-referenced project. Please review the attached information and submit any comments by the extended internal deadline of **February 05, 2021** to the Land Division at DLNR.Land@hawaii.gov, also copied to barbara.j.lee@hawaii.gov and darlene.k.nakamura@hawaii.gov. Any responses received prior to the end of January will be forwarded to the applicant to meet their original deadline.

If no response is received by the above extended due date, we will assume your agency has no comments at this time. If you have any questions, please contact Barbara Lee at barbara.j.lee@hawaii.gov. Thank you.

( ) We have no objections.
(☑) We have no comments.
( ) We have no additional comments.
( ) Comments are attached.

Signed: BC
Print Name: Patti Miyashiro
Division: DLNR-LAND DIV-ODLO
Date: Jan 21, 2021

Attachments
Cc: Central Files

LD 0018

2024 North King Street
Suite 200
Honolulu Hawaii 96819-3470
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

January 4, 2021

Department of Land and Natural Resources (DLNR)
Mr. Russell Y. Tsuji, Administrator
Land Division
P.O. Box 621
Honolulu, Hawai'i 96809

RECEIVED
LAND DIVISION
2021 JAN 11 AM 10:44
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

Attention: Commission on Water Resource Management
Division of Forestry and Wildlife

Dear Administrator Tsuji:

Hawai'i Revised Statutes (HRS), Chapter 343, Environmental Assessment (EA) Preassessment for Waiāhole Water System Improvements Project
Kunia, 'Ewa, Island of O'ahu, Hawai'i
Tax Map Keys (TMKs): (1) 9-4-003: 001;
(1) 9-2-001: 020; and, 9-2-004: 006

The State of Hawai'i Agribusiness Development Corporation (ADC) proposes to construct improvements to the Waiāhole Ditch Irrigation System in Kunia, Central O'ahu, Hawai'i, and is preparing a HRS, Chapter 343, EA to provide information on the project and the potential for environmental effects from the proposed action.

The Waiāhole Ditch Irrigation System was constructed between 1912 and 1916 to irrigate sugar cane fields on the western side of O'ahu. The irrigation system consists of a 26-mile-long transmission system of ditches, tunnels, siphons, and reservoirs that provides a source of irrigation water to local farmers from the windward side of O'ahu. Water is collected both as surface water and from tunnels in the Ko'olau Mountains. After collection, the water is transported through tunnels and ditches and stored in reservoirs for irrigation of approximately 3,000 acres of diversified agriculture, and approximately 2,000 acres of pineapple. The increased use of water for the expansion of diversified agriculture and for restoration of water to Windward O'ahu streams has resulted in a reduction of the available water in the Waiāhole Ditch Irrigation System. The purpose of the proposed project is to provide maintenance and repairs to ensure that the storage and transmission facilities are in sound operational condition.

The Waiāhole Ditch Irrigation System includes the Kunia reservoir and transmission facilities to move surface water and groundwater from the windward side of O'ahu to agricultural areas on the leeward and central parts of O'ahu. The project area is in western O'ahu near Waipahu, approximately five miles northwest of Pearl Harbor and approximately 3.5 miles southwest of the area of Waikele, on the Schofield Plateau at the base of the Wai'anae Range.

The proposed project consists of five major components in seven areas of work. The five major components include (See attached Exhibit, Description of Waiāhole Water System Improvements Project):

- New ditch diversion and intake piping;

- New earthen reservoir which incorporates the footprint of an existing smaller reservoir;
- New water supply well;
- Interconnecting irrigation pipelines and appurtenances/control valves for the System; and,
- Repair/installation of a closed conduit within an existing hairpin bend in the ditch system.

We are seeking your comments on any relevant issues or concerns you may have which should be addressed in the preparation of the project's HRS, Chapter 343 EA. Please forward any written comments you may have within three (3) weeks from the date of this letter. Please be advised that consistent with the HRS, Chapter 343, public review process, a 30-day public comment period shall also be provided following the publication of the project's Draft EA. The public comments, including the applicant's responses, shall be used in the preparation of the project's Final EA.

N.B.. 01/18: Extended to 02/05/21.

Thank you for your consideration of this request. We look forward to the receipt of your comments to the attention of:

Brian Takeda
Planning Project Manager
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawai'i 96819

Sincerely,

Brian Takeda

Brian Takeda
Planning Project Manager
Attachment

cc: State of Hawai'i, Agribusiness Development Corporation
235 South Beretania Street, Suite 205
Honolulu, Hawai'i 96813

BT/

Exhibit
Description of Waiāhole Water System Improvements Project
State of Hawaii Agribusiness Development Corporation (ADB)
Kunia, ʻEwa, Island of Oʻahu, Hawaiʻi
Tax Map Keys (TMKs): (1) 9-4-003: 001;
(1) 9-2-001: 020; and, 9-2-004: 006

January 5, 2020

A. Project Description

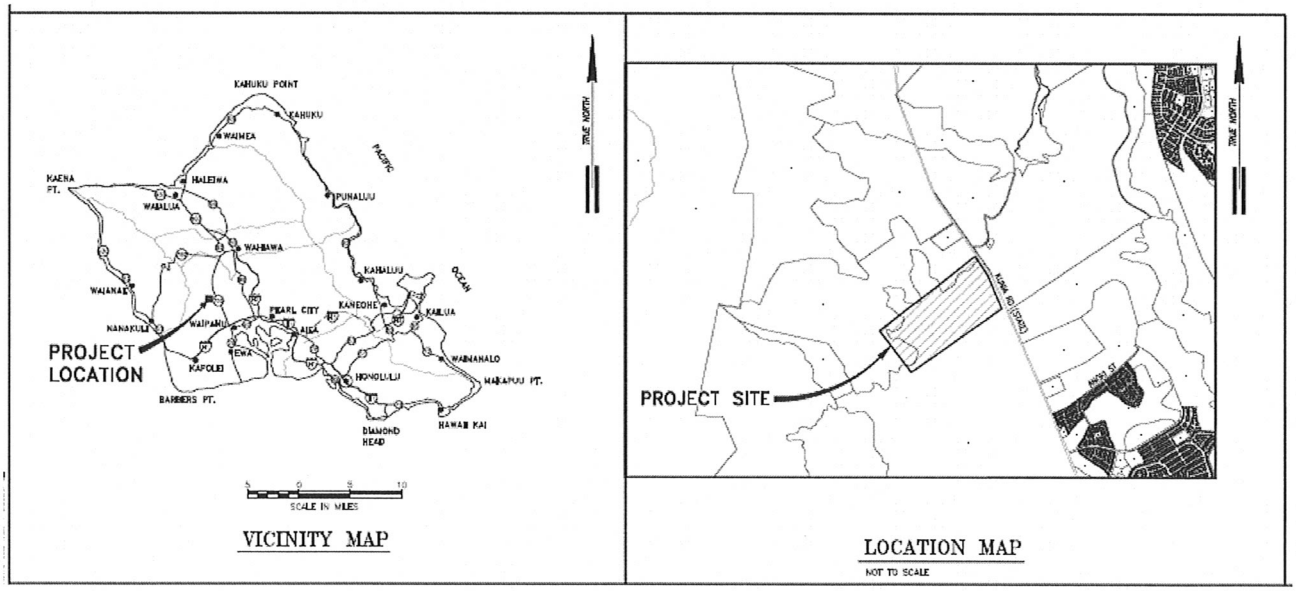
The State of Hawaii, Agribusiness Development Corporation (ADC) is proposing improvements to the Waiahole Ditch system (System) to improve the irrigation system's efficiency and enhance water supply security. The project includes five major components in seven areas of work.

The five major components include:

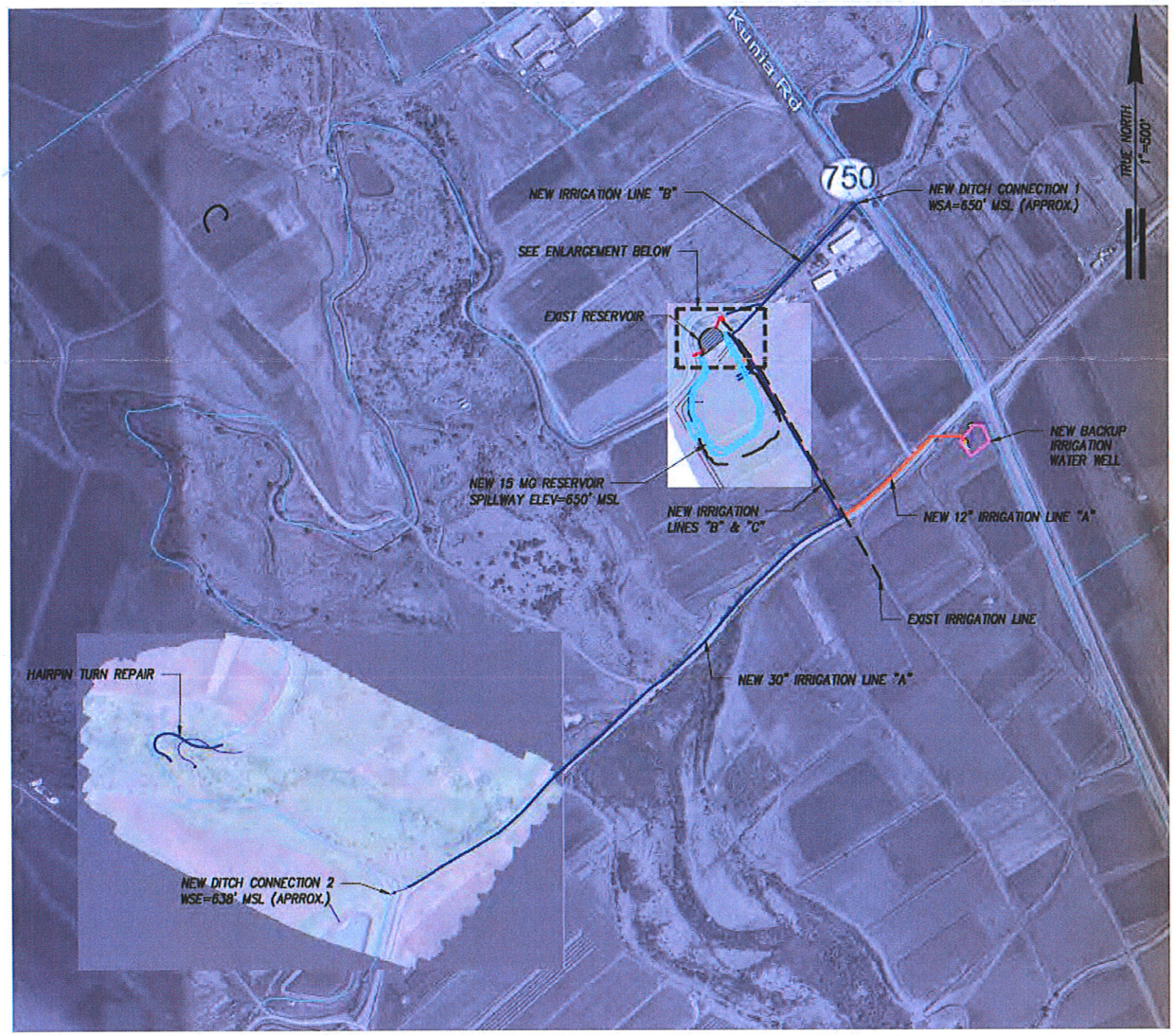
- Ditch diversion and intake piping;
- New lined earthen reservoir;
- New water supply well;
- Interconnecting pipelines and appurtenances/control valves for the System; and
- New closed conduit at an existing hairpin bend in the ditch.

B. Project Location

The project is located in Kunia, Oahu.



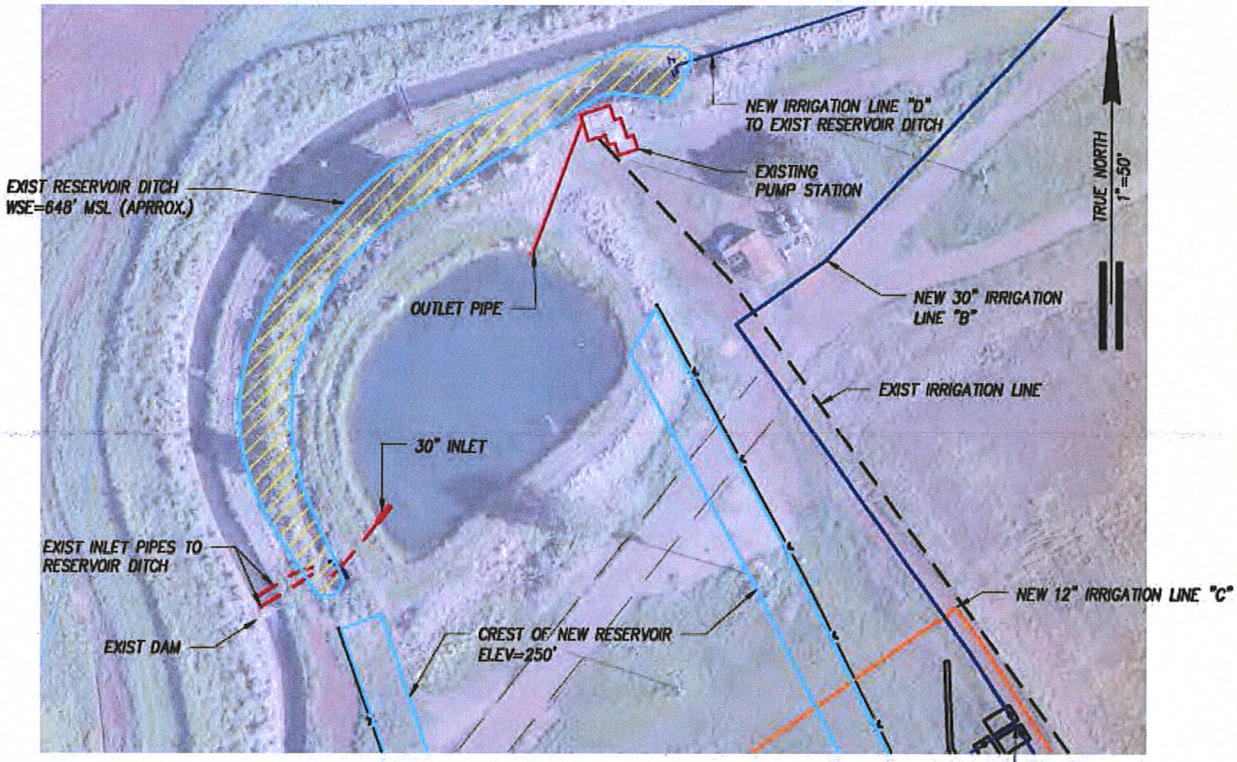
C. Project Details



PROPOSED RESERVOIR AND WELL SYSTEM

The seven major areas of work include the following:

1. Ditch Connection 1 – New intake for Reservoir near Kunia Road
   a. Construct new shallow manhole over existing plugged 24" culvert connected to existing diversion on Waiahole Ditch.
   b. Install new trash rack and new 24" cast iron sluice gate at existing diversion.
   c. Unplug existing 24" culvert.
   d. Connect new 30" Irrigation Line "B" to new shallow manhole.
   e. Water surface elevation (WSE) at ditch is approximately 650 feet mean sea level (ft MSL).



ENLARGEMENT OF EXISTING RESERVOIR AREA

2. New 15 MG Reservoir adjacent to existing reservoir
   a. Water from Waiahole Ditch is diverted into an existing ditch between the reservoir and Waiahole Ditch and then into the existing reservoir.
   b. Existing pump draws water from the existing reservoir and pumps water makai of the existing reservoir.
   c. WSE in existing reservoir is approximately 646 ft MSL.
   d. Construct new 15 MG reservoir connected to southeast side of existing reservoir.
   e. Crest elevation of new reservoir will be 648 ft MSL.
   f. Spillway elevation of new reservoir will be 646 ft MSL.
   g. New reservoir will receive water from Ditch Connection 1 through new Irrigation Line "B-1" through the northeast embankment or through new Irrigation Line "D" connected to the existing reservoir ditch.
   h. New reservoir can also receive water from new backup irrigation water well through Irrigation Line "C-1" through the northeast embankment.

3. New Irrigation Lines "B" and "C"
   a. Alignment of 30" Irrigation Line "B" will be along existing roads to existing reservoir and adjacent to northeast embankment of new reservoir, from Ditch Connection 1 to connection to 12" Irrigation Line "A."

b. Alignment of 12" Irrigation Line "C" will be along an existing road adjacent to northeast embankment of new reservoir, from connection to Irrigation Line "C- 1" to connection to Irrigation Line "A."

4. New Backup Irrigation Water Well
   a. Pump Rated Capacity and Head at 1,770 rpm: 1,400 gpm at 675 feet head
   b. Top of proposed concrete pump pad elevation: 616.0 feet
   c. Elevation of bottom of well perforated casing: (-)130 ft MSL
   d. Connection to 12" Irrigation Line "A."

5. New Irrigation Line "A"
   a. Alignment will be along existing dirt plantation road from Ditch Connection 2 on Waiahole Ditch to the site of the new well.
   b. Size will be 30" from Ditch Connection 2 to connection to 30" Irrigation Line "B" then reduce to 12" before connecting to 12" Irrigation Line "C."
   c. A 30" beveled-gear gate valve (normally closed) will isolate the 12" pumped system (from the new well) from the 30" gravity system.

6. Ditch Connection 2 – Downstream from Hairpin Turn
   a. Construct new headwall at existing cut in Waiahole Ditch
   b. Construct new 30" sluice gate at new headwall
   c. WSE at Ditch approximately 638' MSL.

7. Repair at Hairpin Turn
   a. Remove two existing 18" HDPE pipes from ditch and bulkheads at inlet and outlet.
   b. Place new 36" HDPE in on new concrete saddles at center of ditch and strap to saddles; bend pipe to match curve of ditch.
   c. Encase new pipe in CLSM.
   d. Construct new inlet and outlet concrete bulkheads.

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

February 05, 2021

LD 0018

Brian Takeda, Planning Project Manager
R.M. Towill Corporation
2024 North King Street, Suite 200 *Via email: rmtowill@hawaii.rr.com*
Honolulu, HI 96819-3470

Dear Brian:

SUBJECT: **Environmental Assessment Pre-Assessment Consultation for Waiahole Water System Improvements Project Kunia, 'Ewa, Island of Oahu, Hawaii TMK: (1) 9-4-003:001; 9-2-001:020; and 9-2-004:006**

Thank you for the opportunity to review and comment on the above subject. In addition to previous comments sent to you from the Department of Land and Natural Resources (DLNR) dated February 01, 2021, enclosed are comments from DLNR's Division of Aquatic Resources.

Should you have any questions, please feel free to contact Barbara Lee at 587-0453 or barbara.j.lee@hawaii.gov. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

Attachments
cc: Central Files

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

January 20, 2021

LD 0018

MEMORANDUM

TO: **DLNR Agencies:**
_X_ Div. of Aquatic Resources *(via email: kendall.l.tucker@hawaii.gov)*
__ Div. of Boating & Ocean Recreation
_X_ Engineering Division *(via email: DLNR.Engr@hawaii.gov)*
_X_ Div. of Forestry & Wildlife *(via email: Rubyrosa.T.Terrago@hawaii.gov)*
__ Div. of State Parks
_X_ Commission on Water Resource Management *(via email: DLNR.CWRM@hawaii.gov)*
__ Office of Conservation & Coastal Lands
_X_ Land Division – Oahu District *(via email: DLNR.Land@hawaii.gov)*

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

SUBJECT: **Environmental Assessment Preassessment for Waiahole Water System Improvements Project**

LOCATION: Kunia, ‘Ewa, Island of Oahu, Hawaii
TMK: (1) 9-4-003:001’ 9-2-001:020; and 9-2-004:006

APPLICANT: **R.M. Towill Corporation on behalf of State of Hawaii Agribusiness Development Corporation**

Transmitted for your review and comment is information on the above-referenced project. Please review the attached information and submit any comments by the extended internal deadline of **February 05, 2021** to the Land Division at DLNR.Land@hawaii.gov, also copied to barbara.j.lee@hawaii.gov and darlene.k.nakamura@hawaii.gov. Any responses received prior to the end of January will be forwarded to the applicant to meet their original deadline.

If no response is received by the above extended due date, we will assume your agency has no comments at this time. If you have any questions, please contact Barbara Lee at barbara.j.lee@hawaii.gov. Thank you.

( ) We have no objections.
( ) We have no comments.
( ) We have no additional comments.
(☑) Comments are attached.

Signed: _____
Print Name: Brian J. Neilson
Division: Aquatic Resources
Date: Feb 5, 2021

Attachments
Cc: Central Files

DAVID Y. IGE
GOVERNOR OF
HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
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
DIVISION OF AQUATIC RESOURCES
1151 PUNCHBOWL STREET, ROOM 330
HONOLULU, HAWAII 96813

Date: February 5, 2021
DAR # AR0049

MEMORANDUM

TO: Brian J. Neilson
DAR Administrator

FROM: Glenn Higashi GH, Aquatic Biologist

SUBJECT: Environmental Assessment Preassessment for Waiahole Water System Improvements Project (LD0018)

Request Submitted by: Russell Y. Tsuji, Land Administrator

Location of Project: Kunia, ‘Ewa, Island of Oahu, Hawaii
TMK: (1) 9-4-003:001’ 9-2-001:020; and 9-2-004:006

Brief Description of Project:

The State of Hawai'i Agribusiness Development Corporation (ADC) proposes to construct improvements to the Waiahole Ditch Irrigation System in Kunia, Central O' ahu, Hawai'i, and is preparing a HRS, Chapter 343, EA to provide information on the project and the potential for environmental effects from the proposed action. The proposed project would improve the irrigation's
systems efficiency and enhance water supply security.

The Waiahole Ditch Irrigation System was constructed between 1912 and 1916 to irrigate sugar cane
fields on the western side of Oahu. The irrigation system consists of a 26-mile long

Comments:

☐ No Comments ☒ Comments Attached

Thank you for providing DAR the opportunity to review and comment on the proposed project. Should there be any changes to the project plan, DAR requests the opportunity to review and comment on those changes.

Comments Approved: _____ Date: Feb 5, 2021
Brian J. Neilson
DAR Administrator

DAR# AR0049

Brief Description of Project

system of ditches, tunnels, siphons, and reservoirs that provides a source of irrigation water to local farmers from the windward side of O'ahu. Water is collected both as surface water and from tunnels in the Ko'olau Mountains. After collection, the water is transported through tunnels and ditches and stored in reservoirs for irrigation of approximately 3,000 acres of diversified agriculture, and approximately 2,000 acres of pineapple. The increased use of water for the expansion of diversified agriculture and for restoration of water to Windward O'ahu streams has resulted in a reduction of the available water in the Waiahole Ditch Irrigation System. The purpose of the proposed project is to provide maintenance and repairs to ensure that the storage and transmission facilities are in sound operational condition.

The Waiahole Ditch Irrigation System includes the Kunia reservoir and transmission facilities to
move surface water and groundwater from the windward side of O'ahu to agricultural areas on the leeward and central parts of O'ahu. The project area is in western O'ahu near Waipahu,
approximately five miles northwest of Pearl Harbor and approximately 3.5 miles southwest of the area of Waikele, on the Schofield Plateau at the base of the Wai'anae Range.

The proposed project consists of five major components in seven areas of work. The five major
components include:

- New ditch diversion and intake piping;
- New earthen reservoir which incorporates the footprint of an existing smaller reservoir;
- New water supply well;
- Interconnecting irrigation pipelines and appurtenances/control valves for the System; and,
- Repair/installation of a closed conduit within an existing hairpin bend in the ditch system.

The seven major areas of work include the following:

1. Ditch Connection 1- New intake for Reservoir near Kunia Road
   a. Construct new shallow manhole over existing plugged 24" culvert connected to existing diversion on Waiahole Ditch.
   b. Install new trash rack and new 24" cast iron sluice gate at existing diversion.
   c. Unplug existing 24" culvert.
   d. Connect new 30" Irrigation Line "B" to new shallow manhole.
   e. Water surface elevation (WSE) at ditch is approximately 650 feet mean sea level (ft MSL).

DAR# AR0049

Brief Description of Project

b. Existing pump draws water from the existing reservoir and pumps water makai of the existing reservoir.

c. WSE in existing reservoir is approximately 646 ft MSL.

d. Construct new 15 MG reservoir connected to southeast side of existing reservoir.

e. Crest elevation of new reservoir will be 648 ft MSL.

f. Spillway elevation of new reservoir will be 646 ft MSL.

g. New reservoir will receive water from Ditch Connection 1 through new Irrigation Line "B-1" through the northeast embankment or through new Irrigation Line "D" connected to the existing reservoir ditch.

h. New reservoir can also receive water from new backup irrigation water well through Irrigation Line "C-1" through the northeast embankment.

3. New Irrigation Lines "B" and "C"

a. Alignment of 30" Irrigation Line "B" will be along existing roads to existing reservoir and adjacent to northeast embankment of new reservoir, from Ditch Connection 1 to connection to 12" Irrigation Line "A."

b. Alignment of 12" Irrigation Line "C" will be along an existing road adjacent to northeast embankment of new reservoir, from connection to Irrigation Line "C- 1" to connection to Irrigation Line "A."

4. New Backup Irrigation Water Well

a. Pump Rated Capacity and Head at 1,770 rpm: 1,400 gpm at 675 feet head

b. Top of proposed concrete pump pad elevation: 616.0 feet

c. Elevation of bottom of well perforated casing: (-)130 ft MSL

d. Connection to 12" Irrigation Line "A."

5. New Irrigation Line "A"

a. Alignment will be along existing dirt plantation road from Ditch Connection 2 on Waiahole Ditch to the site of the new well.

b. Size will be 30" from Ditch Connection 2 to connection to 30" Irrigation Line " B" then reduce to 12" before connecting to 12" Irrigation Line "C."

c. A 30" beveled-gear gate valve (normally closed) will isolate the 12" pumped

DAR# AR0049

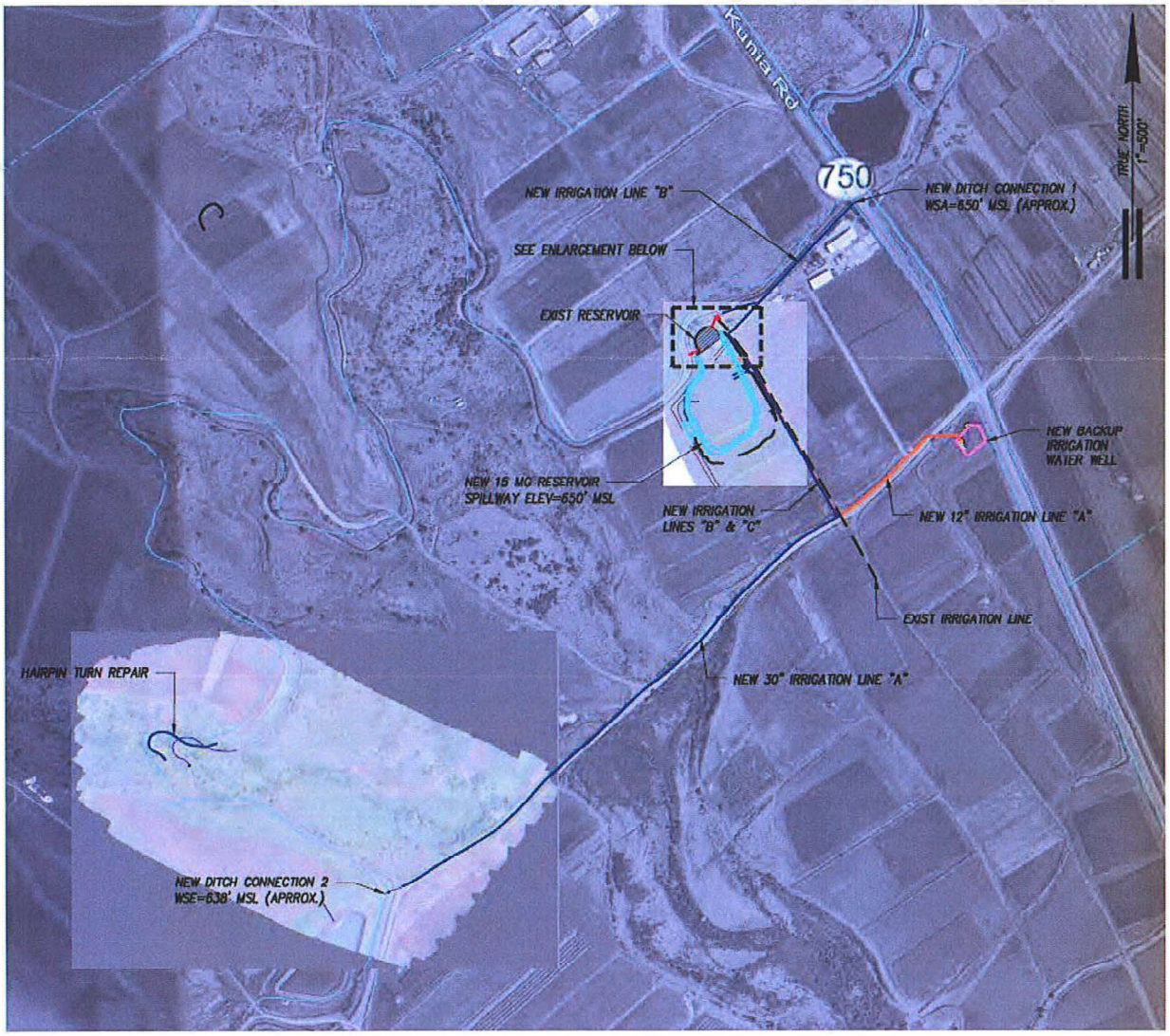
Brief Description of Project

6. Ditch Connection 2 - Downstream from Hairpin Turn
   a. Construct new headwall at existing cut in Waiahole Ditch
   b. Construct new 30" sluice gate at new headwall
   c. WSE at Ditch approximately 638' MSL.

7. Repair at Hairpin Turn
   a. Remove two existing 18" HOPE pipes from ditch and bulkheads at inlet and outlet.
   b. Place new 36" HOPE in on new concrete saddles at center of ditch and strap to saddles;
      bend pipe to match curve of ditch.
   c. Encase new pipe in CLSM.
   d. Construct new inlet and outlet concrete bulkheads.

DAR# AR0049

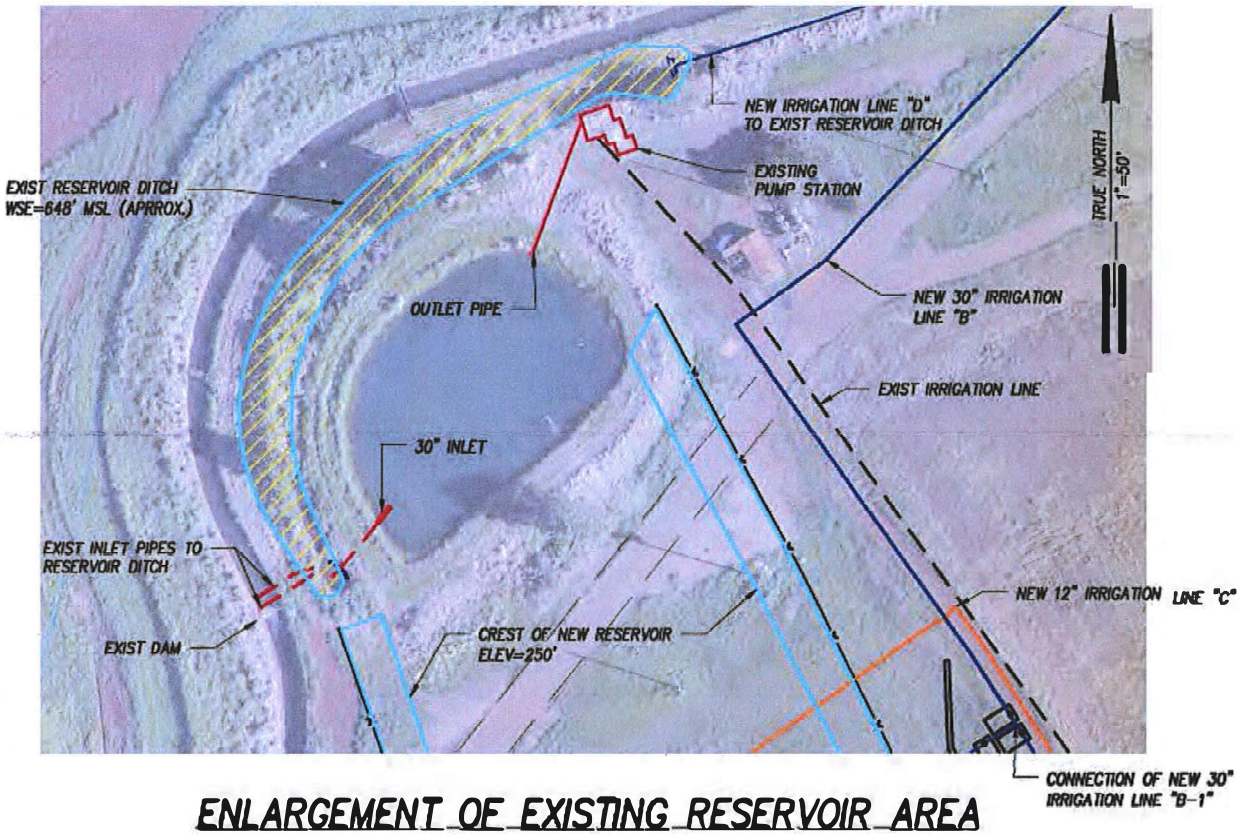
Brief Description of Project



PROPOSED RESERVOIR AND WELL SYSTEM

DAR# AR0049

Brief Description of Project



ENLARGEMENT OF EXISTING RESERVOIR AREA

DAR# AR0049

Comments

The proposed project is not expected to have any adverse impacts on the aquatic environment, as it is part of the Waiahole Ditch Irrigation Transmission System to move surface water and groundwater from the windward side of O'ahu to agricultural areas on the leeward and central parts of O'ahu. Best Management Practices (BMPs) should be implemented during the Waiahole Ditch Irrigation System improvements to minimize the potential for erosion, siltation and pollution of adjacent or receiving water bodies:

1) areas/lands denuded of vegetation should be planted or covered as quickly as possible to prevent erosion;
2) scheduling site work (reservoir construction) during periods of minimal rainfall, and;
3) prevent construction materials, petroleum products, debris and landscaping products from falling, blowing or leaching into the aquatic environment.

Thank you for providing us the opportunity to review and comment on the Environmental Assessment Preassessment for Waiahole Water System Improvements Project. Should there be any changes to the current plans, DAR requests the opportunity to review and comment on those changes.

HDOT Comment Letter pdf was protected from reproduction

DAVID Y. IGE
Governor

JOSH GREEN
Lt. Governor

PHYLLIS SHIMABUKURO-GEISER
Chairperson, Board of Agriculture

MORRIS M. ATTA
Deputy to the Chairperson

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 South King Street
Honolulu, Hawaii 96814-2512
Phone: (808) 973-9600 FAX: (808) 973-9613

January 14, 2021

Brian Takeda
Planning Project Manager
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819

Subject: Preassessment for Waiahole Water System Improvements Project Environmental Assessment (EA)

Dear Mr. Takeda:

The Hawaii Department of Agriculture (HDOA) is currently designing the offsite utilities and irrigation water facilities for the proposed Royal Kunia Agricultural Park. The Royal Kunia Agricultural Park will receive irrigation water from the 255 Reservoir, which is a part of Waiahole Water System.

HDOA does not have any comments at this time, but requests that HDOA be kept informed and be allowed to comment as the EA progresses. Please contact Kirk Saiki at (808) 973-9468 if you need assistance.

Sincerely,

Phyllis Shimabukuro-Geiser

Phyllis Shimabukuro-Geiser, Chairperson
Board of Agriculture

Island Fresh

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

February 09, 2021

LD 0018

Brian Takeda, Planning Project Manager
R.M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, HI 96819-3470

Via email: rmtowill@hawaii.rr.com

Dear Brian:

SUBJECT: **Environmental Assessment Pre-Assessment Consultation for Waiahole Water System Improvements Project Kunia, 'Ewa, Island of Oahu, Hawaii TMK: (1) 9-4-003:001; 9-2-001:020; and 9-2-004:006**

Thank you for the opportunity to review and comment on the above subject. In addition to previous comments sent to you from the Department of Land and Natural Resources (DLNR) dated February 01, 2021, and February 05, 2021, enclosed are comments from DLNR's Commission on Water Resource Management.

Should you have any questions, please feel free to contact Barbara Lee at 587-0453 or barbara.j.lee@hawaii.gov. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

Attachments
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON

KAMANA BEAMER, PH.D.
MICHAEL G. BUCK
ELIZABETH A. CHAR, M.D.
NEIL J. HANNAHS
WAYNE K. KATAYAMA
PAUL J. MEYER

M. KALEO MANUEL
DEPUTY DIRECTOR

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

February 9, 2021

REF: RFD.5580.3

TO: Mr. Russell Tsuji, Administrator
Land Division

FROM: M. Kaleo Manuel, Deputy Director
Commission on Water Resource Management

SUBJECT: Environmental Assessment Preassessment for Waiahole Water System Improvements Project

FILE NO.: RFD.5580.3
TMK NO.: (1) 9-2-001:020, (1) 9-2-004:006, (1) 9-4-003:001

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

Our comments related to water resources are checked off below.

☐ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

☐ 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

☐ 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

☐ 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EAP as having high water efficiency can be found at http://www.epa.gov/watersense.

☐ 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://planning.hawaii.gov/czm/initiatives/low-impact-development/

☐ 6. We recommend the use of alternative water sources, wherever practicable.

☐ 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program.

☐ 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf.

☐ 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

☒ 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

☒ 11. A Well Construction Permit(s) is (are) are required before the commencement of any well construction work.

☒ 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 14. Ground-water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☐ 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration can be made to the bed and/or banks of a steam channel.

☐ 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is constructed or altered.

☐ 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☐ OTHER:

If you have any questions, please contact W. Roy Hardy of the Commission staff at 587-0225.

LD 0018

2024 North King Street
Suite 200
Honolulu Hawaii 96819-3470
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

January 4, 2021

Department of Land and Natural Resources (DLNR)
Mr. Russell Y. Tsuji, Administrator
Land Division
P.O. Box 621
Honolulu, Hawai'i 96809

RECEIVED
LAND DIVISION
2021 JAN 11 AM 10:44
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

Attention: Commission on Water Resource Management
Division of Forestry and Wildlife

Dear Administrator Tsuji:

Hawai'i Revised Statutes (HRS), Chapter 343, Environmental Assessment (EA) Preassessment for Waiāhole Water System Improvements Project
Kunia, 'Ewa, Island of O'ahu, Hawai'i
Tax Map Keys (TMKs): (1) 9-4-003: 001;
(1) 9-2-001: 020; and, 9-2-004: 006

The State of Hawai'i Agribusiness Development Corporation (ADC) proposes to construct improvements to the Waiāhole Ditch Irrigation System in Kunia, Central O'ahu, Hawai'i, and is preparing a HRS, Chapter 343, EA to provide information on the project and the potential for environmental effects from the proposed action.

The Waiāhole Ditch Irrigation System was constructed between 1912 and 1916 to irrigate sugar cane fields on the western side of O'ahu. The irrigation system consists of a 26-mile-long transmission system of ditches, tunnels, siphons, and reservoirs that provides a source of irrigation water to local farmers from the windward side of O'ahu. Water is collected both as surface water and from tunnels in the Ko'olau Mountains. After collection, the water is transported through tunnels and ditches and stored in reservoirs for irrigation of approximately 3,000 acres of diversified agriculture, and approximately 2,000 acres of pineapple. The increased use of water for the expansion of diversified agriculture and for restoration of water to Windward O'ahu streams has resulted in a reduction of the available water in the Waiāhole Ditch Irrigation System. The purpose of the proposed project is to provide maintenance and repairs to ensure that the storage and transmission facilities are in sound operational condition.

The Waiāhole Ditch Irrigation System includes the Kunia reservoir and transmission facilities to move surface water and groundwater from the windward side of O'ahu to agricultural areas on the leeward and central parts of O'ahu. The project area is in western O'ahu near Waipahu, approximately five miles northwest of Pearl Harbor and approximately 3.5 miles southwest of the area of Waikele, on the Schofield Plateau at the base of the Wai'anae Range.

The proposed project consists of five major components in seven areas of work. The five major components include (See attached Exhibit, Description of Waiāhole Water System Improvements Project):

- New ditch diversion and intake piping;

- New earthen reservoir which incorporates the footprint of an existing smaller reservoir;
- New water supply well;
- Interconnecting irrigation pipelines and appurtenances/control valves for the System; and,
- Repair/installation of a closed conduit within an existing hairpin bend in the ditch system.

We are seeking your comments on any relevant issues or concerns you may have which should be addressed in the preparation of the project's HRS, Chapter 343 EA. Please forward any written comments you may have within three (3) weeks from the date of this letter. Please be advised that consistent with the HRS, Chapter 343, public review process, a 30-day public comment period shall also be provided following the publication of the project's Draft EA. The public comments, including the applicant's responses, shall be used in the preparation of the project's Final EA.

N.B.. 01/18: Extended to 02/05/21.

Thank you for your consideration of this request. We look forward to the receipt of your comments to the attention of:

Brian Takeda
Planning Project Manager
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawai'i 96819

Sincerely,

Brian Takeda

Brian Takeda
Planning Project Manager
Attachment

cc: State of Hawai'i, Agribusiness Development Corporation
235 South Beretania Street, Suite 205
Honolulu, Hawai'i 96813

BT/

Exhibit
Description of Waiāhole Water System Improvements Project
State of Hawaii Agribusiness Development Corporation (ADB)
Kunia, ʻEwa, Island of Oʻahu, Hawaiʻi
Tax Map Keys (TMKs): (1) 9-4-003: 001;
(1) 9-2-001: 020; and, 9-2-004: 006

January 5, 2020

A. Project Description

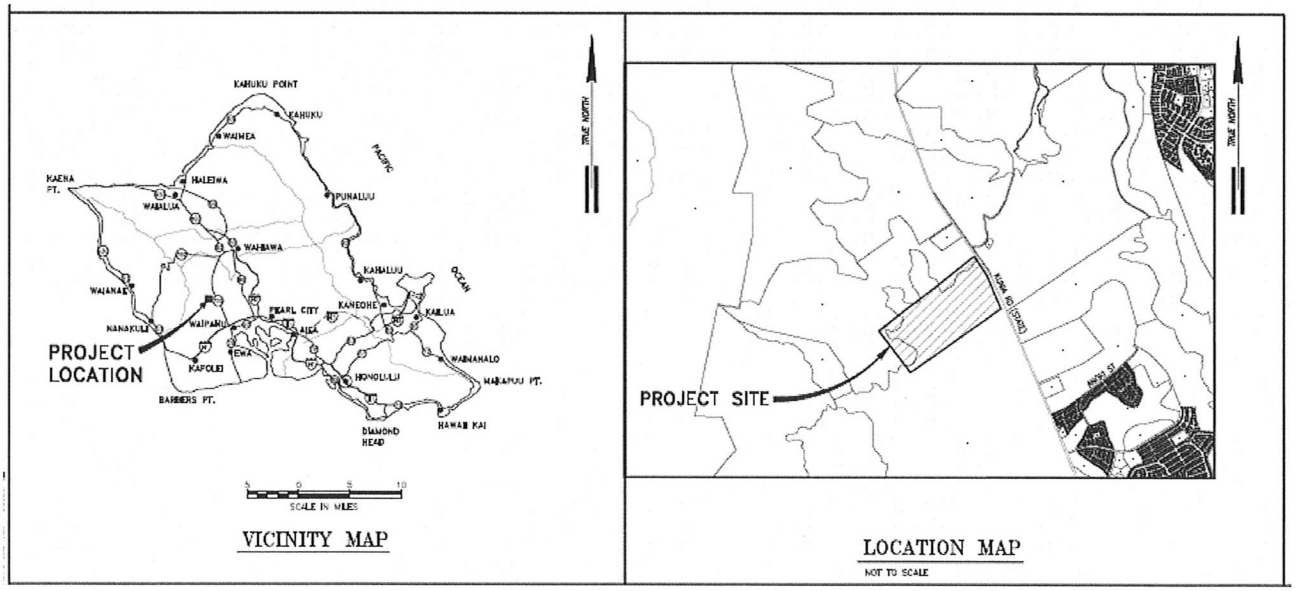
The State of Hawaii, Agribusiness Development Corporation (ADC) is proposing improvements to the Waiahole Ditch system (System) to improve the irrigation system's efficiency and enhance water supply security. The project includes five major components in seven areas of work.

The five major components include:

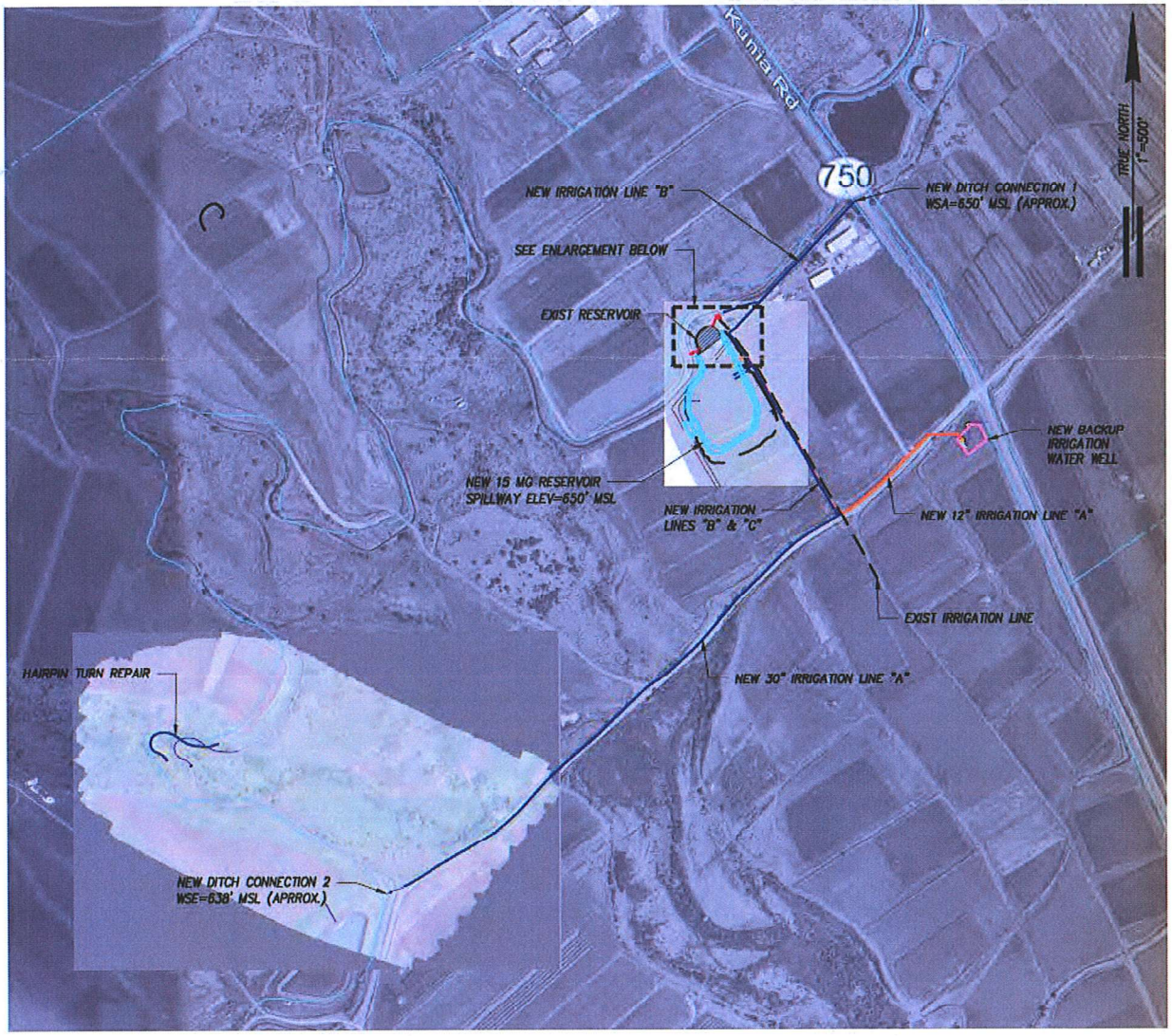
- Ditch diversion and intake piping;
- New lined earthen reservoir;
- New water supply well;
- Interconnecting pipelines and appurtenances/control valves for the System; and
- New closed conduit at an existing hairpin bend in the ditch.

B. Project Location

The project is located in Kunia, Oahu.



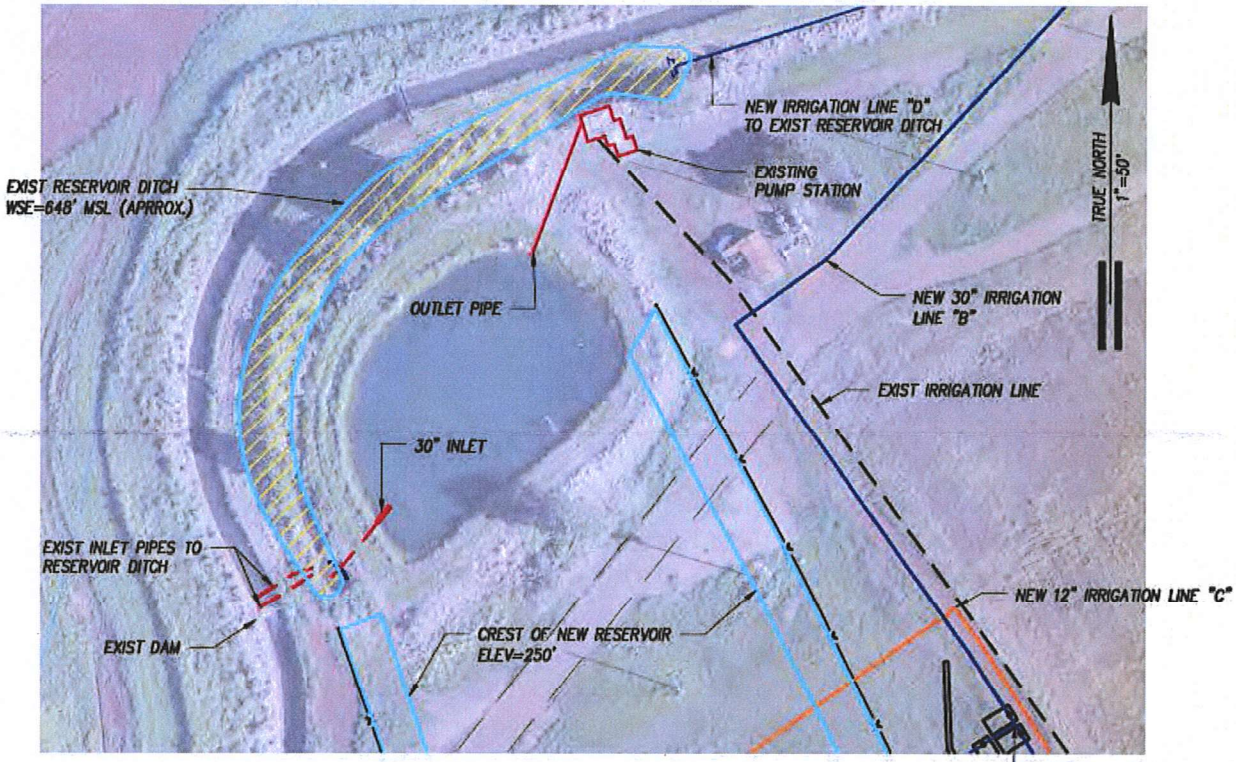
C. Project Details



PROPOSED RESERVOIR AND WELL SYSTEM

The seven major areas of work include the following:

1. Ditch Connection 1 – New intake for Reservoir near Kunia Road
   a. Construct new shallow manhole over existing plugged 24" culvert connected to existing diversion on Waiahole Ditch.
   b. Install new trash rack and new 24" cast iron sluice gate at existing diversion.
   c. Unplug existing 24" culvert.
   d. Connect new 30" Irrigation Line "B" to new shallow manhole.
   e. Water surface elevation (WSE) at ditch is approximately 650 feet mean sea level (ft MSL).



ENLARGEMENT OF EXISTING RESERVOIR AREA

2. New 15 MG Reservoir adjacent to existing reservoir
   a. Water from Waiahole Ditch is diverted into an existing ditch between the reservoir and Waiahole Ditch and then into the existing reservoir.
   b. Existing pump draws water from the existing reservoir and pumps water makai of the existing reservoir.
   c. WSE in existing reservoir is approximately 646 ft MSL.
   d. Construct new 15 MG reservoir connected to southeast side of existing reservoir.
   e. Crest elevation of new reservoir will be 648 ft MSL.
   f. Spillway elevation of new reservoir will be 646 ft MSL.
   g. New reservoir will receive water from Ditch Connection 1 through new Irrigation Line "B-1" through the northeast embankment or through new Irrigation Line "D" connected to the existing reservoir ditch.
   h. New reservoir can also receive water from new backup irrigation water well through Irrigation Line "C-1" through the northeast embankment.

3. New Irrigation Lines "B" and "C"
   a. Alignment of 30" Irrigation Line "B" will be along existing roads to existing reservoir and adjacent to northeast embankment of new reservoir, from Ditch Connection 1 to connection to 12" Irrigation Line "A."

b. Alignment of 12" Irrigation Line "C" will be along an existing road adjacent to northeast embankment of new reservoir, from connection to Irrigation Line "C- 1" to connection to Irrigation Line "A."

4. New Backup Irrigation Water Well
   a. Pump Rated Capacity and Head at 1,770 rpm: 1,400 gpm at 675 feet head
   b. Top of proposed concrete pump pad elevation: 616.0 feet
   c. Elevation of bottom of well perforated casing: (-)130 ft MSL
   d. Connection to 12" Irrigation Line "A."

5. New Irrigation Line "A"
   a. Alignment will be along existing dirt plantation road from Ditch Connection 2 on Waiahole Ditch to the site of the new well.
   b. Size will be 30" from Ditch Connection 2 to connection to 30" Irrigation Line "B" then reduce to 12" before connecting to 12" Irrigation Line "C."
   c. A 30" beveled-gear gate valve (normally closed) will isolate the 12" pumped system (from the new well) from the 30" gravity system.

6. Ditch Connection 2 – Downstream from Hairpin Turn
   a. Construct new headwall at existing cut in Waiahole Ditch
   b. Construct new 30" sluice gate at new headwall
   c. WSE at Ditch approximately 638' MSL.

7. Repair at Hairpin Turn
   a. Remove two existing 18" HDPE pipes from ditch and bulkheads at inlet and outlet.
   b. Place new 36" HDPE in on new concrete saddles at center of ditch and strap to saddles; bend pipe to match curve of ditch.
   c. Encase new pipe in CLSM.
   d. Construct new inlet and outlet concrete bulkheads.

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
PHONE: (808) 768-8000 • FAX: (808) 768-6041
DEPT. WEB SITE: www.honoluludpp.org • CITY WEB SITE: www.honolulu.gov

RICK BLANGIARDI
MAYOR

DEAN UCHIDA
DIRECTOR

DAWN TAKEUCHI APUNA
DEPUTY DIRECTOR

EUGENE H. TAKAHASHI
DEPUTY DIRECTOR

February 19, 2021

2021/ELOG-55(tb)
1996805

Mr. Brian Takeda
Planning Project Manager
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819

Dear Mr. Takeda:

SUBJECT: Pre-Assessment Consultation, Preparation of Draft Environmental Assessment (EA) for Waiahole Water System Improvements Project
Kunia, Central Oahu, Oahu, Hawaii
Tax Map Keys (TMKs) 9-4-003: 001; 9-2-001: 020; and 9-2-004: 006

This is in response to your letter received by the Department of Planning and Permitting (DPP) on January 8, 2021, requesting our comments for a Draft EA you are preparing for the proposed Waiahole Water System Improvements Project (Project).

We offer the following comments:

1. The Draft EA should include a list of all required city, state, and federal permits and approvals for the Project, as well as a schedule for anticipated completion of proposed improvements. A grading permit is required for the Project.

2. The Draft EA should include a discussion on how the Project addresses the objectives and policies of the Oahu General Plan (GP). The Draft EA should also include a discussion on the Project's conformance with the policies, principles, and guidelines in the Central Oahu Sustainable Communities Plan (CO SCP). Please be advised that the revisions to the GP and CO SCP, Resolution 21-23 and Bill 41(2019), CD2, respectively, are currently pending review and approval at the City Council. The discussions should reflect the most recently adopted plans at the time the Draft EA is published. Please check the City Council website for status of the above-mentioned resolution and bill prior to publication of Draft EA.

3. The Draft EA should indicate if other land uses, other than infrastructure development and improvements, are proposed on or near the Project site. If other land uses are proposed, the Draft EA should include more detailed information on the proposed uses, particularly those which are regulated by the Land Use Ordinance.

4. The Draft EA should include a discussion on how the Project will comply with the City's prevailing drainage standards and storm water quality rules as required. If the Project is a Priority A project, then the Draft EA should include a narrative describing the Project's post-construction storm water quality strategic plan to comply with the "Rules Relating to Water Quality" (Rules). The narrative should include a written description of the proposed development, expected activities and pollutants that will be generated by activities at the site, and Low-Impact Development site design strategies that will be used to comply with the Rules. Compliance with these standards and rules will be verified at the time that the grading plans are submitted to DPP for review.

5. The Draft EA should include a discussion on climate change, assess the possible consequences, and evaluate potential adaptation strategies that will mitigate the potential impacts of climate change on the Project during its anticipated lifetime, particularly the potential impacts to changes in rainfall patterns. For assessments of the Project, please review and address the City's Climate Change Commission's Sea Level Rise Guidance (June 5, 2018) and Climate Change Brief (June 5, 2018) in the Draft EA. These resources are screening and reference tools and do not replace more detailed modeling and analysis at the site level. We recommend that you consult with the City Office of Climate Change, Sustainability and Resiliency for further information and comments.

6. The Draft EA should detail the applicant's consultation with the State Historic Preservation Division (SHPD) regarding this historic site listed on the State Register of Historic Places as Site 50-80-09-2268, that should include, but not limited to:

   a. What are, if any, the design components and materials being used for restoring these segments of the ditch system;

   b. What methods and practices will be used to protect and preserve existing sections of the system; and

   c. The final approval from the SHPD regarding this project.

7. The Draft EA should detail how this project is being coordinated with the Mahi Solar Project that is proposed on sections of the same properties (TMKs 9-2-001: 020 and 9-2-004: 006).

8. The Draft EA should include a discussion on how this project fits into the Agribusiness Development Corporation's comprehensive plans for irrigation improvements in Central Oahu and other parts of the island.

9. The Draft EA should discuss what the economic impacts will be from the proposed Project on the agricultural industry, particularly the growing of diversified crops.

10. The Draft EA should discuss how the proposed Project will impact Oahu streams.

11. The Draft EA should describe how the proposed Project impacts the operation of the Waiahole Ditch Irrigation System as a whole, and whether future plans include additional improvements to the system.

We will reserve further comments until we have an opportunity to review the completed Draft EA. Should you have any questions, please contact Thomas Blair, of our staff, at 768-8030 or thomas.blair@honolulu.gov.

Very truly yours,

Dina L.T. Wong
Chief
Planning Division

DLTW:tc

APPENDIX D

Preliminary Engineering Plans

STATE OF HAWAI'I

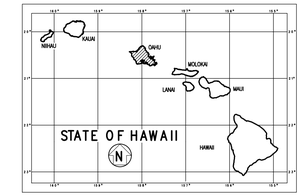
AGRIBUSINESS DEVELOPMENT CORPORATION

JOB NO. 100002

WAIAHOLE WATER SYSTEM IMPROVEMENTS

KUNIA, OAHU, HAWAII

TAX MAP KEY : (1) 9-2-001: 001

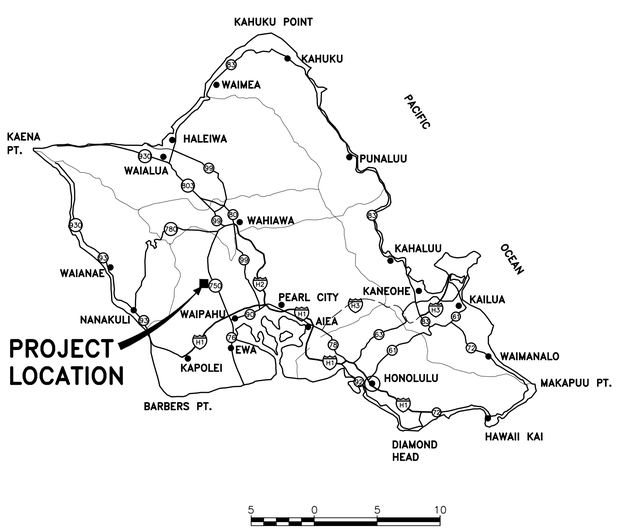


APRIL 2020

PREPARED BY :

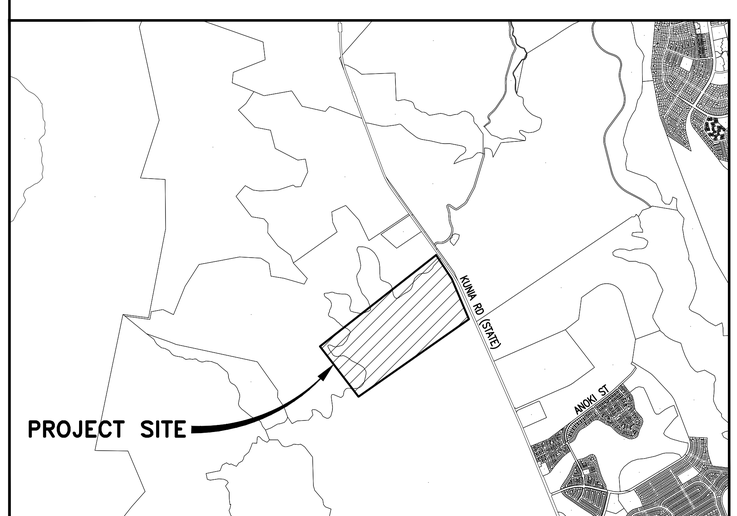
R. M. TOWILL CORPORATION
SINCE 1930

(808) 842-1133 2024 NORTH KING STREET SUITE 200 HONOLULU, HAWAI'I 96819



TRUE NORTH

VICINITY MAP



TRUE NORTH

LOCATION MAP

NOT TO SCALE

APPROVED:

EXECUTIVE DIRECTOR, AGRIBUSINESS DEVELOPMENT CORPORATION — DATE

DIRECTOR, DEPARTMENT OF PLANNING AND PERMITTING, CITY & COUNTY OF HONOLULU (FOR GRADING ONLY) — DATE

WAIAHOLE WATER SYSTEM IMPROVEMENT JOB NO. 100002

RMTC JOB NO.: 1-23620-0E

K:\civil\23620 Waiahole Water System Impr\Drawings\Construction Dwgs\Title Sheet.dwg April 6, 2020 11:00pm AnthonyS

FILE	POCKET	FOLDER	NO.

INDEX TO DRAWINGS

SHEET NO.	DRAWING NO.	TITLE
TITLE		
1	T001	TITLE SHEET
CIVIL		
2	C001	INDEX
3	C002	CONSTRUCTION NOTES 1
4	C003	CONSTRUCTION NOTES 2
5	C004	CONSTRUCTION NOTES 3
6	C005	CONSTRUCTION NOTES 4
7	C100	PROPOSED RESERVOIR AND WELL SYSTEM
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RMTC JOB NO.: 1–23196–OE

WAIAHOLE WATER SYSTEM IMPROVEMENTS

R. M. TOWILL CORPORATION
Planning • Engineering • Environmental Services • Photogrammetry • Surveying • Construction Management
2024 North King Street Suite 200
Honolulu Hawaii 96819

WALTER G. C. CHONG
LICENSED PROFESSIONAL ENGINEERS
No. 8882-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

Signature — 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	BY	APPROVED

APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP–XX

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CONSTRUCTION NOTES

1. ALL APPLICABLE CONSTRUCTION WORK SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, SEPTEMBER 1986 AND STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION, SEPTEMBER 1984, AS AMENDED, OF THE DEPARTMENT OF PUBLIC WORKS, CITY AND COUNTY OF HONOLULU AND THE COUNTIES OF KAUAI, MAUI, AND HAWAII. ALSO, ALL CONSTRUCTION WORK RELATING TO HIGH DENSITY POLYETHYLENE DRAIN PIPES SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, HIGH DENSITY POLYETHYLENE SMOOTH INTERIOR CORRUGATED DRAIN PIPES, MATCH 2013, OF THE DEPARTMENT OF PLANNING AND PERMITTING, CITY AND COUNTY OF HONOLULU.

2. THE UNDERGROUND PIPES, CABLES OR DUCTLINES KNOWN TO EXIST BY THE ENGINEER FROM HIS SEARCH OF RECORDS ARE INDICATED ON THE PLANS. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND DEPTHS OF THE FACILITIES AND EXERCISE PROPER CARE IN EXCAVATING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES TO EXISTING UTILITIES ARE SHOWN ON THE PLANS, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTIONS TO VERIFY THEIR LOCATIONS AND DEPTHS PRIOR TO EXCAVATION FOR THE NEW LINES.

3. NO CONTRACTOR SHALL PERFORM ANY CONSTRUCTION OPERATION SO AS TO CAUSE FALLING ROCKS, SOIL OR DEBRIS IN ANY FORM TO FALL, SLIDE OR FLOW INTO EXISTING CITY DRAINAGE SYSTEMS, OR ADJOINING PROPERTIES, STREETS OR NATURAL WATERCOURSES. SHOULD SUCH VIOLATIONS OCCUR, THE CONTRACTOR MAY BE CITED AND THE CONTRACTOR SHALL IMMEDIATELY MAKE ALL REMEDIAL ACTIONS NECESSARY.

4. THE GENERAL CONTRACTOR/DEVELOPER/OWNER OF THE PROJECT SHALL BE RESPONSIBLE FOR CONFORMANCE WITH APPLICABLE PROVISIONS OF THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 54, "WATER QUALITY STANDARDS," AND TITLE 11, CHAPTER 55, "WATER POLLUTION CONTROL," AS WELL AS CHAPTER 14 OF THE REVISED ORDINANCES OF HONOLULU, AS AMENDED. BEST MANAGEMENT PRACTICES SHALL BE EMPLOYED AT ALL TIMES DURING CONSTRUCTION.

   THE GENERAL CONTRACTOR/DEVELOPER/OWNER OF THE PROJECT SHALL OBTAIN NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT COVERAGE(S) FOR THE FOLLOWING:

   1. STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES THAT DISTURB ONE (1) ACRE OR MORE, AND
   2. DISCHARGES OF HYDROTESTING EFFLUENT, DEWATERING EFFLUENT, AND WELL DRILLING EFFLUENT TO STATE WATERS.

   IN ACCORDANCE WITH STATE LAW, ALL DISCHARGES RELATED TO PROJECT CONSTRUCTION OR OPERATIONS ARE REQUIRED TO COMPLY WITH STATE WATER QUALITY STANDARDS (HAWAII ADMINISTRATIVE RULES, CHAPTER 11-54). BEST MANAGEMENT PRACTICES SHALL BE USED TO MINIMIZE OR PREVENT THE DISCHARGE OF SEDIMENT, DEBRIS, AND OTHER POLLUTANTS TO STATE WATERS. PERMIT COVERAGE IS AVAILABLE FROM THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH AT http://health.hawaii.gov/cwb. THE OWNER/DEVELOPER/CONTRACTOR IS RESPONSIBLE FOR OBTAINING OTHER FEDERAL, STATE, OR LOCAL AUTHORIZATIONS AS REQUIRED BY LAW.

5. THE CONTRACTOR SHALL NOTIFY THE CIVIL ENGINEERING BRANCH, D.P.P. AT 768-8084 TO ARRANGE FOR INSPECTIONAL SERVICES AND SUBMIT TWO (2) SETS OF APPROVED CONSTRUCTION PLANS SEVEN (7) DAYS PRIOR TO COMMENCEMENT OF CONSTRUCTION WORK.

6. THE CONTRACTOR MAY SUBMIT A SUBSTITUTION REQUEST TO PRECAST ANY CITY OWNED AND/OR MAINTAINED DRAINAGE STRUCTURE (EX., CATCH BASINS, DRAIN MANHOLES, DRAIN INLETS, CULVERTS, ETC). HOWEVER, PRIOR TO CONSTRUCTION AND INSTALLATION OF ANY PRECAST STRUCTURE, THE CONTRACTOR SHALL A) SUBMIT SIX (6) SETS OF SHOP DRAWINGS TO THE CIVIL ENGINEERING BRANCH, DEPARTMENT OF PLANNING AND PERMITTING AND OBTAIN WRITTEN APPROVAL AND B) NOTIFY THE CIVIL ENGINEERING BRANCH, DEPARTMENT OF PLANNING AND PERMITTING AT 768-8084 TO ARRANGE FOR INSPECTIONAL SERVICES. NON-COMPLIANCE WITH ANY OF THESE REQUIREMENTS SHALL MEAN IMMEDIATE SUSPENSION OF ALL PRECAST CONSTRUCTION WORK AND REJECTION OF ALL PRECAST STRUCTURES ALREADY CONSTRUCTED.

7. CONFINED SPACE
   FOR ENTRY BY CITY PERSONNEL, INCLUDING INSPECTORS, INTO A PERMIT REQUIRED CONFINED SPACE AS DEFINED IN 29 CFR PART 1910.146(B), THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING:

   I. ALL SAFETY EQUIPMENT REQUIRED BY THE CONFINED SPACE REGULATIONS APPLICABLE TO ALL PARTIES OTHER THAN THE CONSTRUCTION INDUSTRY, TO INCLUDE, BUT NOT LIMITED TO, THE FOLLOWING:

      A. FULL BODY HARNESSES FOR UP TO TWO PERSONNEL
      B. LIFELINE AND ASSOCIATED CLIPS
      C. INGRESS/EGRESS AND FALL PROTECTION EQUIPMENT
      D. TWO-WAY RADIOS (WALKIE-TALKIES) IF OUT OF LINE-OF-SIGHT
      E. EMERGENCY (ESCAPE) RESPIRATOR (10 MINUTE DURATION)
      F. CELLULAR TELEPHONE TO CALL FOR EMERGENCY ASSISTANCE
      G. CONTINUOUS GAS DETECTOR (CALIBRATED) TO MEASURE OXYGEN, HYDROGEN, SULFIDE, CARBON MONOXIDE AND FLAMMABLES (CAPABLE OF MONITORING AT A DISTANCE OF AT LEAST 20-FEET AWAY)
      H. PERSONAL MULTI-GAS DETECTOR TO BE CARRIED BY INSPECTOR

   II. CONTINUOUS FORCED AIR VENTILATION ADEQUATE TO PROVIDE SAFE ENTRY CONDITIONS.

   III. ONE ATTENDANT/RESUCE PERSONNEL TOPSIDE (TWO, IF CONDITIONS WARRANT IT).

8. PURSUANT TO CHAPTER 6E, HRS, IN THE EVENT ANY ARTIFACTS OR HUMAN REMAINS ARE UNCOVERED DURING CONSTRUCTION OPERATIONS, THE CONTRACTOR SHALL IMMEDIATELY SUSPEND WORK AND NOTIFY THE HONOLULU POLICE DEPARTMENT, THE STATE DEPARTMENT OF LAND AND NATURAL RESOURCES-HISTORIC PRESERVATION DIVISION (692-8015). IN ADDITION, FOR NON-CITY PROJECTS, THE CONTRACTOR SHALL INFORM THE CIVIL ENGINEERING BRANCH, D.P.P. (768-8084); AND FOR CITY PROJECTS, NOTIFY THE RESPONSIBLE CITY AGENCY.

9. FOR PROJECTS ABUTTING STATE HIGHWAYS' RIGHTS-OF-WAY, THE OWNER OR HIS AUTHORIZED REPRESENTATIVE SHALL NOTIFY THE STATE DEPARTMENT OF TRANSPORTATION, HIGHWAYS DIVISION, OAHU DISTRICT, DRAINAGE DISCHARGE UNIT AT 831-6793 FOR AN ASSESSMENT OF STATE HIGHWAYS PERMIT REQUIREMENTS.

10. FOR BENCH MARK, SEE SHEET T001.

GRADING NOTES

1. ALL GRADING WORK SHALL BE DONE IN ACCORDANCE WITH CHAPTER 14, ARTICLES 13, 14, 15 AND 16, AS RELATED TO GRADING, SOIL EROSION AND SEDIMENT CONTROL OF THE REVISED ORDINANCES HONOLULU, 1990, AS AMENDED.

2. NO CONTRACTOR SHALL PERFORM ANY GRADING OPERATION SO AS TO CAUSE FALLING ROCKS, SOIL OR DEBRIS IN ANY FORM TO FALL, SLIDE OR FLOW ONTO ADJOINING PROPERTIES, STREETS OR NATURAL WATERCOURSES. SHOULD SUCH VIOLATIONS OCCUR, THE CONTRACTOR MAY BE CITED AND THE CONTRACTOR SHALL IMMEDIATELY MAKE ALL REMEDIAL ACTIONS NECESSARY.

3. THE CONTRACTOR, AT HIS OWN EXPENSE, SHALL KEEP THE PROJECT AREA AND SURROUNDING AREA FREE FROM DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION CONTROL STANDARDS CONTAINED IN THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 60.1, "AIR POLLUTION CONTROL."

4. THE UNDERGROUND PIPES, CABLES OR DUCTLINES KNOWN TO EXIST BY THE ENGINEER FROM HIS SEARCH OF RECORDS ARE INDICATED ON THE PLANS. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND DEPTHS OF THE FACILITIES AND EXERCISE PROPER CARE IN EXCAVATING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES ARE SHOWN ON THE PLANS, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTIONS TO VERIFY THEIR LOCATIONS AND DEPTHS PRIOR TO EXCAVATION FOR THE NEW LINES.

5. ADEQUATE PROVISIONS SHALL BE MADE TO PREVENT SURFACE WATERS FROM DAMAGING THE CUT FACE OF AN EXCAVATION OR THE SLOPED SURFACES OF A FILL. FURTHERMORE, ADEQUATE PROVISIONS SHALL BE MADE TO PREVENT SEDIMENT-LADEN RUNOFF FROM LEAVING THE SITE.

6. ALL SLOPES AND EXPOSED AREAS SHALL BE GRASSED OR PAVED (FOR AREAS WITHIN PROPOSED ROADWAY RIGHT-OF-WAY) OR SPRAYED WITH SOIL SEMENT CHEMICAL STABILIZER OR APPROVED EQUAL (FOR AREAS OUTSIDE OF THE PROPOSED ROADWAY RIGHT-OF-WAY) AS SOON AS FINAL GRADES HAVE BEEN ESTABLISHED. EROSION CONTROL APPLICATION SHALL NOT BE DELAYED UNTIL ALL GRADING WORK HAS BEEN COMPLETED. GRADING TO FINAL GRADE SHALL BE CONTINUOUS, AND ANY AREA WITHIN WHICH WORK HAS BEEN INTERRUPTED OR DELAYED SHALL BE PROTECTED.

7. FILLS ON SLOPES STEEPER THAN 5:1 SHALL BE KEYED.

8. THE CITY SHALL BE INFORMED OF THE LOCATION OF THE BORROW/DISPOSAL SITE FOR THE PROJECT WHEN THE APPLICATION FOR A GRADING PERMIT IS MADE. THE BORROW/DISPOSAL SITE MUST ALSO FULFILL THE REQUIREMENTS OF THE GRADING ORDINANCE.

9. NO GRADING WORK SHALL BE DONE ON SATURDAYS, SUNDAYS AND HOLIDAYS AT ANY TIME WITHOUT PRIOR NOTICE TO THE DIRECTOR D.P.P, PROVIDED SUCH GRADING WORK IS ALSO IN CONFORMANCE WITH THE COMMUNITY NOISE CONTROL STANDARDS CONTAINED IN THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 46, "COMMUNITY NOISE CONTROL".

10. THE LIMITS OF THE AREA TO BE GRADED SHALL BE FLAGGED BEFORE THE COMMENCEMENT OF THE GRADING WORK.

11. THE GENERAL CONTRACTOR/DEVELOPER/OWNER OF THE PROJECT SHALL BE RESPONSIBLE FOR CONFORMANCE WITH APPLICABLE PROVISIONS OF THE HAWAII ADMINISTRATIVE RULES, TITLE 11, CHAPTER 54, "WATER QUALITY STANDARDS," AND TITLE 11, CHAPTER 55, "WATER POLLUTION CONTROL," AS WELL AS CHAPTER 14 OF THE REVISED ORDINANCES OF HONOLULU, AS AMENDED. BEST MANAGEMENT PRACTICES SHALL BE EMPLOYED AT ALL TIMES DURING CONSTRUCTION.

    THE GENERAL CONTRACTOR/DEVELOPER/OWNER OF THE PROJECT SHALL OBTAIN NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT COVERAGE(S) FOR THE FOLLOWING:

    1. STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES THAT DISTURB ONE (1) ACRE OR MORE, AND
    2. DISCHARGES OF HYDROTESTING EFFLUENT, DEWATERING EFFLUENT, AND WELL DRILLING EFFLUENT TO STATE WATERS.

    IN ACCORDANCE WITH STATE LAW, ALL DISCHARGES RELATED TO PROJECT CONSTRUCTION OR OPERATIONS ARE REQUIRED TO COMPLY WITH STATE WATER QUALITY STANDARDS (HAWAII ADMINISTRATIVE RULES, CHAPTER 11-54). BEST MANAGEMENT PRACTICES SHALL BE USED TO MINIMIZE OR PREVENT THE DISCHARGE OF SEDIMENT, DEBRIS, AND OTHER POLLUTANTS TO STATE WATERS. PERMIT COVERAGE IS AVAILABLE FROM THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH AT http://health.hawaii.gov/cwb. THE OWNER/DEVELOPER/CONTRACTOR IS RESPONSIBLE FOR OBTAINING OTHER FEDERAL, STATE, OR LOCAL AUTHORIZATIONS AS REQUIRED BY LAW.

12. WHERE APPLICABLE AND FEASIBLE THE MEASURES TO CONTROL EROSION AND OTHER POLLUTANTS SHALL BE IN PLACE BEFORE ANY EARTH MOVING PHASE OF THE GRADING IS INITIATED.

13. TEMPORARY EROSION CONTROLS SHALL NOT BE REMOVED BEFORE PERMANENT EROSION CONTROLS ARE IN-PLACE AND ESTABLISHED.

14. TEMPORARY EROSION CONTROL PROCEDURES SHALL BE SUBMITTED FOR APPROVAL PRIOR TO APPLICATION FOR GRADING PERMIT.

15. IF THE GRADING WORK INVOLVES CONTAMINATED SOIL, THEN ALL GRADING WORK SHALL BE DONE IN CONFORMANCE WITH APPLICABLE STATE AND FEDERAL REQUIREMENTS.

16. FOR NON-CITY PROJECTS, THE CONTRACTOR SHALL NOTIFY THE CIVIL ENGINEERING BRANCH, D.P.P. AT 768-8084 TO ARRANGE FOR INSPECTIONAL SERVICES AND SUBMIT TWO (2) SETS OF APPROVED CONSTRUCTION PLANS SEVEN (7) DAYS PRIOR TO COMMENCEMENT OF CONSTRUCTION WORK. FOR CITY PROJECTS, THE CONTRACTOR SHALL COORDINATE INSPECTIONAL SERVICES WITH THE RESPONSIBLE CITY AGENCY.

17. PURSUANT TO CHAPTER 6E, HRS, IN THE EVENT ANY ARTIFACTS OR HUMAN REMAINS ARE UNCOVERED DURING CONSTRUCTION OPERATIONS, THE CONTRACTOR SHALL IMMEDIATELY SUSPEND WORK AND NOTIFY THE HONOLULU POLICE DEPARTMENT, THE STATE DEPARTMENT OF LAND AND NATURAL RESOURCES-HISTORIC PRESERVATION DIVISION (692-8015). IN ADDITION, FOR NON-CITY PROJECTS, THE CONTRACTOR SHALL INFORM THE CIVIL ENGINEERING BRANCH, D.P.P. (768-8084); AND FOR CITY PROJECTS, NOTIFY THE RESPONSIBLE CITY AGENCY.

18. FOR ALL PROJECTS, WHICH WILL DISTURB ONE (1) ACRE OR MORE OF LAND, THE CONTRACTOR SHALL NOT START CONSTRUCTION UNTIL A NOTICE OF GENERAL PERMIT COVERAGE (NGPC) IS RECEIVED FROM THE DEPARTMENT OF HEALTH, STATE OF HAWAII, AND HAS SATISFIED ANY OTHER APPLICABLE REQUIREMENTS OF THE NPDES PERMIT PROGRAM. ALSO, FOR NON-CITY AND OTHER NON-GOVERNMENTAL AGENCY PROJECTS, THE CONTRACTOR SHALL PROVIDE A WRITTEN COPY OF THE NGPC TO THE PERMITTING AND INSPECTION SECTION, CIVIL ENGINEERING BRANCH, D.P.P., AT LEAST SEVEN (7) CALENDAR DAYS BEFORE THE START OF THE CONSTRUCTION. FOR CITY OR OTHER GOVERNMENTAL PROJECTS, THE CONTRACTOR SHOULD PROVIDE A WRITTEN COPY OF THE NGPC TO THE APPROPRIATE CITY DEPARTMENT OR GOVERNMENTAL AGENCY PER THEIR REQUIREMENTS.

GRADING NOTES CON'T

19. ALL GRADING AND CONSTRUCTION WORK SHALL IMPLEMENT MEASURES TO ENSURE THAT THE DISCHARGE OF POLLUTANTS FROM THE CONSTRUCTION SITE WILL BE REDUCED TO THE MAXIMUM EXTENT PRACTICABLE AND WILL NOT CAUSE OR CONTRIBUTE TO AN EXCEEDANCE OF WATER QUALITY STANDARDS.

20. NON-COMPLIANCE TO ANY OF THE ABOVE REQUIREMENTS SHALL MEAN IMMEDIATE SUSPENSION OF ALL WORK, AND REMEDIAL WORK SHALL COMMENCE IMMEDIATELY. ALL COSTS INCURRED SHALL BE BILLED TO THE VIOLATOR. FURTHERMORE, VIOLATORS SHALL BE SUBJECTED TO ADMINISTRATIVE, CIVIL AND/OR CRIMINAL PENALTIES.

21. FOR BENCH MARK, SEE SHEET T001.

PUBLIC HEALTH, SAFETY AND CONVENIENCE

1. THE CONTRACTOR SHALL OBSERVE AND COMPLY WITH ALL FEDERAL, STATE AND LOCAL LAWS REQUIRED FOR THE PROTECTION OF PUBLIC HEALTH AND SAFETY AND ENVIRONMENTAL QUALITY.

2. THE CONTRACTOR AT HIS OWN EXPENSE, SHALL KEEP THE PROJECT AND ITS SURROUNDING AREAS FREE FROM DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION STANDARDS AND REGULATIONS OF THE STATE DEPARTMENT OF HEALTH. THE CITY SHALL REQUIRE SUPPLEMENTARY MEASURES AS NECESSARY.

3. THE CONTRACTOR SHALL PROVIDE, INSTALL AND MAINTAIN ALL NECESSARY SIGNS, BARRICADES, AND OTHER PROTECTIVE FACILITIES AND SHALL TAKE ALL NECESSARY PRECAUTIONS FOR THE PROTECTION, CONVENIENCE, AND SAFETY OF THE PUBLIC.

STATE OF HAWAII UTILITY NOTIFICATION CENTER

1. PRIOR TO EXCAVATION, THE CONTRACTOR IS REQUIRED BY SECTION 269E OF HAWAII REVISED STATUES TO CONTRACT THE HAWAII ONE CALL CENTER AT 1-866-423-7287.

2. THE CONTRACTOR SHALL COORDINATE WITH EMERGENCY SERVICES AND UTILITY COMPANIES TO ENSURE THAT UTILITY RELOCATIONS MEET THEIR NEEDS.

TEMPORARY DUST CONTROL

1. THE PROJECT SITE THAT IS CLEARED OF VEGETATION SHALL BE KEPT DAMP FOR SEVEN (7) DAYS A WEEK. AT THE END OF EACH DAY, THE SITE SHALL BE SUFFICIENTLY DAMPENED SO THAT THE SITE WILL REMAIN MOISTENED DURING THE NIGHT.

2. THE CONTRACTOR SHALL CONDUCT HIS OPERATIONS SO THAT EXCAVATION, EMBANKMENT, AND IMPORTED MATERIAL SHALL BE DAMPENED TO PREVENT DUST PROBLEMS.

MECHANICAL/ELECTRICAL DIVISION NOTES:

1. THE CONTRACTOR SHALL NOTIFY THE JOINT POLE COMMITTEE TWO (2) WEEKS IN ADVANCE OF ANY RELOCATION OF UTILITY POLE(S) THAT MAY BE NECESSARY.

2. THE CONTRACTOR SHALL NOTIFY THE MECHANICAL/ELECTRICAL DIVISION, DEPARTMENT OF DESIGN AND CONSTRUCTION, THREE (3) WORKING DAYS PRIOR TO COMMENCING WORK ON THE STREET LIGHTING SYSTEM (PHONE: 768-8431).

3. THE STREET LIGHTING SYSTEM SHALL BE KEPT OPERATIONAL DURING CONSTRUCTION. ANY RELOCATION REQUIRED SHALL BE APPROVED BY THE MECHANICAL/ELECTRICAL DIVISION, DEPARTMENT OF DESIGN AND CONSTRUCTION, AND PAID FOR BY THE CONTRACTOR.

4. THE LOCATIONS OF THE EXISTING UNDERGROUND STREET LIGHT FACILITIES SHOWN ON THE PLANS ARE FROM EXISTING PLANS AND ARE APPROXIMATE ONLY. THE CONTRACTOR SHALL EXERCISE CAUTION WHEN CONSTRUCTION CROSSES OR IS IN CLOSE PROXIMITY TO THE EXISTING STREET LIGHT FACILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGES TO THE EXISTING STREET LIGHTING FACILITIES. ANY AND ALL DAMAGES TO THESE FACILITIES SHALL BE REPAIRED BY THE CONTRACTOR AT HIS COST IN ACCORDANCE WITH THE REQUIREMENTS OF THE CITY AND COUNTY OF HONOLULU.

5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGES TO THE CITY'S EXISTING COMMUNICATIONS FIBER OPTIC CABLE SYSTEM. ANY AND ALL DAMAGES TO THESE FACILITIES SHALL BE REPAIRED BY THE CONTRACTOR AT HIS COST IN ACCORDANCE WITH THE REQUIREMENTS OF THE CITY AND COUNTY OF HONOLULU.

TRAFFIC NOTES FOR WORK ON CITY & COUNTY STREETS

1. A PERMIT SHALL BE OBTAINED FROM THE DEPARTMENT OF TRANSPORTATION SERVICES BEFORE WORK ON ANY PORTION OF A PUBLIC STREET OR HIGHWAY MAY BEGIN. CONSTRUCTION TRAFFIC CONTROL PLANS APPROVED BY THE DEPARTMENT OF TRANSPORTATION SERVICES AND/OR THE DEPARTMENT OF PLANNING AND PERMITTING MUST BE PROVIDED WHEN APPLYING FOR THE PERMIT.

2. THE CONTRACTOR SHALL PROVIDE, INSTALL, AND MAINTAIN ALL NECESSARY SIGNS AND OTHER PROTECTIVE FACILITIES, WHICH SHALL CONFORM WITH THE "HAWAII ADMINISTRATION RULES GOVERNING THE USE OF TRAFFIC CONTROL DEVICES AT WORK SITES ON OR ADJACENT TO PUBLIC STREETS AND HIGHWAYS" ADOPTED BY THE DIRECTOR OF TRANSPORTATION, AND THE CURRENT U.S. FEDERAL HIGHWAYS ADMINISTRATION'S "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS, PART VI - TRAFFIC CONTROLS FOR STREET AND HIGHWAY CONSTRUCTION AND MAINTENANCE OPERATIONS."

3. WORK ON ANY CITY STREET AREA MAY BE PERFORMED ONLY BETWEEN THE HOURS OF 8:30 A.M. TO 3:30 P.M., MONDAY THROUGH FRIDAY, UNLESS OTHERWISE PERMITTED BY THE DEPARTMENT OF TRANSPORTATION SERVICES.

4. DURING WORKING HOURS, THE CONTRACTOR SHALL PROVIDE FOR THROUGH TRAFFIC. DURING NON-WORKING HOURS, ALL TRENCHES SHALL BE COVERED WITH A SAFE NON-SKID BRIDGING MATERIAL AND ALL LANES SHALL BE OPEN TO TRAFFIC.

5. AS REQUIRED BY THE DEPARTMENT OF TRANSPORTATION SERVICES, THE CONTRACTOR SHALL PROVIDE OFF-DUTY POLICE OFFICERS TO CONTROL THE FLOW OF TRAFFIC.

6. WHERE PEDESTRIAN WALKWAYS EXIST, THEY SHALL BE MAINTAINED IN PASSABLE CONDITION OR OTHER FACILITIES FOR PEDESTRIANS SHALL BE PROVIDED. PASSAGE BETWEEN WALKWAYS AT INTERSECTIONS SHALL LIKEWISE BE PROVIDED.

7. DRIVEWAYS SHALL BE KEPT OPEN UNLESS THE OWNERS OF THE PROPERTY USING THESE RIGHTS-OFWAY ARE OTHERWISE PROVIDED FOR SATISFACTORILY.

8. CONTRACTOR SHALL REFERENCE TO THE APPROVAL OF THE DEPARTMENT OF TRANSPORTATION SERVICES AND THE DEPARTMENT OF PLANNING AND PERMITTING, ALL EXISTING TRAFFIC SIGNS, POSTS AND PAVEMENT MARKINGS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR SHALL REPLACE OR REPAIR ALL TRAFFIC SIGNS, POSTS AND PAVEMENT MARKINGS DISTURBED BY HIS ACTIVITIES.

9. THE CONTRACTOR SHALL NOTIFY THE DEPARTMENT OF PLANNING AND PERMITTING AT 768-8084 ONE (1) WEEK PRIOR TO ANY WORK TO BE DONE ON SIGNS, POSTS AND PAVEMENT MARKINGS.

10. NO EQUIPMENT SHALL BE STORED WITHIN STREET RIGHTS-OF-WAY EXCEPT AT LOCATIONS DESIGNATED IN WRITING AND APPROVED BY THE DEPARTMENT OF TRANSPORTATION SERVICES.

11. GENTRY HOMES LTD. SHALL ENSURE THAT THE CONTRACTOR INSTALLS THE CONSTRUCTION TRAFFIC CONTROL DEVICES IN ACCORDANCE WITH THE MUTCD AND THE HAWAII ADMINISTRATION RULES AS SPECIFIED IN TRAFFIC NOTE #2.

ARCHAEOLOGICAL NOTES

1. KNOWN ARCHAEOLOGICAL SITE(S) ARE IDENTIFIED AND SHOWN ON THE DRAWINGS. PRIOR TO COMMENCING CONSTRUCTION, THE CONTRACTOR SHALL FLAG ALL ARCHAEOLOGICAL SITES WITH THE ASSISTANCE OF THE PROJECT ARCHAEOLOGIST, CULTURAL SURVEYS, INC.

2. IF, DURING CONSTRUCTION, ANY ARCHAEOLOGICAL SITES OR REMAINS (SUCH AS ARTIFACTS, SHELL, BONE, OR CHARCOAL DEPOSITS, HUMAN BURIALS, ROCK OR CORAL ALIGNMENTS, PAVINGS, OR WALLS) ARE ENCOUNTERED, THE CONTRACTOR SHALL IMMEDIATELY SUSPEND WORK AND NOTIFY THE HONOLULU POLICE DEPARTMENT, THE STATE DEPARTMENT OF LAND AND NATURAL RESOURCES-HISTORIC PRESERVATION DIVISION (692-8015). IN ADDITION, FOR NON-CITY PROJECTS, THE CONTRACTOR SHALL INFORM THE CIVIL ENGINEERING BRANCH, D.P.P. (768-8084); AND FOR CITY PROJECTS, NOTIFY THE RESPONSIBLE CITY AGENCY.

3. ALL TRENCHING AND EXCAVATION WORK IN THE ARCHAEOLOGICAL SITE(S) SHALL BE MONITORED BY AN ARCHAEOLOGIST RETAINED BY THE OWNER FOR THIS PROJECT.

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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No. 6882-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

Signature — 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	BY	APPROVED

APPROVED BY

Chief, Civil Engineering Branch, DPP — DATE

Chief, Traffic Review Branch, DPP — DATE

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

CONSTRUCTION NOTES 1

RMTC JOB NO: 1-23196-OE

K:\civil\23620 Waiahole Water System Impr\Drawings\Construction Dwgs\C002 Construction Notes 1.dwg 4/16/2020

FILE	POCKET	FOLDER	NO.

WATER NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL MATERIALS AND CONSTRUCTION OF WATER SYSTEM FACILITIES AND APPURTENANCES SHALL BE IN ACCORDANCE WITH THE CITY AND COUNTY OF HONOLULU BOARD OF WATER SUPPLY'S "WATER SYSTEM STANDARDS" DATED 2002, THE "WATER SYSTEM EXTERNAL CORROSION CONTROL STANDARDS", VOLUME 3, DATED 1991, AND ALL SUBSEQUENT AMENDMENTS AND ADDITIONS.

2. ALL PLANS APPROVED BY THE BOARD OF WATER SUPPLY ARE BASED SOLELY ON THE ADEQUACY OF THE WATER SUPPLY.

3. TEST PRESSURE SHALL BE 150 PSI. DURING THE 30-MINUTE PRESSURE TEST, THE PRESSURE SHALL NOT DROP MORE THAN 10 PSI.

4. THE CONTRACTOR SHALL NOTIFY BWS CAPITAL PROJECTS DIVISION CONSTRUCTION SECTION IN WRITING AND SUBMIT SIX (6) SETS OF APPROVED CONSTRUCTION PLANS ONE WEEK PRIOR TO COMMENCING WORK ON THE WATER SYSTEM.

5. THE CONTRACTOR SHALL CHLORINATE THE ENTIRE INSIDE SURFACE OF EACH PIPE AND FITTING WITH DISINFECTION SOLUTION OF 5 OUNCES OF SODIUM HYPOCHLORITE MIXED WITH 10 GALLONS OF WATER. (FOR CONNECTION ONLY)

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL WATER LINES DURING CONSTRUCTION. THE CONTRACTOR SHALL BE ESPECIALLY CAREFUL WHEN EXCAVATING BEHIND WATER LINES, TEES, AND BENDS WHEREVER THERE IS A POSSIBILITY OF WATER LINE MOVEMENT DUE TO THE REMOVAL OF THE SUPPORTING EARTH BEYOND THE EXISTING REACTION BLOCKS. THE CONTRACTOR SHALL TAKE WHATEVER MEASURES NECESSARY TO PROTECT THE WATER LINES, SUCH AS CONSTRUCTING SPECIAL REACTION BLOCKS (WITH BWS APPROVAL) AND/OR MODIFYING HIS CONSTRUCTION METHOD.

7. THE EXISTENCE AND LOCATION OF UNDERGROUND UTILITIES AND STRUCTURES AS SHOWN ON THE PLANS ARE FROM THE LATEST AVAILABLE DATA BUT IS NOT GUARANTEED AS TO THE ACCURACY OR THE ENCOUNTERING OF OTHER OBSTACLES DURING THE COURSE OF THE WORK. THE CONTRACTOR SHALL BE RESPONSIBLE AND SHALL PAY FOR ALL DAMAGES TO EXISTING UTILITIES. THE CONTRACTOR SHALL NOT ASSUME THAT WHERE NO UTILITIES ARE SHOWN, THAT NONE EXIST.

8. PRIOR TO INSTALLATION, THE CONTRACTOR SHALL SUBMIT FOR APPROVAL BY BOARD OF WATER SUPPLY, THE MANUFACTURER'S CERTIFICATION THAT ALL CAST IRON (GRAY OR DUCTILE) FITTINGS FOR THE PROJECT CONFORM IN ALL RESPECTS TO THE WATER SYSTEM STANDARDS, DATED 2002.

9. POLYGON SHAPE FOR MECHANICAL JOINT GLANDS AS DESCRIBED IN AWWA STANDARD C111 SHALL BE "STRAIGHT-SIDED" OR AN APPROVED EQUAL ON A JOB TO JOB BASIS.

10. RE-APPROVAL SHALL BE REQUIRED IF THIS PROJECT IS NOT UNDER CONSTRUCTION WITHIN A PERIOD OF TWO (2) YEARS.

11. CONTRACTOR SHALL CUT AND PLUG ALL EXISTING UNUSED LATERALS AT THE MAIN WHETHER OR NOT SHOWN ON THE PLANS. THE DAMAGED AREA SHALL BE REPAIRED TO AN EQUAL OR BETTER CONDITION THAN THE IMMEDIATE AREA. ALL WORK SHALL BE DONE AT THE EXPENSE OF THE CONTRACTOR.

12. THE CONTRACTOR SHALL FURNISH AND INSTALL POLYETHYLENE WRAP, 3 FEET MINIMUM AT ALL TAPS (FOR DI PIPE AND COPPER LATERAL COMBINATION ONLY).

13. ADEQUATE OFFSITE FIRE PROTECTION MEETING THE BWS STANDARD SHALL BE INSTALLED AND COMPLETED PRIOR TO CONSTRUCTION OF HOMES INCLUDING MODEL HOMES.

14. THE CONTRACTOR/DEVELOPER SHALL OBTAIN A NPDES PERMIT PRIOR TO CHLORINATION AND/OR DEWATERING. A COPY OF THE PERMIT SHALL BE SUBMITTED TO THE BOARD OF WATER SUPPLY, CAPITAL PROJECTS DIVISION, CONSTRUCTION SECTION.

15. SOIL RESISTIVITY, FOR THE SITE HAS A CORROSION RATING OF 2 AS REPORTED BY STEWART ENGINEERING INC., IN THEIR REPORT ENTITLED "GEOTECHNICAL ENGINEERING EXPLORATION AREAS 17, 51 AND 52, AND KAMAKANA STREET, EWA BY GENTRY WEST, EWA, OAHU, HAWAII", DATED JUNE 14, 2013 AND "AMENDMENT TO GEOTECHNICAL REPORT", DATED SEPTEMBER 3, 2013. ALL REQUIRED ELECTRICAL ISOLATION PROCEDURES AND CORROSION CONTROL REQUIREMENTS SHALL APPLY.

16. PIPE CUSHION SHALL BE OF HIGH RESISTIVITY MATERIAL. THE CONTRACTOR SHALL SUBMIT A SOIL CERTIFICATION THAT HIGH RESISTANT CUSHION MATERIAL HAS A RESISTIVITY GREATER THAN 5,000 OHMCM. REMAINDER OF THE BACKFILL MATERIAL SHALL BE AS SPECIFIED IN VOLUME 1 OF THE WATER SYSTEM STANDARDS. PIPE CUSHION AND BACKFILL MATERIAL SHALL CONTAIN NO HAZARDOUS SUBSTANCES ABOVE REGULATORY ACTION LEVELS INCLUDING BUT NOT LIMITED TO LEAD, ASBESTOS, MERCURY, CHROMIUM, CADMIUM, ZINC, STRONTIUM, AND POLYCHLORINATED BIPHENYLS (PCB).

17. UPON COMPLETION OF THE PROJECT, THE DEVELOPER SHALL PROVIDE THE BWS WITH A CERTIFICATE FROM A REGISTERED SOILS ENGINEER CERTIFYING THAT THE ROAD PRISM HAS BEEN CONSTRUCTED IN ACCORDANCE TO CITY AND COUNTY ROAD STANDARDS.

18. TWO-WAY BLUE REFLECTIVE HYDRANT MARKERS TYPE DB SHALL BE INSTALLED AT ALL NEW FIRE HYDRANT INSTALLATIONS. CONTRACTOR SHALL VERIFY THE EXACT LOCATIONS OF HYDRANT MARKERS WITH THE NEAREST HONOLULU FIRE DEPARTMENT BATTALION CHIEF.

19. CLEANING SHALL BE BY THE USE OF "PIGS" INTRODUCED INTO THE PIPELINE AND RUN COMPLETELY THROUGH ALL INSTALLED PIPELINES AND ALL BRANCH LINES FOR FIRE HYDRANTS. "PIGGING" OF SERVICE LATERALS IS NOT REQUIRED. BARE FOAM "PIGS" SHALL BE USED TO SWAB PIPING CLEAN AS EACH LENGTH OF THE PIPELINE IS INSTALLED. EACH "PIG" SHALL CONSIST OF A CYLINDRICAL PIECE OF POLYURETHANE FOAM WITH A DENSITY OF 3-7 POUNDS PER CUBIC FOOT AND A VINYL-COATED NOSE. OUTSIDE DIAMETER OF THE "PIG" SHALL BE EQUAL TO 1-1/4 TO 1- 1/2 TIMES THE INSIDE DIAMETER OF THE PIPE BEING INSTALLED. THE LENGTH OF THE "PIG" SHALL BE 1-1/2 TO 2 TIMES ITS DIAMETER. PRIOR TO USE, THE "PIG" SHALL BE SUBMERGED IN A CHLORINE SOLUTION OF 1 OZ. OF 5% CHLORINE BLEACH IN 5 GALLONS OF WATER. "PIGGING" OF THE PIPELINE SHALL BE CONSIDERED INCIDENTAL TO THE INSTALLATION OF THE NEW PIPELINE.

20. ALL SECTIONS OF THE WATER MAIN REQUIRING REINFORCED CONCRETE JACKETING SHALL BE DUCTILE IRON PIPE CLASS 53 WITH DUCTILE IRON FITTINGS.

21. BALL CORP AND BALL STOP SHALL BE USED IN LIEU OF A CORPORATION STOP AND STOPCOCK, RESPECTIVELY.

WATER NOTES CON'T

23. THE CONTRACTOR SHALL FOLLOW THE FOLLOWING REVISED CHLORINATION AND WATER SAMPLING PROCEDURES:

    A. THE FOLLOWING CHLORINATION AND WATER SAMPLE COLLECTION PROCEDURE SHALL APPLY TO ALL WATER PIPELINE PROJECTS:

    STEP 1: CHLORINATE MAIN BY FILLING WITH WATER AND INTRODUCING CHLORINE IN SUFFICIENT QUANTITY TO OBTAIN A MINIMUM CHLORINE CONCENTRATION OF 50 PARTS PER MILLION. LEAVE CHLORINATED WATER IN MAIN OVERNIGHT.

    STEP 2: FLUSH MAIN WITH FRESH WATER UNTIL ALL CHLORINE HAS BEEN FLUSHED OUT AS EVIDENCED BY THE N,N-DIETHYL-P-PHENYLENEDIAMINE (DPD) TEST, THEN COLLECT A WATER SAMPLE WHILE CONTINUING TO FLUSH THE MAIN.

    STEP 3: REPEAT STEPS 1 AND 2. AFTER COLLECTING THE SECOND WATER SAMPLE, STOP FLUSHING AND ALLOW THE WATER TO STAND IN THE MAIN OVERNIGHT.

    STEP 4: THOROUGHLY FLUSH THE MAIN WITH FRESH WATER UNTIL ALL WATER THAT HAD BEEN STANDING IN THE MAIN OVERNIGHT HAS BEEN FLUSHED OUT. STOP FLUSHING AND LET THE WATER STAND IN THE MAIN FOR ONE HOUR. COLLECT A WATER SAMPLE.

    B. THE MAIN IS DEEMED ACCEPTABLE AND CERTIFIED WHEN (1) TWO CONSECUTIVE WATER SAMPLES, COLLECTED 24 HOURS APART UNDER STEPS 1 AND 2, SHOW NO TOTAL AND FECAL COLIFORM AND LESS THAN 200 COLONY FORMING UNITS (CFU) OF TOTAL BACTERIA AND (2) THE SAMPLE OF WATER HELD IN THE MAIN FOR ONE HOUR, COLLECTED UNDER STEP 4, ALSO SHOWS NO TOTAL AND FECAL COLIFORM AND LESS THAN 200 CFU OF TOTAL BACTERIA.

    C. CHLORINATION, FLUSHING, SAMPLING AND TESTING WILL BE EXTENDED SHOULD UNSATISFACTORY RESULTS BE ENCOUNTERED. ANY SAMPLE THAT SHOWS POSITIVE COLIFORM PRESENCE OR TOTAL BACTERIA GREATER THAN 200 CFU IS UNSATISFACTORY.

    D. STEPS 1 AND 2 MAY BE REPEATED BEFORE COLLECTING THE ONE HOUR HOLD SAMPLE SPECIFIED IN STEP 4. REPEATING STEPS 1 AND 2 IS RECOMMENDED IN THE EVENT SAMPLES SHOW THE PRESENCE OF COLIFORMS AND/OR INCREASING TOTAL BACTERIAL RESULTS FROM ONE SAMPLE TO THE NEXT.

    E. WATER SAMPLES THAT SHOW THE PRESENCE OF ATYPICAL COLONIES, DEBRIS OR RESULTS INCONSISTENT WITH EXISTING WATER ARE SUBJECT TO RECONFIRMATION. BWS RESERVES THE RIGHT TO REQUEST AND TEST ADDITIONAL WATER SAMPLES IN THE INTEREST OF SAFEGUARDING PUBLIC HEALTH AND SAFETY.

24. AT THE ELECTRICAL/SIGNAL DUCTLINE WATER CROSSINGS, ADJUST ALL ELECTRICAL/SIGNAL DUCTLINE ELEVATIONS TO MAINTAIN 12" VERTICAL CLEAR SEPARATION FROM ALL WATERLINES AT NO COST TO THE BOARD OF WATER SUPPLY.

25. MAINTAIN 3'-0" MIN. HORIZONTAL CLEAR SEPARATION BETWEEN ALL WATERLINE SYSTEMS AND NEAREST ELECTRICAL/SIGNAL DUCTLINES PARALLELING THE WATER SYSTEM AT NO COST TO THE BOARD OF WATER SUPPLY.

26. MAINTAIN 3'-0" MIN. HORIZONTAL CLEAR SEPARATION BETWEEN STREET LIGHT/TRAFFIC SIGNAL STANDARDS (INCLUDING MODULAR UNITS) AND THE NEAREST WATER SYSTEM. CONTRACTOR SHALL FIELD VERIFY FOR ANY CONFLICTS AT EACH STREET LIGHT/TRAFFIC SIGNAL STANDARD LOCATION. WHERE CONFLICTS OCCUR, THE CONTRACTOR SHALL COORDINATE WITH THE PROJECT ENGINEER TO REVISE THE STREET LIGHT/TRAFFIC SIGNAL STANDARD TO PROVIDE THE REQUIRED CLEARANCES AT NO COST TO THE BOARD OF WATER SUPPLY.

27. PRIOR TO ANY EXCAVATING, THE CONTRACTOR SHALL VERIFY IN THE FIELD THE LOCATION OF EXISTING WATER MAINS AND APPURTENANCES.

28. INSTALL 4 MIL THICK, NON-METALLIC, BLUE COLORED, 6 INCHES WIDE WARNING TAPE OVER CENTERLINE OF THE PIPE AND BELOW THE BASE COURSE ALONG THE ENTIRE LENGTH OF TRENCH. TAPE SHOULD BE MARKED WITH "CAUTION WATER LINE BURIED BELOW".

29. POLYVINYL CHLORIDE (PVC) PIPES SHALL BE DR14 (FOR 4"-16"). ALL DUCTILE IRON VALVES AND METALLIC FITTINGS SHALL BE WRAPPED WITH TWO LAYERS OF 8 MIL POLYETHYLENE WRAP. NO BENDING OF POLYVINYL CHLORIDE PIPES SHALL BE PERMITTED. THE INSTALLATION OF PVC PIPE, ACCORDING TO THE PLANS AND SPECIFICATIONS AS BID ON BY THE CONTRACTOR, MAY REQUIRE ADDITIONAL DESIGN WORK AND ADDITIONAL FITTINGS AND SHALL BE CONSIDERED INCIDENTAL TO THE UNIT PRICE BID IN THE PROPOSAL FOR PVC PIPE. ANY ADDITIONAL DESIGN WORK SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

30. PVC FITTINGS, INCLUDING DEFLECTION COUPLINGS ARE NOT APPROVED.

31. BOARD OF WATER SUPPLY APPROVAL OF THESE PLANS DOES NOT CONSTITUTE A WATER COMMITMENT. AVAILABILITY OF WATER WILL BE DETERMINED WHEN BUILDING PERMIT IS PRESENTED TO THE DEPARTMENT. WATER COMMITMENT WILL DEPEND UPON THE STATUS OF THE WATER SYSTEM AT THAT TIME. SHOULD WATER SERVICE BE MADE AVAILABLE, THE WATER COMMITMENT WILL BE EFFECTIVE WHEN THE PROJECT RECEIVES AN APPROVED BUILDING PERMIT FROM THE BUILDING DEPARTMENT. ALL WATER COMMITMENTS WILL BE CANCELED IN THE EVENT THE BUILDING PERMIT IS CANCELED.

32. THE CONTRACTOR SHALL INSTALL ELECTRONIC MARKERS TO ALL MAINS AND TEST THE ELECTRONIC MARKERS PRIOR TO INSTALLATIONS TO VERIFY PROPER OPERATION. BWS PERSONNEL SHALL VERIFY THE NUMBER AND LOCATIONS OF PLACED ELECTRONIC MARKERS BEFORE FINAL PAVING OF THE PROJECT.

33. DUCTILE IRON BOSSED TEES REQUIRED FOR ALL LATERAL AND ARV CONNECTIONS TO PVC MAINS 8" AND SMALLER (DUCTILE IRON CONNECTOR PIECE LARGER THAN 8").

34. UNLESS OTHERWISE SPECIFIED, ALL LATERALS AND CONNECTIONS SHALL BE COPPER TYPE "C-1", WITH BLIND METER SPLICE LENGTHS, 7-1/2", TO ACCOMMODATE 3/4" METERS.

35. PRESSURE REGULATORS RECOMMENDED FOR ALL LOTS BELOW THE 43 FOOT ELEVATION.

STORM DRAIN NOTES

1. SUBMITTALS

    A. PRODUCT WILL NOT BE ACCEPTED UNLESS THE PRECAST REINFORCED CONCRETE MANUFACTURER CAN PROVIDE THE FOLLOWING:

    1) SUBMIT PLANT'S CURRENT NPCA CERTIFICATION CERTIFICATE.

    2) SUBMIT WHAT PRODUCTS WERE PRODUCED UNDER THE NPCA CERTIFICATION PROCESS.

    3) SUBMIT A COPY OF THE MOST RECENT ANNUAL UN-ANNOUNCED PLANT INSPECTION REPORT ALONG WITH A COPY OF ALL WRITTEN CORRECTIVE ACTION RESPONSES FOR ALL DEFICIENCIES IN THE REPORT.

    4) SUBMIT QUALITY CONTROL TEST RECORDS FOR THE UNITS ASSOCIATED WITH THE PRODUCT DELIVERED TO THE PROJECT.

2. QUALITY ASSURANCE

    A. NATIONAL PRECAST CONCRETE ASSOCIATION PLANT CERTIFICATION

    1) THE PRECAST CONCRETE PRODUCER MUST BE CERTIFIED BY THE NATIONAL PRECAST CONCRETE ASSOCIATION PLANT CERTIFICATION PROGRAM PRIOR TO AND DURING PRODUCTION OF THE PRODUCTS FOR THIS PROJECT.

WAIAHOLE WATER SYSTEM IMPROVEMENTS

R. M. TOWILL CORPORATION
Planning • Engineering • Environmental Services • Photogrammetry • Surveying • Construction Management
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WALTER G. C. CHONG
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No. 8882-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

Signature — EXP. DATE 4/30/22

REVISION	DATE	BRIEF	BY	APPROVED

APPROVED BY

Chief, Civil Engineering Branch, DPP — DATE

Manager and Chief Engineer, BWS — DATE
(For work affecting BWS facilities in City/State R/W and BWS easements only)

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
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CONSTRUCTION NOTES 2

RMTC JOB NO.: 1-23196-OE

K:\civil\23620 Waiahole Water System Impr\Drawings\Construction Dwgs\C003 Construction Notes 2.dwg 4/16/2020

FILE	POCKET	FOLDER	NO.

GEOTECHNICAL ASSUMPTIONS

FOR BIDDING PURPOSES THE CONTRACTOR CAN ASSUME THAT FIELD EXPLORATION WILL GENERALLY ENCOUNTER SILTY CLAY/CLAYEY SILT SOILS EXTENDING TO AT LEAST THE DEPTHS EXPLORED (20 – 21 FEET). WEATHERED BASALT COBBLES AND BOULDERS, I.E., REMNANT CORESTONES, MAY BE ENCOUNTERED IN A FEW BORINGS, INDICATING THAT THERE IS A POTENTIAL FOR ENCOUNTERING HARD EXCAVATION IN LOCALIZED AREAS WITHIN THE SITE.

BASED ON THE SUBSURFACE CONDITIONS ANTICIPATED TO BE ENCOUNTERED AT THE PROJECT SITE, THAT SHALLOW FOUNDATIONS CONSISTING OF SPREAD AND/OR CONTINUOUS FOOTINGS MAY BE USED TO SUPPORT THE ANTICIPATED LIGHT STRUCTURES. AN ALLOWABLE BEARING PRESSURE OF UP TO 3,000 POUNDS PER SQUARE FOOT (PSF) MAY BE USED FOR THE DESIGN OF SHALLOW FOUNDATIONS BEARING ON IN-PLACE OR RECOMPACTED ON-SITE SOILS PREPARED IN ACCORDANCE WITH THE RECOMMENDATIONS PRESENTED IN THIS REPORT. THIS BEARING VALUE IS FOR DEAD-PLUS-LIVE LOADS AND MAY BE INCREASED BY ONE-THIRD (1/3) FOR TRANSIENT LOADS, SUCH AS THOSE CAUSED BY WIND OR SEISMIC FORCES.

IT IS ANTICIPATED THAT FOR LABORATORY TEST RESULTS, THE NEAR-SURFACE CLAYEY SOILS WILL EXHIBIT A LOW SHRINK/SWELL POTENTIAL WHEN SUBJECTED TO FLUCTUATIONS IN SOIL MOISTURE CONTENT. HOWEVER, SPECIAL ATTENTION SHOULD STILL BE GIVEN TO THE SUBGRADE PREPARATION REQUIREMENTS AND THE SLAB-ON-GRADE DESIGN. TO REDUCE THE POTENTIAL FOR DISTRESS TO FUTURE FOUNDATIONS AND SLABS-ON-GRADE RESULTING FROM SWELLING OF THE CLAYEY SOILS, IT IS RECOMMENDED THAT KEEPING THE FOUNDATION AND SLAB SUBGRADES MOIST (I.E., ABOUT 2 TO 4 PERCENT ABOVE OPTIMUM MOISTURE CONTENT) PRIOR TO THE PLACEMENT OF CONCRETE.

IT IS NOT ANTICIPATED TO ENCOUNTER GROUNDWATER IN THE DRILLED BORINGS AT THE TIME OF FIELD EXPLORATION. HOWEVER, IT SHOULD BE NOTED THAT GROUNDWATER LEVELS ARE SUBJECT TO OCCUR OR CHANGE DUE TO RAINFALL, TIME OF YEAR, SEASONAL PRECIPITATION, SURFACE WATER RUNOFF, AND OTHER FACTORS.

A. SITE GRADING

ITEMS OF GRADING ADDRESSED IN THE FOLLOWING SUBSECTIONS INCLUDE: (1) SITE PREPARATION; (2) EXCAVATION; (3) FILLS AND BACKFILLS; (4) FILL PLACEMENT AND COMPACTION REQUIREMENTS; AND (5) CUT AND FILL SLOPES.

THE OWNER'S GEOTECHNICAL ENGINEER'S REPRESENTATIVE SHOULD MONITOR THE SITE GRADING OPERATIONS TO OBSERVE WHETHER UNDESIRABLE MATERIALS ARE ENCOUNTERED DURING THE EXCAVATION PROCESS AND TO CONFIRM WHETHER THE EXPOSED SOIL/ROCK CONDITIONS ARE SIMILAR TO THOSE ENCOUNTERED IN OUR FIELD EXPLORATION.

(1) SITE PREPARATION

MUCH OF THE SITE IS CURRENTLY UNDER CULTIVATION. THE SOILS IN THE PORTIONS NOT IN CULTIVATION ARE GENERALLY IN DRY AND FRIABLE CONDITION.

IN GENERAL, THE AREAS WITHIN THE CONTRACT GRADING LIMITS SHOULD BE CLEARED AND GRUBBED THOROUGHLY AT THE ON-SET OF EARTHWORK. VEGETATION, DEBRIS, DELETERIOUS MATERIALS, AND OTHER UNSUITABLE MATERIALS SHOULD BE REMOVED AND DISPOSED PROPERLY OFF-SITE OR DISPOSED IN A DESIGNATED AREA TO REDUCE THE POTENTIAL FOR CONTAMINATION OF THE EXCAVATED MATERIALS. THE UPPER 12 INCHES OF THE SOILS BELOW THE EXISTING GROUND SURFACE SHOULD BE REMOVED AS PART OF THE CLEARING AND GRUBBING OPERATIONS, AND THE RESULTING SOILS SHOULD BE DISPOSED PROPERLY OFF-SITE (OR USED IN LANDSCAPED AREAS, IF APPROPRIATE) BECAUSE THEY CONTAIN AN APPRECIABLE AMOUNT OF ORGANIC MATERIALS. THE UPPER 12 INCHES OF THE SOILS BELOW THE GROUND SURFACE THAT WILL BE REMOVED AS PART OF THE CLEARING AND GRUBBING OPERATIONS MAY BE CLASSIFIED AS 'UNSUITABLE' MATERIALS AND SHOULD NOT BE USED AS FILL FOR THIS PROJECT.

AFTER CLEARING AND GRUBBING TO REMOVE THE UPPER 12 INCHES OF THE SOILS BELOW THE GROUND SURFACE, THE NORMALLY DRY AND FRIABLE SOILS SHOULD BE OVER-EXCAVATED BY ANOTHER 12 INCHES, MOISTURE-CONDITIONED TO AT LEAST 2 PERCENT ABOVE THE OPTIMUM MOISTURE, AND REPLACED AS COMPACTED FILL. AFTER OVER-EXCAVATION OF THE SOILS BELOW THE EXISTING GROUND SURFACE, THE OVER-EXCAVATED SUBGRADE AREAS SHOULD BE SCARIFIED TO A DEPTH OF AT LEAST 12 INCHES, MOISTURE-CONDITIONED TO AT LEAST 2 PERCENT ABOVE THE OPTIMUM MOISTURE CONTENT, AND COMPACTED TO NO LESS THAN 90 PERCENT RELATIVE COMPACTION PRIOR TO PLACEMENT OF THE NEW FILL.

(2) EXCAVATION

IT IS ANTICIPATED GRADING AND EXCAVATION WILL INVOLVE CUTS INTO VERY STIFF TO HARD CLAYEY SOILS. IT IS ANTICIPATED THAT THESE SOILS MAY BE EXCAVATED WITH CONVENTIONAL HEAVY EXCAVATION AND EARTHMOVING EQUIPMENT. HOWEVER, LOCALIZED AREAS OF HARD EXCAVATION MAY BE ENCOUNTERED WHERE REMNANT BOULDERS AND COBBLES ARE ENCOUNTERED IN THE SUBSOILS.

THE ABOVE DISCUSSIONS REGARDING THE RIPPABILITY OF THE SURFACE MATERIALS ARE BASED ON FIELD DATA OBTAINED FROM OUR FIELD EXPLORATION. CONTRACTORS BIDDING ON THIS PROJECT SHOULD BE ENCOURAGED TO EXAMINE THE SITE CONDITIONS AND SOIL DATA TO MAKE THEIR OWN INTERPRETATION.

(3) FILLS AND BACKFILLS

GENERAL FILLS AND FILL AT LEAST 2 TO 3 FEET BELOW THE STRUCTURE FINISHED SUBGRADE MAY CONSIST OF ON-SITE CLAYEY SOILS PLACED AT A MINIMUM OF 2 PERCENT ABOVE OPTIMUM MOISTURE CONTENT. IMPORTED GENERAL FILL MATERIALS SHOULD CONSIST OF SOIL AND ROCK MATERIALS LESS THAN 6 INCHES IN SIZE WITH A CBR VALUE OF 8 OR MORE AND WITH A MAXIMUM SWELL OF LESS THAN 2 PERCENT WHEN TESTED IN ACCORDANCE WITH ASTM D1883.

STRUCTURAL FILL MATERIAL MAY BE REQUIRED FOR THE TOP 2 TO 3 FEET OF FILL BELOW STRUCTURES. THE STRUCTURAL FILL SHOULD CONSIST OF NON-EXPANSIVE GRANULAR MATERIAL, SUCH AS CRUSHED CORAL, BASALT OR CINDER SAND. THE MATERIAL SHOULD BE WELL-GRADED FROM COARSE TO FINE WITH PARTICLES NO LARGER THAN 3 INCHES IN LARGEST DIMENSION AND SHOULD CONTAIN BETWEEN 10 AND 30 PERCENT PARTICLES PASSING THE NO. 200 SIEVE. THE MATERIAL SHOULD HAVE A LABORATORY CBR VALUE OF 20 OR MORE AND SHOULD HAVE A MAXIMUM SWELL OF LESS THAN 1 PERCENT WHEN TESTED IN ACCORDANCE WITH ASTM D1883. OWNER'S GEOTECHNICAL ENGINEER SHOULD TEST IMPORTED FILL MATERIALS FOR CONFORMANCE WITH THESE RECOMMENDATIONS PRIOR TO DELIVERY TO THE PROJECT SITE FOR ITS INTENDED USE. OWNER'S GEOTECHNICAL ENGINEER SHOULD OBSERVE AND/OR TEST IMPORTED FILL MATERIALS FOR THEIR SUITABILITY PRIOR TO BEING TRANSPORTED TO THE SITE FOR THE INTENDED USE.

THE REQUIREMENT FOR STRUCTURAL FILL SHOULD BE DETERMINED ON AN INDIVIDUAL LOT BASIS BY A GEOTECHNICAL ENGINEER.

BASE COURSE AND SELECT BORROW SUBBASE MATERIAL FOR ROAD PAVEMENT CONSTRUCTION SHOULD CONSIST OF CRUSHED BASALT AGGREGATE AND SHOULD CONFORM TO THE CITY AND COUNTY OF HONOLULU, DEPARTMENT OF PUBLIC WORKS, "STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION," DATED SEPTEMBER 1986.

GEOTECHNICAL ASSUMPTIONS CONT'D

(4) FILL PLACEMENT AND COMPACTION REQUIREMENTS

FILL, BORROW FILL AND BACKFILL, SHOULD BE MOISTURE-CONDITIONED TO ABOVE THE OPTIMUM MOISTURE, PLACED IN LEVEL LIFTS NOT EXCEEDING 8 INCHES IN LOOSE THICKNESS, AND COMPACTED TO AT LEAST 90 PERCENT RELATIVE COMPACTION.

RELATIVE COMPACTION REFERS TO THE IN-PLACE DRY DENSITY OF SOIL EXPRESSED AS A PERCENTAGE OF THE MAXIMUM DRY DENSITY OF THE SAME SOIL ESTABLISHED IN ACCORDANCE WITH ASTM D1557. OPTIMUM MOISTURE IS THE WATER CONTENT (PERCENTAGE BY DRY WEIGHT) CORRESPONDING TO THE MAXIMUM DRY DENSITY.

COMPACTION SHOULD BE ACCOMPLISHED WITH SHEEPSFOOT ROLLERS, VIBRATORY ROLLERS, MULTIPLE-WHEEL PNEUMATIC-TIRED ROLLERS, OR OTHER TYPES OF ACCEPTABLE COMPACTION EQUIPMENT.

MOISTURE-CONDITIONING AND COMPACTION OF THE FILL MATERIALS, ESPECIALLY WITH CLAYEY SOILS, ARE CRITICAL ELEMENTS OF EARTHWORK; THEREFORE OWNER'S GEOTECHNICAL ENGINEER SHOULD CONDUCT OBSERVATIONS AND SOIL DENSITY TESTS DURING SITE GRADING TO ASSIST THE CONTRACTOR IN OBTAINING THE REQUIRED DEGREE OF COMPACTION AND THE PROPER MOISTURE CONTENT. WHERE COMPACTION IS LESS THAN REQUIRED, ADDITIONAL COMPACTIVE EFFORT SHOULD BE APPLIED WITH ADJUSTMENT OF MOISTURE CONTENT, AS NECESSARY, TO OBTAIN THE SPECIFIED COMPACTION. IT SHOULD BE NOTED THAT THE MOISTURE REQUIREMENT OF THE FILLS AND SUBGRADES (ABOUT 2 PERCENT ABOVE THE OPTIMUM MOISTURE) IS AN IMPORTANT REQUIREMENT PARTICULARLY WHEN THE ON-SITE CLAYEY SOILS ARE USED.

(5) CUT AND FILL SLOPES

IN GENERAL CUT SLOPES INTO THE SOIL MATERIAL MAY BE CUT AT AN INCLINATION OF TWO HORIZONTAL TO ONE VERTICAL (2H:1V) OR FLATTER.

FILL SLOPES SHOULD BE DESIGNED WITH A SLOPE INCLINATION OF 2H:1V OR FLATTER. FILLS SHOULD BE KEYED AND BENCHED INTO EXISTING SLOPES TO PROVIDE STABILITY OF THE NEW FILL AGAINST SLIDING. THE FILLING OPERATIONS SHOULD START AT THE LOWEST POINT AND CONTINUE UP IN LEVEL HORIZONTAL COMPACTED LAYERS IN ACCORDANCE WITH THE ABOVE FILL PLACEMENT RECOMMENDATIONS.

FILL SLOPES SHOULD BE CONSTRUCTED BY OVERFILLING AND CUTTING BACK TO THE DESIGN SLOPE RATIO TO OBTAIN A WELL-COMPACTED SLOPE FACE. TRACK-ROLLING OF SLOPES SHOULD NOT BE ACCEPTED. IN THE EVENT THAT OVER-CUTTING OF A SLOPE OCCURS, KEYING AND BENCHING REQUIREMENTS SHOULD BE IMPLEMENTED INSTEAD OF BACKFILLING THE SLOPE TO THE DESIGN GRADE WITH SLIVER FILLS. WATER SHOULD BE DIVERTED AWAY FROM THE TOPS OF SLOPES AND SLOPE PLANTING SHOULD BE PROVIDED AS SOON AS POSSIBLE TO REDUCE THE POTENTIAL FOR EROSION OF THE FINISHED SLOPES.

B. FOUNDATIONS

IN GENERAL, THAT LIGHT STRUCTURES FOR THE NEW DEVELOPMENT AT THE SITE MAY BE SUPPORTED ON SHALLOW FOUNDATION SUPPORT SYSTEMS BEARING ON IN-PLACE OR RECOMPACTED ON-SITE SOILS PREPARED IN ACCORDANCE WITH THE RECOMMENDATIONS PRESENTED BELOW. BASED ON THE GENERALLY HARD SUBSURFACE CONDITIONS, WE BELIEVE SHALLOW ISOLATED SPREAD AND/OR CONTINUOUS FOOTINGS MAY BE USED TO SUPPORT NEW CONSTRUCTION. AN ALLOWABLE BEARING PRESSURE OF UP TO 3,000 PSF MAY BE USED FOR THE DESIGN OF SHALLOW FOUNDATIONS BEARING ON IN-PLACE OR PROPERLY COMPACTED ON-SITE SOILS. THIS BEARING VALUE IS FOR DEAD-PLUS-LIVE LOADS AND MAY BE INCREASED BY ONE-THIRD (1/3) FOR TRANSIENT LOADS, SUCH AS THOSE CAUSED BY WIND OR SEISMIC FORCES.

THE BOTTOM OF THE FOOTING EXCAVATIONS SHOULD BE RECOMPACTED TO AT LEAST 90 PERCENT RELATIVE COMPACTION TO PROVIDE A RELATIVELY FIRM AND SMOOTH BEARING SURFACE PRIOR TO THE PLACEMENT OF REINFORCING STEEL AND/OR CONCRETE. SOFT AND/OR LOOSE MATERIALS ENCOUNTERED AT THE BOTTOM OF THE FOOTING EXCAVATIONS SHOULD BE OVER-EXCAVATED TO

EXPOSE THE UNDERLYING FIRM MATERIALS. THE OVER-EXCAVATION MAY BE BACKFILLED WITH THE ON-SITE SOILS COMPACTED TO A MINIMUM OF 90 PERCENT RELATIVE COMPACTION, OR THE BOTTOM OF FOOTING MAY BE EXTENDED DOWN TO BEAR DIRECTLY ON THE UNDERLYING COMPETENT MATERIALS.

IN GENERAL, FOOTINGS SHOULD BE EMBEDDED A MINIMUM OF 18 INCHES BELOW THE LOWEST ADJACENT FINISHED GRADES. FOOTINGS ADJACENT TO PLANNED (OR EXISTING) RETAINING WALLS SHOULD BE EMBEDDED DEEP ENOUGH TO AVOID SURCHARGING THE RETAINING WALL FOUNDATIONS, OR THE PLANNED RETAINING WALLS SHOULD BE DESIGNED TO RESIST THE ADDITIONAL STRUCTURAL LOADS.

IF FOUNDATIONS ARE NEXT TO UTILITY TRENCHES OR EASEMENTS, THE FOOTINGS SHOULD BE EMBEDDED BELOW A 45-DEGREE IMAGINARY PLANE EXTENDING UPWARD FROM THE BOTTOM EDGE OF THE UTILITY TRENCH OR THE FOOTING SHOULD BE EMBEDDED TO A DEPTH AS DEEP AS THE INVERTS OF THE UTILITY LINES. THIS REQUIREMENT IS NECESSARY TO AVOID SURCHARGING ADJACENT BELOW-GRADE STRUCTURES WITH ADDITIONAL STRUCTURAL LOADS AND TO REDUCE THE POTENTIAL FOR APPRECIABLE FOUNDATION SETTLEMENT.

IF STRUCTURE FOUNDATIONS ARE DESIGNED AND CONSTRUCTED IN STRICT ACCORDANCE WITH OUR RECOMMENDATIONS, WE ESTIMATE TOTAL SETTLEMENTS OF FOOTINGS SUPPORTED ON THE RECOMPACTED ON-SITE SOILS SHOULD BE ON THE ORDER OF ABOUT 1 INCH OR LESS. WE ESTIMATE THAT DIFFERENTIAL SETTLEMENTS BETWEEN ADJACENT FOOTINGS SUPPORTED ON SIMILAR MATERIALS TO BE ON THE ORDER OF ABOUT 0.5 INCHES.

LATERAL LOADS ACTING ON THE STRUCTURES MAY BE RESISTED BY FRICTION DEVELOPED BETWEEN THE BOTTOM OF THE FOUNDATION AND THE BEARING SOIL AND BY PASSIVE EARTH PRESSURE ACTING AGAINST THE NEAR-VERTICAL FACES OF THE FOUNDATION SYSTEM. A COEFFICIENT OF FRICTION OF 0.30 MAY BE USED FOR FOOTINGS BEARING ON THE RECOMPACTED ON-SITE SOILS. RESISTANCE DUE TO PASSIVE EARTH PRESSURE MAY BE ESTIMATED USING AN EQUIVALENT FLUID PRESSURE OF 300 POUNDS PER SQUARE FOOT PER FOOT OF DEPTH (PCF). THIS ASSUMES THAT THE SOILS AROUND THE FOOTINGS ARE WELL COMPACTED. UNLESS COVERED BY PAVEMENTS OR SLABS, THE PASSIVE RESISTANCE IN THE UPPER 12 INCHES OF SOIL SHOULD BE NEGLECTED.

A OWNER'S GEOTECHNICAL ENGINEER REPRESENTATIVE SHOULD OBSERVE FOOTING EXCAVATIONS PRIOR TO THE PLACEMENT OF REINFORCING STEEL OR CONCRETE TO CONFIRM THE FOUNDATION BEARING CONDITIONS AND THE REQUIRED EMBEDMENT DEPTHS.

GEOTECHNICAL ASSUMPTIONS CONT'D

C. SLABS-ON-GRADE

IT IS ANTICIPATED THAT THE ON-SITE SOILS HAVE A LOW EXPANSION POTENTIAL. ALTHOUGH THIS POTENTIAL IS LOW, THERE IS A POSSIBILITY FOR FUTURE DISTRESS TO LIGHTLY LOADED SLABS-ON-GRADE RESULTING FROM SHRINKING AND SWELLING OF THE CLAYEY SOILS DUE TO CHANGES IN THE MOISTURE CONTENT. TO REDUCE THE POTENTIAL FOR STRUCTURAL DISTRESS RESULTING FROM SWELLING OF THE SUBGRADE SOILS, WE RECOMMEND KEEPING THE FOUNDATION AND SLAB SUBGRADES MOIST (I.E., ABOUT 2 TO 4 PERCENT ABOVE OPTIMUM MOISTURE CONTENT) PRIOR TO THE PLACEMENT OF CONCRETE.

IT SHOULD BE EMPHASIZED THAT THE AREAS ADJACENT TO THE SLABS SHOULD BE BACKFILLED TIGHTLY AGAINST THE SLAB EDGES WITH LOW EXPANSION, RELATIVELY IMPERVIOUS SOILS. THESE AREAS ALSO SHOULD BE GRADED TO DIVERT WATER AWAY FROM THE SLABS AND TO REDUCE THE POTENTIAL FOR WATER PONDING AROUND THE SLABS AND FOUNDATIONS.

D. RETAINING STRUCTURES

RETAINING WALLS MAY BE REQUIRED FOR GRADE SEPARATION AND AS HEADWALLS FOR CULVERT STRUCTURES. IN GENERAL, THE FOLLOWING GUIDELINES MAY BE USED FOR PRELIMINARY DESIGN OF RETAINING STRUCTURES.

(1) RETAINING WALL FOUNDATIONS

IN GENERAL RETAINING WALL FOUNDATIONS MAY BE DESIGNED IN ACCORDANCE WITH THE "FOUNDATIONS" SECTION HEREIN. THE FOUNDATIONS SHOULD HAVE A MINIMUM WIDTH OF 18 INCHES AND SHOULD BE EMBEDDED A MINIMUM OF 24 INCHES BELOW THE LOWEST ADJACENT FINISHED GRADE ON RELATIVELY FLAT AREAS. FOR SLOPING GROUND CONDITIONS, THE FOOTINGS SHOULD EXTEND DEEPER TO OBTAIN A MINIMUM 8-FOOT SETBACK DISTANCE MEASURED HORIZONTALLY FROM THE OUTSIDE EDGE OF THE FOOTING TO THE FACE OF THE SLOPE. WALL FOOTINGS ORIENTED PARALLEL TO THE DIRECTION OF THE SLOPE SHOULD BE CONSTRUCTED IN STEPPED FOOTINGS.

(2) LATERAL EARTH PRESSURES

RETAINING STRUCTURES SHOULD BE DESIGNED TO RESIST THE LATERAL EARTH PRESSURES DUE TO THE ADJACENT SOILS AND SURCHARGE EFFECTS. THE RECOMMENDED LATERAL EARTH PRESSURES FOR DESIGN OF RETAINING STRUCTURES, EXPRESSED IN EQUIVALENT FLUID PRESSURES OF POUNDS PER SQUARE FOOT PER FOOT OF DEPTH (PCF), ARE PRESENTED IN THE FOLLOWING TABLE.

LATERAL EARTH PRESSURES FOR DESIGN OF RETAINING STRUCTURES

BACKFILL CONDITION	EARTH PRESSURE COMPONENT	ACTIVE (PCF)	AT-REST (PCF)
LEVEL BACKFILL	HORIZONTAL	40	60
	VERTICAL	NONE	NONE
MAXIMUM 2H:1V SLOPING BACKFILL	HORIZONTAL	58	75
	VERTICAL	29	38

THE VALUES PROVIDED IN THE TABLE ABOVE ASSUME THAT THE ON-SITE SOILS OR IMPORTED GENERAL FILLS WILL BE USED TO BACKFILL BEHIND THE WALLS. IT IS ASSUMED THAT THE BACKFILL BEHIND RETAINING STRUCTURES WILL BE COMPACTED TO BETWEEN 90 AND 95 PERCENT RELATIVE COMPACTION. OVER-COMPACTION OF THE RETAINING STRUCTURE BACKFILL SHOULD BE AVOIDED.

IN GENERAL, AN ACTIVE CONDITION MAY BE USED FOR GRAVITY RETAINING WALLS AND RETAINING STRUCTURES THAT ARE FREE TO DEFLECT BY AS MUCH AS 0.5 PERCENT OF THE STRUCTURE HEIGHT. IF THE TOPS OF THE STRUCTURES ARE NOT FREE TO DEFLECT BEYOND THIS DEGREE, OR ARE RESTRAINED, THE RETAINING STRUCTURES SHOULD BE DESIGNED FOR THE AT-REST CONDITION. THESE LATERAL EARTH PRESSURES DO NOT INCLUDE HYDROSTATIC PRESSURES THAT MIGHT BE CAUSED BY GROUNDWATER TRAPPED BEHIND THE STRUCTURES.

SURCHARGE STRESSES DUE TO AREAL SURCHARGES, LINE LOADS, AND POINT LOADS WITHIN A HORIZONTAL DISTANCE EQUAL TO THE DEPTH OF THE RETAINING STRUCTURES SHOULD BE CONSIDERED IN THE DESIGN. FOR UNIFORM SURCHARGE STRESSES IMPOSED ON THE LOADED SIDE OF THE STRUCTURE, A RECTANGULAR DISTRIBUTION WITH UNIFORM PRESSURE EQUAL TO 33 PERCENT OF THE VERTICAL SURCHARGE PRESSURE ACTING ON THE ENTIRE HEIGHT OF THE STRUCTURE, WHICH IS FREE TO DEFLECT (CANTILEVER), MAY BE USED IN DESIGN. FOR RETAINING STRUCTURES THAT ARE RESTRAINED, A RECTANGULAR DISTRIBUTION EQUAL TO 50 PERCENT OF THE VERTICAL SURCHARGE PRESSURE ACTING OVER THE ENTIRE HEIGHT OF THE STRUCTURES MAY BE USED FOR DESIGN. ADDITIONAL ANALYSES DURING DESIGN MAY BE NEEDED TO EVALUATE THE SURCHARGE EFFECTS OF POINT LOADS AND LINE LOADS.

(3) DRAINAGE

RETAINING STRUCTURES SHOULD BE WELL DRAINED TO REDUCE THE BUILD-UP OF HYDROSTATIC PRESSURES. A TYPICAL DRAINAGE SYSTEM WOULD CONSIST OF A 12-INCH WIDE ZONE OF PERMEABLE MATERIAL, SUCH AS NO. 3B FINE GRAVEL (ASTM C33, NO. 67 GRADATION), PLACED DIRECTLY AROUND A PERFORATED PIPE (PERFORATIONS DOWN) AT THE BASE OF THE RETAINING STRUCTURE DISCHARGING TO AN APPROPRIATE OUTLET OR WEEPHOLES. AS AN ALTERNATIVE, A PREFABRICATED DRAINAGE PRODUCT, SUCH AS MIRADRAIN OR ENKADRAIN, MAY BE USED IN LIEU OF THE DRAINAGE MATERIAL. THE PREFABRICATED DRAINAGE PRODUCT SHOULD ALSO BE HYDRAULICALLY CONNECTED TO A PERFORATED PIPE AT THE BASE OF THE WALL.

BACKFILL BEHIND THE PERMEABLE DRAINAGE ZONE MAY CONSIST OF GRANULAR FILL LESS THAN 3 INCHES IN MAXIMUM DIMENSION. UNLESS COVERED BY CONCRETE SLABS, THE UPPER 12 INCHES OF BACKFILL SHOULD CONSIST OF RELATIVELY IMPERVIOUS MATERIALS TO REDUCE THE POTENTIAL FOR WATER INFILTRATION BEHIND THE RETAINING STRUCTURES.

GEOTECHNICAL ASSUMPTIONS CONT'D

E. UTILITY INSTALLATION

IT IS ANTICIPATED THAT UTILITY INSTALLATION FOR THE PROPOSED PROJECT MAY CONSIST PRIMARILY OF WATER AND DRAINAGE. IN GENERAL, GOOD CONSTRUCTION PRACTICES SHOULD BE UTILIZED FOR THE INSTALLATION AND BACKFILLING OF THE TRENCHES FOR THE NEW UTILITIES. THE CONTRACTOR SHOULD DETERMINE THE METHOD AND EQUIPMENT TO BE USED FOR TRENCH EXCAVATION SUBJECT TO PRACTICAL LIMITS AND SAFETY CONSIDERATIONS. IN ADDITION, THE EXCAVATIONS SHOULD COMPLY WITH THE APPLICABLE FEDERAL, STATE, AND LOCAL SAFETY REQUIREMENTS. THE CONTRACTOR SHOULD BE RESPONSIBLE FOR TRENCH SHORING DESIGN AND INSTALLATION.

GRANULAR BEDDING CONSISTING OF 6 INCHES OF NO. 3B FINE GRAVEL (ASTM C33, NO. 67 GRADATION) IS RECOMMENDED BELOW THE PIPES. FREE-DRAINING GRANULAR MATERIALS, SUCH AS NO. 3B FINE GRAVEL (ASTM C33, NO. 67 GRADATION), SHOULD BE USED FOR THE TRENCH BACKFILL UP TO ABOUT 12 INCHES ABOVE THE PIPES TO PROVIDE ADEQUATE SUPPORT AROUND THE PIPES AND TO REDUCE COMPACTION OF THE BACKFILL, THUS REDUCING THE POSSIBILITY OF PIPE DAMAGE.

THE UPPER PORTION OF THE TRENCH BACKFILL SHOULD CONSIST OF GRANULAR MATERIAL GENERALLY LESS THAN 3 INCHES IN MAXIMUM SIZE COMPACTED TO AT LEAST 90 PERCENT RELATIVE COMPACTION. WHERE TRENCHES WILL BE LOCATED IN PAVED AREAS, THE UPPER 3 FEET OF THE TRENCH BACKFILL BELOW THE PAVEMENT FINISHED GRADE SHOULD BE COMPACTED TO NO LESS THAN 95 PERCENT RELATIVE COMPACTION. WHERE A UTILITY LINE CROSSES BENEATH THE FOOTINGS, THE UTILITY PIPES SHOULD BE JACKETED WITH CONCRETE.

F. SUBSURFACE INFILTRATION

WHILE NOT DETERMINED AT THIS TIME, THE PROJECT MAY INCLUDE A SYSTEM, OR SYSTEMS, FOR THE ON-SITE MANAGEMENT OF STORM WATER RUNOFF. THESE SYSTEMS MAY INCLUDE, BUT ARE NOT LIMITED TO: DETENTION BASINS OR BIOSWALES. IN ORDER TO OBTAIN SUBSURFACE INFILTRATION INFORMATION IN SUPPORT OF THE PLANNING OF SUCH SYSTEMS, REPRESENTATIVE FALLING HEAD INFILTRATION TESTS AT THE EIGHT BORING LOCATIONS TO PROVIDE A GENERAL DATA.

THE FIELD INFILTRATION TESTS WERE PERFORMED BY AUGERING A BORING TO THE SELECTED TEST DEPTH OF ABOUT 5 FEET BELOW GROUND SURFACE. UPON REACHING THE TEST DEPTH, A 4-INCH DIAMETER PVC SOLID CASING WAS SET TO THE BOTTOM OF THE DRILLED HOLE TO ALLOW INFILTRATION ONLY THROUGH THE SOIL EXPOSED ON THE BOTTOM OF THE BORING. FALLING HEAD INFILTRATION TESTS WERE PERFORMED TO DETERMINE THE INFILTRATION RATES OF THE UNDERLYING SUBSURFACE MATERIALS. EACH TEST CONSISTED OF THREE OR FOUR TRIALS OF FILLING THE CASING WITH 24 INCHES OF WATER AND TAKING PERIODIC READINGS OVER A ONE HOUR TRIAL PERIOD. THE INFILTRATION RATES ARE THEN CALCULATED BASED ON THE RESULT OF THE LAST TRIAL FOR EACH TEST LOCATION. THE RESULTS ARE SUMMARIZED IN THE FOLLOWING TABLE:

FIELD INFILTRATION TEST RESULTS

TEST	TEST DEPTH (FEET)	FINAL INFILTRATION RATE (INCH/HOUR)
B-1	3.9	0.4
B-2	4.25	0.9
B-3	3.1	3.8
B-4	4.0	1.0
B-5	5.0	2.5
B-6	4.5	1.3
B-7	4.0	4.8
B-8	4.6	4.5
SITE AVERAGE		2.4

IN GENERAL, THE RATES OBTAINED BY SURFACE TESTING RANGE FROM RESTRICTIVE TO VERY FAVORABLE FOR THE USE OF INFILTRATION SYSTEMS FOR THE MANAGEMENT OF STORM WATER RUNOFF. THE OVERALL SITE AVERAGE INDICATES THAT THE SITE IS FAVORABLE FOR THE USE OF ONE OR MORE INFILTRATION METHODS FOR ON-SITE DISPOSAL OF STORM WATER RUNOFF GENERATED ON THE SITE. IT IS RECOMMENDED, THAT ONCE THE RUNOFF MANAGEMENT SYSTEMS ARE LOCATED, FURTHER SITE SPECIFIC TESTING BE CONDUCTED TO EVALUATE THE INFILTRATION CAPACITIES AT THOSE LOCATIONS.

G. DESIGN REVIEW

DRAWINGS AND SPECIFICATIONS FOR PROPOSED SITE GRADING SHOULD BE FORWARDED TO OWNER'S GEOTECHNICAL ENGINEER FOR REVIEW AND WRITTEN COMMENTS PRIOR TO BID ADVERTISEMENT. THIS REVIEW IS NECESSARY TO EVALUATE ADHERENCE OF THE PLANS AND SPECIFICATIONS TO THE INTENT OF THE FOUNDATION AND EARTHWORK RECOMMENDATIONS PROVIDED HEREIN. IF THIS REVIEW IS NOT MADE, OWNER'S GEOTECHNICAL ENGINEER CANNOT ASSUME RESPONSIBILITY FOR MISINTERPRETATION OF THE PRESENTED RECOMMENDATIONS.

WAIAHOLE WATER SYSTEM IMPROVEMENTS

R. M. TOWILL CORPORATION
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Signature 4/30/22 EXP. DATE

REVISION	DATE	BY

APPROVED BY

Chief, Civil Engineering Branch, DPP DATE

Chief, Traffic Review Branch, DPP DATE

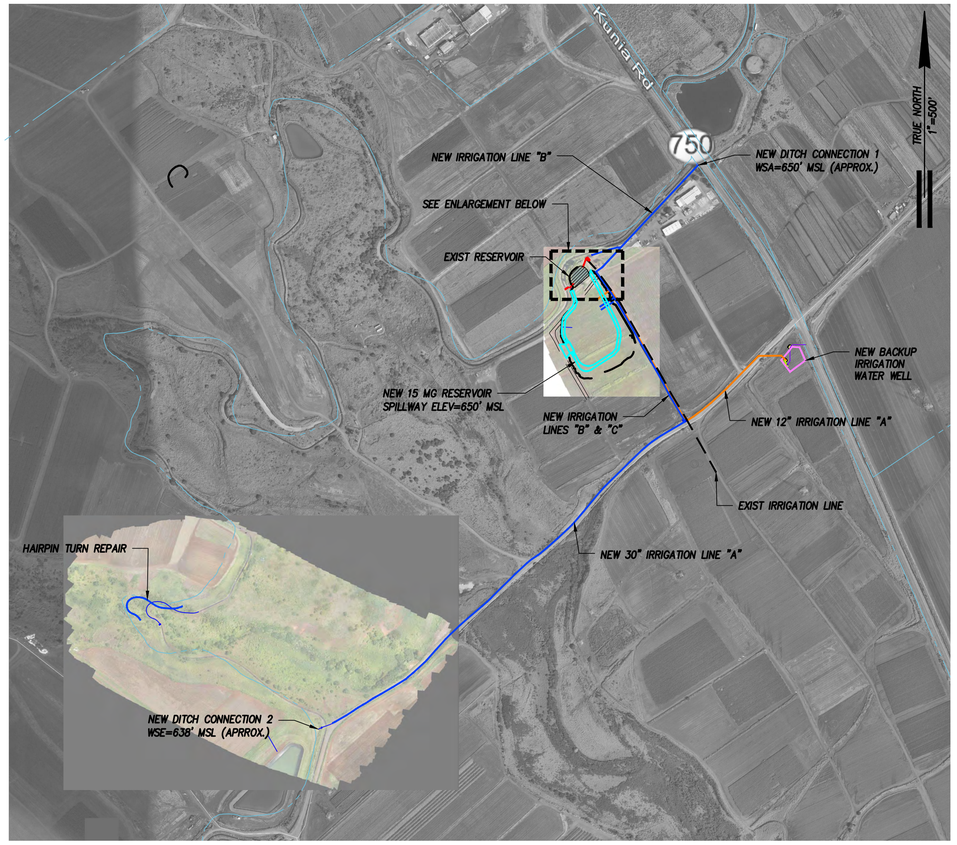
ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

CONSTRUCTION NOTES 3

FILE	POCKET	FOLDER	NO.

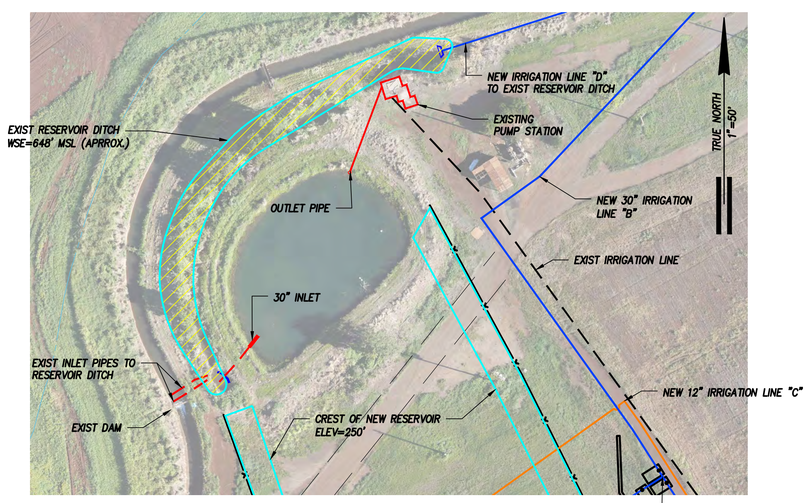
RMTC JOB NO.: 1-23196-0E

K:\civil\23620 Waiahole Water System Impr\Drawings\Construction Dwgs\C004 Construction Notes 3.dwg 4/16/2020



PROPOSED RESERVOIR AND WELL SYSTEM

SCALE: 1" = 500'



ENLARGEMENT OF EXISTING RESERVOIR AREA

SCALE: 1" = 50'

DESCRIPTION OF WAIAHOLE WATER SYSTEM IMPROVEMENTS

1. DITCH CONNECTION 1 – NEW INTAKE FOR RESERVOIR NEAR KUNIA ROAD
   - A. CONSTRUCT NEW SHALLOW MANHOLE OVER EXISTING PLUGGED 24" CULVERT CONNECTED TO EXISTING DIVERSION ON WAIAHOLE DITCH.
   - B. INSTALL NEW TRASH RACK AND NEW 24" CAST IRON SLUICE GATE AT EXISTING DIVERSION.
   - C. UNPLUG EXISTING 24" CULVERT.
   - D. CONNECT NEW 30" IRRIGATION LINE "B" TO NEW SHALLOW MANHOLE.
   - E. WATER SURFACE ELEVATION (WSE) AT DITCH IS APRROX. 650 FEET MEAN SEA LEVEL (FT MSL).
2. NEW 15 MG RESERVOIR ADJACENT TO EXISTING RESERVOIR
   - A. WATER FROM WAIAHOLE DITCH IS DIVERTED INTO AN EXISTING DITCH BETWEEN THE RESERVOIR AND WAIAHOLE DITCH AND THEN INTO THE EXISTING RESERVOIR.
   - B. EXISTING PUMP DRAWS WATER FROM THE EXISTING RESERVOIR AND PUMPS WATER MAKAI OF THE EXISTING RESERVOIR.
   - C. MAXIMUM WSE IN EXISTING RESERVOIR IS APPROX. 248 FT MSL.
   - D. CONSTRUCT NEW 15 MG RESERVOIR CONNECTED TO SOUTHEAST SIDE OF EXISTING RESERVOIR.
   - E. CREST ELEVATION OF NEW RESERVOIR WILL BE 650 FT MSL.
   - F. SPILLWAY ELEVATION OF NEW RESERVOIR WILL BE 648 FT MSL.
   - G. NEW RESERVOIR WILL RECEIVE WATER FROM DITCH CONNECTION 1 THROUGH NEW IRRIGATION LINE "B-1" THROUGH THE NORTHEAST EMBANKMENT OR THROUGH NEW IRRIGATION LINE "D" CONNECTED TO THE EXISTING RESERVOIR DITCH.
   - H. NEW RESERVOIR CAN ALSO RECEIVE WATER FROM NEW BACKUP IRRIGATION WATER WELL THROUGH IRRIGATION LINE "C-1" THROUGH THE NORTHEAST EMBANKMENT.
3. NEW IRRIGATION LINES "B" AND "C"
   - A. ALIGNMENT OF 30" IRRIGATION LINE "B" WILL BE ALONG EXISTING ROADS TO EXISTING RESERVOIR AND ADJACENT TO NORTHEAST EMBANKMENT OF NEW RESERVOIR, FROM DITCH CONNECTION 1 TO CONNECTION TO 12" IRRIGATION LINE "A."
   - B. ALIGNMENT OF 12" IRRIGATION LINE "C" WILL BE ALONG AN EXISTING ROAD ADJACENT TO NORTHEAST EMBANKMENT OF NEW RESERVOIR, FROM CONNECTION TO IRRIGATION LINE "C-1" TO CONNECTION TO IRRIGATION LINE "A."
4. NEW BACKUP IRRIGATION WATER WELL
   - A. PUMP RATED CAPACITY AND HEAD AT 1770 RPM: 1400 GPM AT 675 FEET HEAD
   - B. TOP OF PROPOSED CONCRETE PUMP PAD ELEVATION: 616.0 FEET
   - C. ELEVATION OF BOTTOM OF WELL PERFORATED CASING: (–)130 FT MSL
   - D. CONNECTION TO 12" IRRIGATION LINE "A."
5. NEW IRRIGATION LINE "A"
   - A. ALIGNMENT WILL BE ALONG EXISTING DIRT PLANTATION ROAD FROM DITCH CONNECTION 2 ON WAIAHOLE DITCH TO THE SITE OF THE NEW WELL.
   - B. SIZE WILL BE 30" FROM DITCH CONNECTION 2 TO CONNECTION TO 30" IRRIGATION LINE "B" THEN REDUCE TO 12" BEFORE CONNECTING TO 12" IRRIGATION LINE "C."
   - C. A 30" BEVELED-GEAR GATE VALVE (NORMALLY CLOSED) WILL ISOLATE THE 12" PUMPED SYSTEM (FROM THE NEW WELL) FROM THE 30" GRAVITY SYSTEM.
6. DITCH CONNECTION 2 – DOWNSTREAM FROM HAIRPIN TURN
   - A. CONSTRUCT NEW HEADWALL AT EXISTING CUT IN WAIAHOLE DITCH
   - B. CONSTRUCT NEW 30" SLUICE GATE AT NEW HEADWALL
   - C. WSE AT DITCH APPROX. 638 FT MSL.
7. REPAIR AT HAIRPIN TURN
   - A. REMOVE TWO EXISTING 20" HDPE PIPES FROM DITCH AND BULKHEADS AT INLET AND OUTLET.
   - B. PLACE NEW 36" HDPE IN ON NEW CONCRETE SADDLES AT CENTER OF DITCH AND STRAP TO SADDLES; BEND PIPE TO MATCH CURVE OF DITCH.
   - C. ENCASE NEW PIPE IN CLSM.
   - D. CONSTRUCT NEW INLET AND OUTLET CONCRETE BULKHEADS.

GRAPHIC SCALES:

1" = 50' — 50' 25' 0 50' 100'

1" = 500' — 500' 250' 0 500' 1000'

SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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Signature — 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	BY	APPROVED

APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
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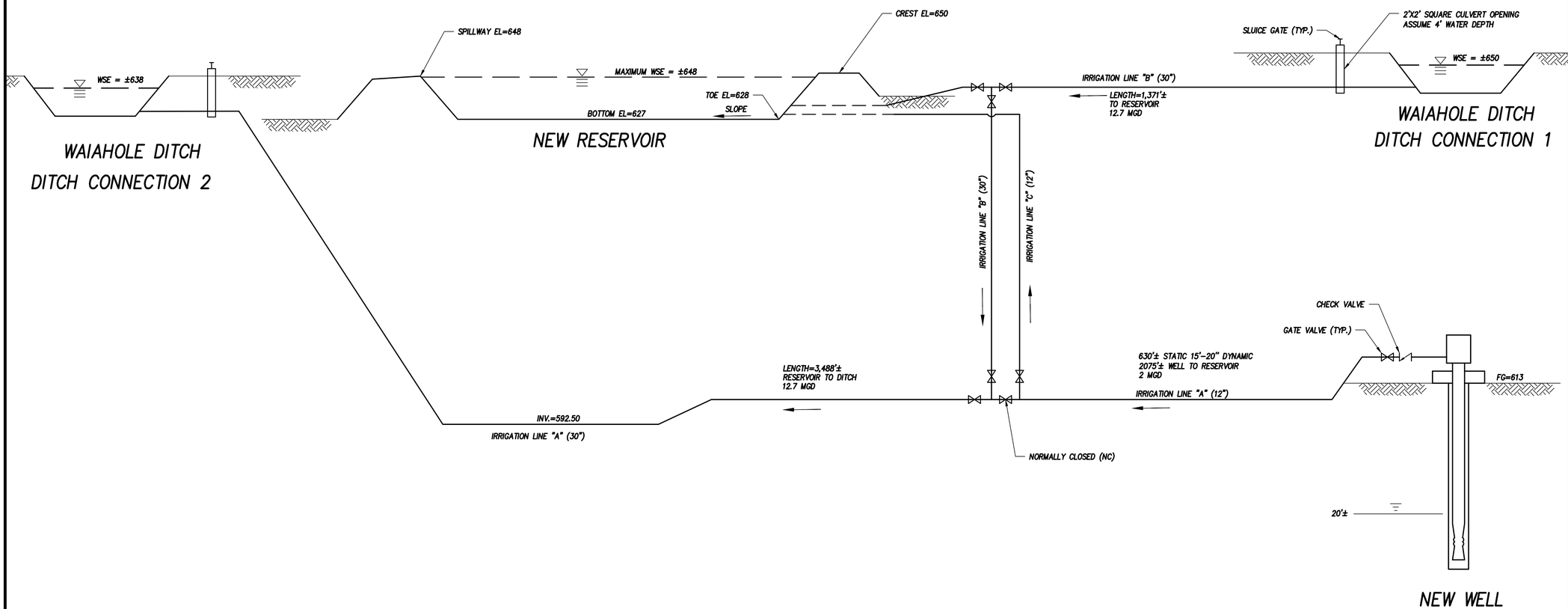
PROPOSED RESERVOIR AND WELL SYSTEM

RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



HYDRAULIC PROFILE

NOT TO SCALE

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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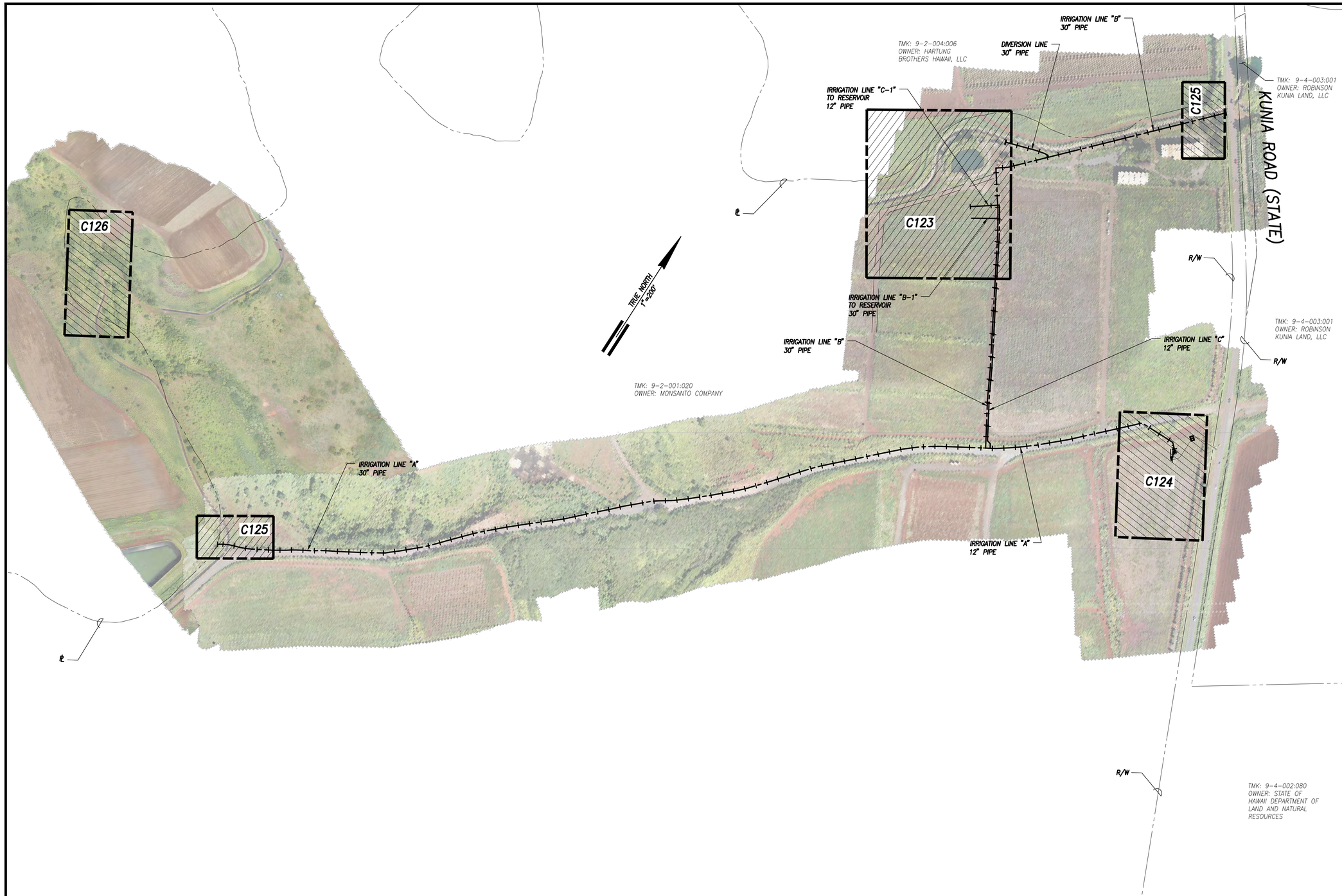

KEY PLAN – EROSION & SEDIMENT CONTROL PLANS

SCALE: 1" = 200'

GRAPHIC SCALE:
1" = 200' 200' 100' 0 200' 400'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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KEY PLAN – EROSION & SEDIMENT CONTROL PLANS

RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.

GOOD HOUSEKEEPING BMPS NOTES:

1. STREET SWEEPING AND VACUUMING.

   ALL POLLUTANTS DISCHARGED FROM CONSTRUCTION SITE TO OFF-SITE AREAS MUST BE SWEPT OR VACUUMED EACH DAY BEFORE LEAVING THE JOB SITE.

2. MATERIALS DELIVERY, STORAGE AND USE MANAGEMENT.

   PREVENT, REDUCE, OR ELIMINATE THE DISCHARGE OF POLLUTANTS FROM MATERIAL DELIVERY, STORAGE, AND USE TO THE STORM WATER SYSTEM OR WATERCOURSES BY MINIMIZING THE STORAGE OF HAZARDOUS MATERIALS ONSITE, STORING MATERIALS IN A DESIGNATED AREA, INSTALLING SECONDARY CONTAINMENT. CONSTRUCTION MATERIALS, WASTE, TOXIC AND HAZARDOUS SUBSTANCES, STOCKPILES AND OTHER SOURCES OF POLLUTION SHALL NOT BE STORED IN BUFFER AREAS, NEAR AREAS OF CONCENTRATED FLOW, OR AREAS ABUTTING THE MS4, RECEIVING WATERS, OR DRAINAGE IMPROVEMENTS THAT DISCHARGE OFF-SITE. PRIMARY AND SECONDARY CONTAINMENT CONTROLS AND COVERS SHALL BE IMPLEMENTED TO THE MAXIMUM EXTENT PRACTICAL (MEP).

3. SPILL PREVENTION AND CONTROL.

   CREATE AND IMPLEMENT SPILL PREVENTION AND RESPONSE PLANS TO ELIMINATE AND MINIMIZE THE DISCHARGE OF POLLUTANTS TO THE MS4 AND RECEIVING WATERS FROM LEAKS AND SPILLS BY REDUCING THE CHANCE FOR SPILLS, ABSORBING, CONTAINING, AND CLEANING UP SPILLS AND PROPERLY DISPOSING OF SPILL MATERIALS. AT A MINIMUM, ALL PROJECTS SHALL CLEANUP ALL LEAKS AND SPILLS IMMEDIATELY.

4. HAZARDOUS MATERIALS.

   PREVENT OR REDUCE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM HAZARDOUS WASTE THROUGH PROPER MATERIAL USE AND WASTE DISPOSAL. IN THE EVENT THAT HAZARDOUS MATERIALS ARE DISCHARGED TO THE MS4, THE PROPERTY OWNER OR ESCP COORDINATOR SHALL IMMEDIATELY NOTIFY THE DEPARTMENT OF FACILITIES MAINTENANCE, HONOLULU FIRE DEPARTMENT, AND HONOLULU POLICE DEPARTMENT OF THE DISCHARGE BY TELEPHONE. A WRITTEN REPORT DESCRIBING THE POLLUTANTS THAT WERE DISCHARGED, THE REASONS FOR THE DISCHARGE, AND THE MEASURES THAT HAVE BEEN TAKEN OR WILL BE TAKEN TO PREVENT A REOCCURRENCE OF THE DISCHARGE SHALL BE SUBMITTED TO THE DIRECTOR NO LESS THAN 3 DAYS AFTER NOTIFICATION BY PHONE.

5. NONHAZARDOUS MATERIALS.

   IN THE EVENT THAT NONHAZARDOUS MATERIALS ARE DISCHARGED TO THE MS4, THE PROPERTY OWNER OR ESCP COORDINATOR SHALL NOTIFY THE CITY DEPARTMENT OF FACILITIES MAINTENANCE BY TELEPHONE NO LATER THAN THE NEXT BUSINESS DAY. A WRITTEN REPORT DESCRIBING THE POLLUTANTS THAT WERE DISCHARGED, THE REASONS FOR THE DISCHARGE, AND THE MEASURES THAT HAVE BEEN TAKEN OR WILL BE TAKEN TO PREVENT A REOCCURRENCE OF THE DISCHARGE SHALL BE SUBMITTED TO THE DIRECTOR NO LESS THAN 3 DAYS AFTER NOTIFICATION BY PHONE.

6. VEHICLE AND EQUIPMENT CLEANING.

   ELIMINATE AND MINIMIZE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM VEHICLE AND EQUIPMENT CLEANING OPERATIONS BY USING OFF-SITE FACILITIES WHEN FEASIBLE, WASHING IN DESIGNATED, CONTAINED AREAS ONLY, AND ELIMINATING DISCHARGES TO THE STORM DRAIN SYSTEM BY EVAPORATING AND/OR TREATING WASH WATER, AS APPROPRIATE OR INFILTRATING WASH WATER FOR EXTERIOR CLEANING ACTIVITIES THAT USE WATER ONLY.

7. VEHICLE AND EQUIPMENT FUELING.

   PREVENT FUEL SPILLS AND LEAKS BY USING OFF-SITE FACILITIES, FUELING ONLY IN DESIGNATED AREAS, ENCLOSING OR COVERING STORED FUEL, AND IMPLEMENTING SPILL CONTROLS SUCH AS SECONDARY CONTAINMENT AND ACTIVE MEASURES USING SPILL RESPONSE KITS.

8. VEHICLE AND EQUIPMENT MAINTENANCE.

   ELIMINATE AND MINIMIZE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM VEHICLE AND EQUIPMENT MAINTENANCE OPERATIONS BY USING OFF-SITE FACILITIES WHEN FEASIBLE, PERFORMING WORK IN DESIGNATED AREAS ONLY, USING SPILL PADS UNDER VEHICLES AND EQUIPMENT, CHECKING FOR LEAKS AND SPILLS, AND CONTAINING AND CLEANING UP SPILLS IMMEDIATELY.

9. SOLID WASTE MANAGEMENT.

   PREVENT OR REDUCE DISCHARGE OF POLLUTANTS TO THE LAND, GROUNDWATER, AND IN STORM WATER FROM SOLID WASTE OR CONSTRUCTION AND DEMOLITION WASTE BY PROVIDING DESIGNATED WASTE COLLECTION AREAS, COLLECT SITE TRASH DAILY, AND ENSURING THAT CONSTRUCTION WASTE IS COLLECTED, REMOVED, AND DISPOSED OF ONLY AT AUTHORIZED DISPOSAL AREAS.

10. SANITARY/SEPTIC WASTE MANAGEMENT.

    TEMPORARY AND PORTABLE SANITARY AND SEPTIC WASTE SYSTEMS SHALL BE MOUNTED OR STAKED IN, WELL-MAINTAINED AND SCHEDULED FOR REGULAR WASTE DISPOSAL AND SERVICING. SOURCES OF SANITARY AND/OR SEPTIC WASTE SHALL NOT BE STORED NEAR THE MS4 OR RECEIVING WATERS.

11. STOCKPILE MANAGEMENT.

    STOCKPILES SHALL NOT BE LOCATED IN DRAINAGE WAYS, WITHIN 50 FEET FROM AREAS OF CONCENTRATED FLOWS, AND ARE NOT ALLOWED IN THE CITY RIGHT-OF-WAY. SEDIMENT BARRIERS OR SILT FENCES SHALL BE USED AROUND THE BASE OF ALL STOCKPILES. STOCKPILES SHALL NOT EXCEED 15 FEET IN HEIGHT. STOCKPILES GREATER THAN 15 FEET IN HEIGHT SHALL REQUIRE 8 FOOT WIDE BENCHING IN ACCORDANCE WITH ROH CHAPTER 14, ARTICLE 15. STOCKPILES MUST BE COVERED WITH PLASTIC SHEETING OR A COMPARABLE MATERIAL IF THEY WILL NOT BE ACTIVELY USED WITHIN 7 DAYS.

12. LIQUID WASTE MANAGEMENT.

    LIQUID WASTE SHALL BE CONTAINED IN A CONTROLLED AREA SUCH AS A HOLDING PIT, SEDIMENT BASIN, ROLL-OFF BIN, OR PORTABLE TANK OF SUFFICIENT VOLUME AND TO CONTAIN THE LIQUID WASTES GENERATED. CONTAINMENT AREAS OR DEVICES MUST BE IMPERMEABLE AND LEAK FREE AND SHOULD NOT BE LOCATED WHERE ACCIDENTAL RELEASE OF THE CONTAINED LIQUID CAN DISCHARGE TO WATER BODIES, CHANNELS, OR STORM DRAINS.

13. CONCRETE WASTE MANAGEMENT.

    PREVENT OR REDUCE THE DISCHARGE OF POLLUTANTS TO STORM WATER FROM CONCRETE WASTE BY CONDUCTING WASHOUT OFFSITE OR PERFORMING ONSITE WASHOUT IN A DESIGNATED AREA CONSTRUCTED AND MAINTAINED IN SUFFICIENT QUANTITY AND SIZE TO CONTAIN ALL LIQUID AND CONCRETE WASTE GENERATED BY WASHOUT OPERATIONS. PLASTIC LINING MATERIAL SHOULD BE A MINIMUM OF 10 MILLIMETER POLYETHYLENE SHEETING AND SHOULD BE FREE OF HOLES, TEARS, OR OTHER DEFECTS THAT COMPROMISE THE IMPERMEABILITY OF THE MATERIAL. CONTAINMENT AREAS OR DEVICES SHOULD NOT BE LOCATED WHERE ACCIDENTAL RELEASE OF THE CONTAINED LIQUID CAN DISCHARGE TO WATER BODIES, CHANNELS, OR STORM DRAINS. WASHOUT FACILITIES MUST BE CLEANED, OR NEW FACILITIES MUST BE CONSTRUCTED AND READY FOR USE ONCE THE WASHOUT IS 75 PERCENT FULL. ONCE CONCRETE WASTES ARE WASHED INTO THE DESIGNATED AREA AND ALLOWED TO HARDEN, THE CONCRETE SHOULD BE BROKEN UP, REMOVED, AND DISPOSED OF AS SOLID WASTES.

GOOD HOUSEKEEPING BMPS NOTES (CONT'D):

14. CONTAMINATED SOIL MANAGEMENT.

    AT MINIMUM CONTAIN CONTAMINATED MATERIAL SOIL BY SURROUNDING WITH IMPERMEABLE LINED BERMS OR COVER EXPOSED CONTAMINATED MATERIAL WITH PLASTIC SHEETING. CONTAMINATED SOIL SHOULD BE DISPOSED OF PROPERLY IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS.

15. DUST CONTROL.

    THE CONTRACTOR, AT HIS OWN EXPENSE, SHALL PROVIDE EFFECTIVE MEASURES FOR THE CONTROL OF DUST FROM THE PROJECT SITE AND HAUL ROADS SO IT SHALL NOT BE TRANSPORTED OR DISCHARGED TO OFF-SITE AREAS. THE WORK MUST BE IN CONFORMANCE WITH AIR POLLUTION CONTROL STANDARDS CONTAINED IN THE HAWAII ADMINISTRATIVE RULES: TITLE 11 CHAPTER 60.1, "AIR POLLUTION CONTROL".

16. BMP AND SITE MAINTENANCE.

    THE CONTRACTOR SHALL MAINTAIN TEMPORARY EROSION CONTROL MEASURES THROUGHOUT THE PROJECT DURATION. THE CONTRACTOR SHALL CLEAN TRASH AND DEBRIS AROUND THE SURROUNDING AREA ON A WEEKLY BASIS.

EROSION AND SEDIMENT CONTROL PLAN SCHEDULE AND RAIN RESPONSE PLAN NOTES:

PROJECT SEQUENCE:

1. INSTALL STABILIZED CONSTRUCTION ENTRANCES, PERIMETER CONTROLS, INLET PROTECTION, AND CLEARING AND GRUBBING AS NECESSARY FOR THE INSTALLATION OF THESE BMPS.
2. CONSTRUCT TEMPORARY SEDIMENT BASINS, STABILIZE IMMEDIATELY.
3. CONSTRUCT TEMPORARY SWALES TO DIRECT RUNOFF INTO THE SEDIMENT BASINS. STABILIZE IMMEDIATELY.
4. CLEAR, GRUB AND GRADE THE SITE AS SHOWN IN THE GRADING PLANS. RELOCATE, RECONSTRUCT AND MAINTAIN BMPS AS NEEDED TO KEEP THEM EFFECTIVE AT ALL TIMES. INITIATE TEMPORARY STABILIZATION IMMEDIATELY ONCE GRADING IS COMPLETED IN EACH PHASE.
5. INITIATE STABILIZATION OF STEEP SLOPES (> 15%) WITH HYDROSEEDING OR CHEMICAL STABILIZATION AS SOON AS GRADING IS COMPLETED ON THOSE AREAS.
6. PROCEED WITH CONSTRUCTION WITH LEAST POSSIBLE DISTURBANCE OF VEGETATIVE AREAS AND TEMPORARY STRUCTURES.
7. STABILIZE EXPOSED AREAS WITH GRASSING OR CHEMICAL STABILIZATION IF NOT BEING ACTIVELY USED WITHIN 7 DAYS.
8. PLANT PERMANENT GROUND COVER.
9. REMOVE OR DISMANTLE TEMPORARY EROSION CONTROL STRUCTURES AFTER FULL ESTABLISHMENT OF PERMANENT VEGETATIVE COVER.
10. PRACTICE GOOD HOUSEKEEPING MEASURES THROUGHOUT THE DURATION OF CONSTRUCTION.
11. INSPECTIONS WILL BE PERFORMED WEEKLY.

RAIN RESPONSE PLAN:

THE FOLLOWING WILL BE PERFORMED WHEN HEAVY RAINS, TROPICAL STORM OR HURRICANE IS IMMINENT OR IS FORECASTED IN THE NEXT 48 HOURS:

1. TEMPORARY SUSPENSION OF ACTIVE GRADING.
2. INSPECT ALL SEDIMENT BASINS, TEMPORARY DITCHES/ SWALES, PERIMETER CONTROLS, AND INLET PROTECTION DEVICES, AND MAINTAIN AS NEEDED. REINSTALL ANY PERIMETER CONTROLS THAT WERE REMOVED DUE TO ACTIVE WORK IN THE AREA. IF A SEVERE STORM IS EXPECTED, REMOVE INLET PROTECTION DEVICES TO PREVENT FLOODING ON SURROUNDING STREETS.
3. COVER OR RELOCATE MATERIAL STOCKPILES AND LIQUID MATERIAL CONTAINERS TO AVOID CONTACT WITH RAINWATER.
4. PLACE SPILL PANS OR OIL-ONLY SPILL PADS UNDER CONSTRUCTION VEHICLES TO PREVENT RUNOFF FROM CONTACTING ANY SPILLED PETROLEUM PRODUCTS. PROPERLY DISPOSE OF ANY ACCUMULATED OILY WATER AFTER THE RAIN EVENT.
5. RE-INSPECT AFTER THE APPROACHING HEAVY RAINS, TROPICAL STORM OR HURRICANE AND REPLACE OR MAINTAIN BMPS AS NEEDED.

EROSION PREVENTION / SEDIMENT CONTROL NOTES

1. THE CONTRACTOR SHALL FOLLOW THE GUIDELINES IN THE CITY AND COUNTY OF HONOLULU'S "RULES RELATING TO WATER QUALITY."
2. MEASURES TO CONTROL EROSION AND OTHER POLLUTANTS SHALL BE IN PLACE BEFORE ANY EARTHWORK IS INITIATED.
3. SLOPE PROTECTION

   SLOPE PROTECTION IS REQUIRED ON AREAS WITH SLOPES GREATER THAN 15% AND ON AREAS OF MODERATE SLOPE THAT ARE PRONE TO EROSION UNLESS THEY ARE BEING ACTIVELY WORKED. USE DIVERSION OF SLOPE (DIKES, SWALES, SLOPE DRAINS) TO DIVERT WATER AROUND THE SLOPE. PROVIDE A 10-FT BUFFER ZONE AT THE TOE OF SLOPE. ONLY 5 ACRES MAY BE DISTURBED AT ANYTIME ON SLOPES GREATER THAN 15%.
4. TEMPORARY STABILIZATION IS REQUIRED ON DISTURBED AREAS WHICH ARE AT FINAL GRADE OR WHEN THE DISTURBED AREA WILL NOT BE WORKED FOR 14 CONSECUTIVE DAYS OR MORE.
5. PERMANENT STABILIZATION

   ALL SLOPES AND EXPOSED AREAS SHALL BE GRASSED OR SPRAYED WITH SOIL SEMENT CHEMICAL STABILIZER OR APPROVED EQUAL PRIOR TO REMOVING EROSION AND SEDIMENT MEASURES. TRAPPED SEDIMENT AND AREAS OF DISTURBED SOIL WHICH RESULT FROM THE REMOVAL OF THE TEMPORARY MEASURES SHALL BE IMMEDIATELY AND PERMANENTLY STABILIZED.
6. PRESERVE EXISTING VEGETATION

   CLEARLY MARK THE AREAS TO BE PRESERVED WITH FLAGS OR TEMPORARY FENCING. WHERE TEMPORARY FENCING IS USED, FENCING MUST BE ADEQUATELY SUPPORTED BY POSTS AND MAINTAINED IN AN UPRIGHT POSITION.

EROSION PREVENTION / SEDIMENT CONTROL NOTES (CONT'D):

7. MINIMIZE SOIL COMPACTION

   AREAS WHERE FINAL STABILIZATION OR INFILTRATION PRACTICES WILL BE INSTALLED SHALL BE PROTECTED FROM EXCESSIVE COMPACTION DURING CONSTRUCTION. VEHICLE AND EQUIPMENT USE SHALL BE RESTRICTED OR TECHNIQUES TO CONDITION THE SOILS TO SUPPORT VEGETATION SHALL BE IMPLEMENTED IN THE AREAS THAT HAVE BEEN COMPACTED AND ARE DESIGNATED TO REMAIN VEGETATIVE OR POST-CONSTRUCTION INFILTRATION AREAS. CLEARLY MARK THE AREAS TO BE AVOIDED WITH FLAGS OR TEMPORARY FENCING. WHERE TEMPORARY FENCING IS USED, FENCING MUST BE ADEQUATELY SUPPORTED BY POSTS AND MAINTAINED IN AN UPRIGHT POSITION.

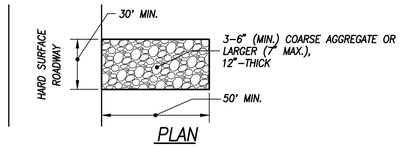
8. PERIMETER CONTROLS

   PERIMETER CONTROLS ARE REQUIRED DOWNSLOPE OF ALL DISTURBED AREAS. MAINTAIN DOWNSTREAM VEGETATED BUFFER AREA.

9. INLET PROTECTION
   - ALL STORM DRAIN INLETS ONSITE AND THOSE OFFSITE WHICH MAY RECEIVE RUNOFF FROM THE SITE SHALL USE AN INLET PROTECTION DEVICE UNLESS THEY ARE DIRECTED TO A SEDIMENT BASIN.
   - SEDIMENT LEVELS MAY NOT EXCEED ONE THIRD OF THE HEIGHT OF A SEDIMENT BARRIER OR INLET PROTECTION DEVICE AT ANY POINT ALONG THE LENGTH OF THE SEDIMENT BARRIER OR THE INLET PROTECTION DEVICE.
   - SEDIMENT BARRIERS AND INLET PROTECTION DEVICES MUST BE UNCLOGGED AND CLEANED WHEN PERFORMANCE IS COMPROMISED.
   - TORN, WEATHERED OR SAGGING SEDIMENT BARRIERS OR INLET PROTECTION DEVICES MUST BE REPAIRED OR REPLACED IMMEDIATELY.
10. SEDIMENT BASINS

    SEDIMENT BASINS MUST BE KEPT IN EFFECTIVE OPERATING CONDITION AND SEDIMENT SHALL BE REMOVED TO MAINTAIN AT LEAST ONE HALF OF THE DESIGN CAPACITY AT ALL TIMES.

11. TRACKING CONTROL
    - MINIMIZE SEDIMENT TRACK-OUT ONTO OFF-SITE STREETS, OTHER PAVED AREAS, AND SIDEWALKS FROM VEHICLES EXITING THE CONSTRUCTION SITE BY RESTRICTING VEHICLE TRAFFIC TO PROPERLY DESIGNATED AREAS AND USING ADDITIONAL CONTROLS TO REMOVE SEDIMENT FROM VEHICLE TIRES PRIOR TO EXITING THE SITE.
    - VEHICULAR PARKING AND MOVEMENTS ON PROJECT SITES MUST BE CONFINED TO PAVED SURFACES OR PREDEFINED PARKING AREAS AND VEHICLE PATHS, WHICH SHALL BE MARKED WITH FLAGS OR BOUNDARY FENCING.
    - ALL POLLUTANTS AND MATERIALS THAT ARE DROPPED, WASHED, TRACKED, SPILLED, OR OTHERWISE DISCHARGED FROM A PROJECT SITE TO OFF-SITE STREETS, OTHER PAVED AREAS, SIDEWALKS OR THE MS4 MUST BE CLEANED USING DRY METHODS SUCH AS SWEEPING OR VACUUMING.
    - WASHING POLLUTANTS AND MATERIALS THAT ARE DISCHARGED FROM THE PROJECT SITE TO THE MS4 INTO DRAIN INLETS OR CATCH BASINS IS PROHIBITED UNLESS THE MATERIAL IS SEDIMENT AND THE INLETS ARE DIRECTED TO A SEDIMENT BASIN OR SEDIMENT TRAP.
12. BEST MANAGEMENT PRACTICES (BMPS) SHALL NOT BE REMOVED UNTIL FINAL STABILIZATION IS COMPLETE FOR THAT PHASE.
13. REFER TO CITY AND COUNTY OF HONOLULU BEST MANAGEMENT PRACTICES MANUAL-CONSTRUCTION, FOR MORE INFORMATION ON BMPS.
14. THE FOLLOWING BMPS WERE DETERMINED TO BE NOT APPLICABLE BASED ON THE SPECIFIC SITE CONDITIONS. AS CONSTRUCTION PROGRESSES, REVISIONS MAY BE NECESSARY AND WILL BE PROVIDED TO DPP INSPECTORS.
    - DEWATERING PRACTICES ARE NOT APPLICABLE. COMPLETION OF THE PROJECT DOES NOT INVOLVE DEWATERING PRACTICES AS IT IS NOT ANTICIPATED THAT GROUNDWATER WILL BE ENCOUNTERED.
    - SEDIMENT BARRIERS ARE NOT APPLICABLE. BMP'S SUCH AS PERIMETER CONTROL AND SEDIMENT BASINS WILL BE USED AND ARE SUFFICIENT TO ADDRESS SEDIMENT RUNOFF.
    - BUFFER ZONES ARE NOT APPLICABLE. PROJECT SITE IS NOT WITHIN 50 FT OF STATE WATERS AND GRADING DOES NOT OCCUR ON SLOPES WITH A GRADE OF 15% OR MORE.
    - SEDIMENT TRAPS ARE NOT APPLICABLE. PROJECT INVOLVES MORE THAN 5 ACRES OF DISTURBED AREA, THEREFORE SEDIMENT TRAPS WILL BE USED.
    - VELOCITY DISSIPATION DEVICES ARE NOT APPLICABLE. SCOUR OR EROSION IS MINIMAL AS FLOW VELOCITY THROUGH THE PROJECT SITE IS LOW.
    - DIVERSION BMPS TO DIVERT RUNOFF FROM UPSTREAM AREAS AROUND DISTURBED AREAS OF THE SITE ARE NOT APPLICABLE. GRADING DOES NOT OCCUR ON SLOPES WITH A GRADE OF 15% OR MORE.
15. AN ESCP COORDINATOR IS REQUIRED FOR THIS PROJECT. THE OWNER OF THE PROPERTY OR THEIR AUTHORIZED AGENT MUST DESIGNATE A PERSON RESPONSIBLE FOR IMPLEMENTING THE ESCP AT THE PROJECT SITE ("ESCP COORDINATOR") PRIOR TO PERMIT ISSUANCE USING THE FORM PROVIDED AS APPENDIX A TO THE RULES RELATING TO WATER QUALITY.
16. THE CONTRACTOR SHALL COMPLY WITH THE PROJECT SCHEDULING REQUIREMENT AS SPECIFIED IN THE "ADMINISTRATIVE RULES, TITLE 20, DEPARTMENT OF PLANNING AND PERMITTING, CHAPTER 3, RULES RELATING TO WATER QUALITY", SECTION 20-3-28. THE SCHEDULED START DATE SHALL BE SUBMITTED TO THE DIRECTOR IN WRITING 2 WEEKS PRIOR TO COMMENCING ANY WORK GOVERNED BY THESE RULES.



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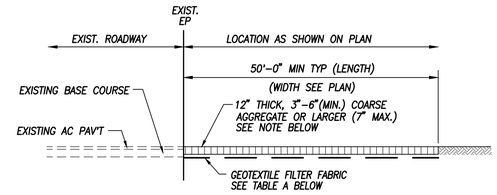


SECTION

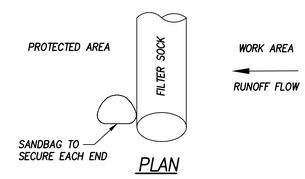
NOTE:
12" COARSE AGGREGATE LAYER SHALL BE REMOVED IMMEDIATELY PRIOR TO INSTALLATION OF ROADWAY BASE COURSE.

TABLE A GEOTEXTILE REQUIREMENTS

PHYSICAL PROPERTY	REQUIREMENTS
GRAB TENSILE STRENGTH	220 LB (ASTM D1682)
ELONGATION FAILURE	60% (ASTM D1682)
MULLEN BURST STRENGTH	430 LB (ASTM D3768)
PUNCTURE STRENGTH	125 LB (ASTM D751, MODIFIED)
EQUIVALENT OPENING	SIZE 40-80 (U.S. STD SIEVE, CW-02215)

CONSTRUCTION INGRESS/EGRESS

NOT TO SCALE



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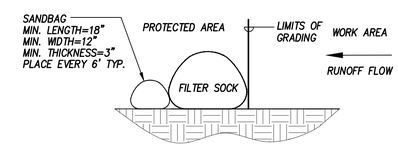

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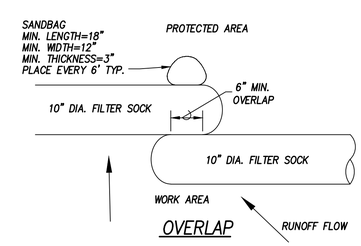


OVERLAP

COMPOST FILTER SOCK DETAIL

NOT TO SCALE

WAIAHOLE WATER SYSTEM IMPROVEMENTS

R. M. TOWILL CORPORATION
Planning • Engineering • Environmental Services • Photogrammetry • Surveying • Construction Management
2024 North King Street Suite 200
Honolulu Hawaii 96819

WALTER G. C. CHONG LICENSED PROFESSIONAL ENGINEERS No. 8882-C HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

Signature — 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	BY

APPROVED BY

Chief, Civil Engineering Branch, DPP — DATE

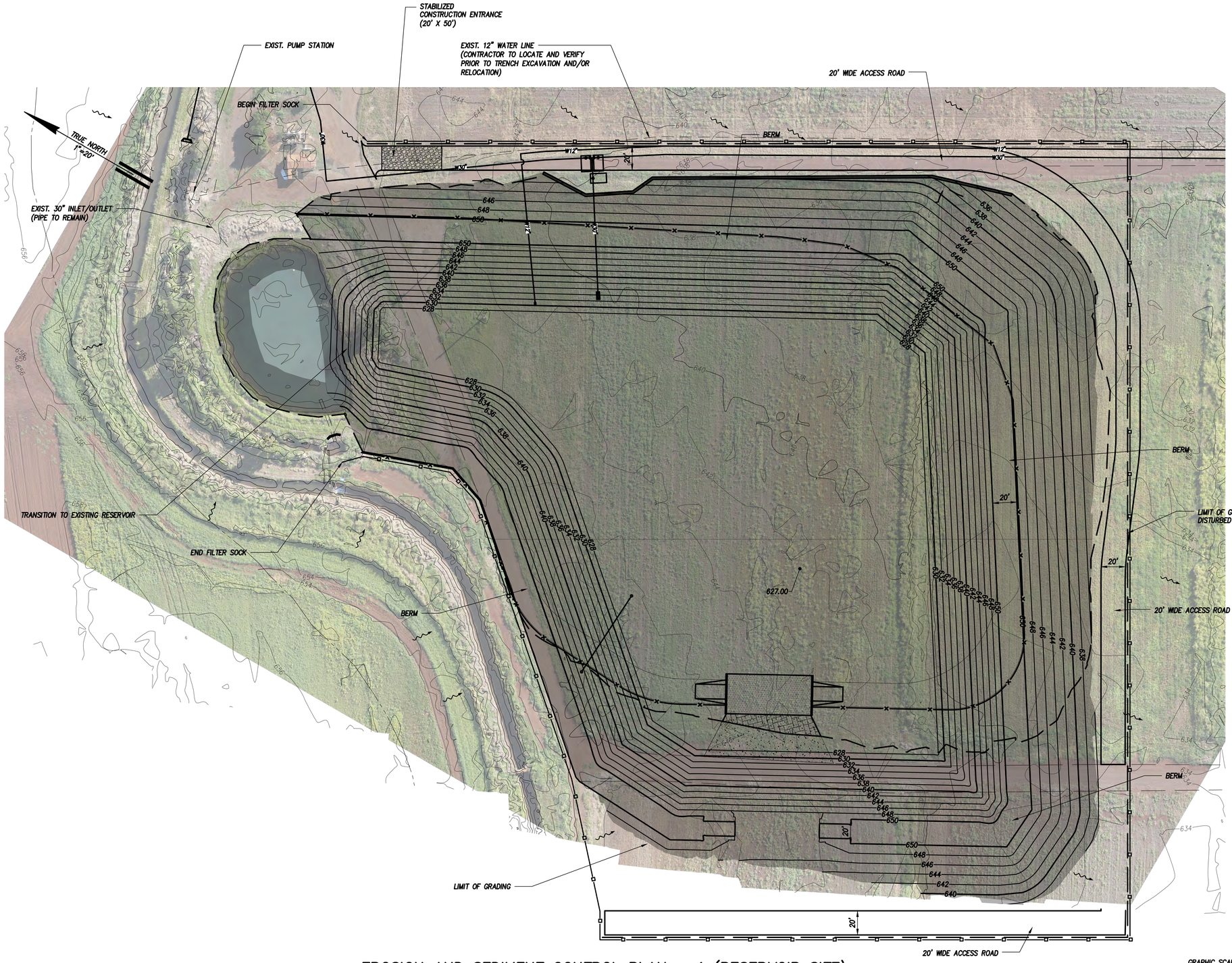
ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

EROSION AND SEDIMENT CONTROL NOTES

FILE	POCKET	FOLDER	NO.

RMTC JOB NO.: 1-23196-OE

K:\civil\23620 Waiahole Water System Impr\Drawings\Construction Dwgs\C101 Erosion and Sediment Control Notes.dwg 4/16/2020



EROSION AND SEDIMENT CONTROL PLAN – 1 (RESERVOIR SITE)

SCALE: 1" = 40'

GRAPHIC SCALE:
1" = 40'
40' 20' 0 40' 80'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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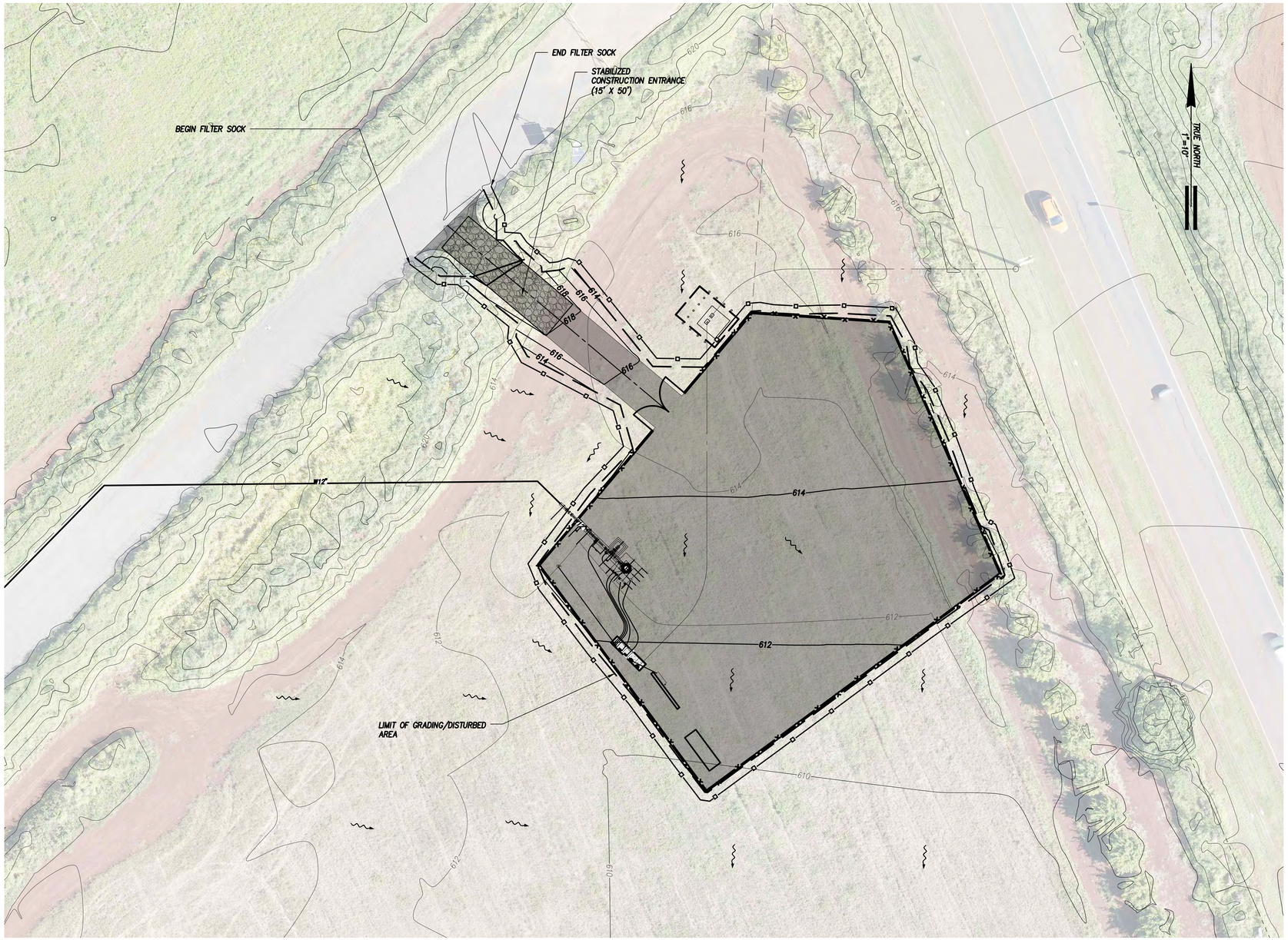
APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

EROSION AND SEDIMENT CONTROL PLAN – 1 (RESERVOIR SITE)

RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



EROSION AND SEDIMENT CONTROL PLAN – 2 (WELL SITE)

SCALE: 1" = 20'

GRAPHIC SCALE:
1" = 20'
20' 10' 0 20' 40'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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REVISION	DATE	BRIEF	BY

APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

EROSION AND SEDIMENT CONTROL PLAN – 2 (WELL SITE)

RMTC JOB NO.: 1-23196-0E

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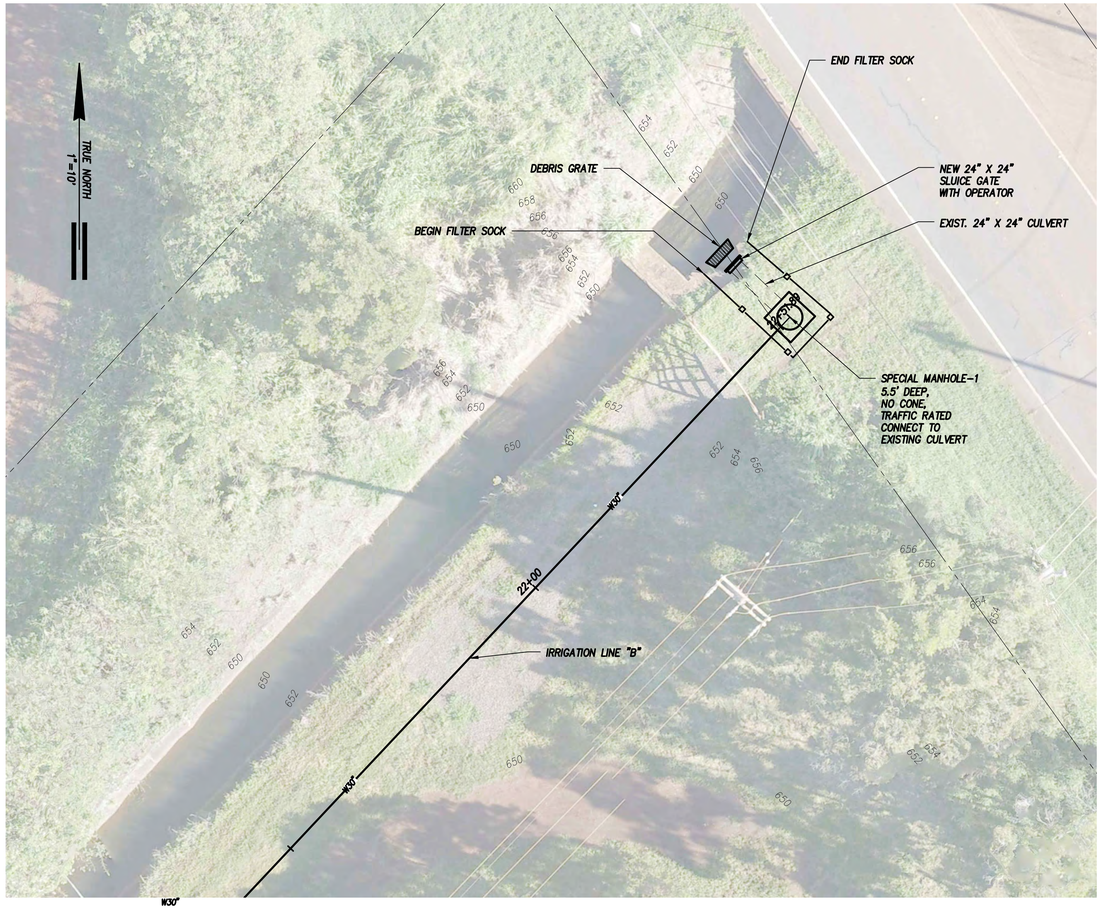
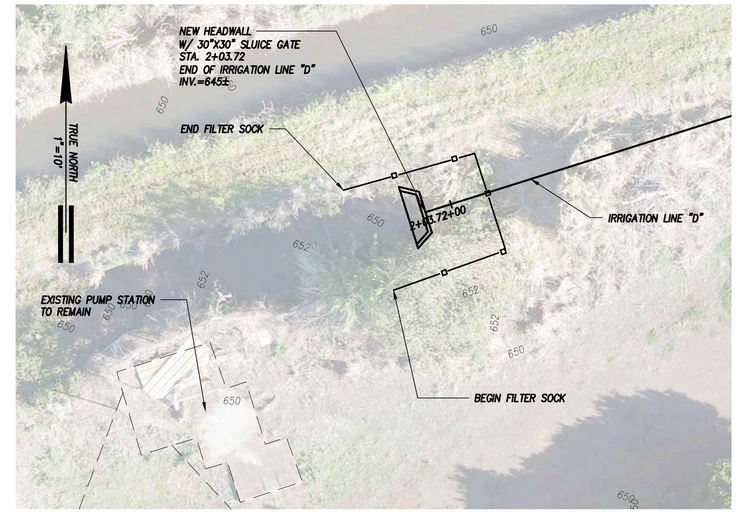


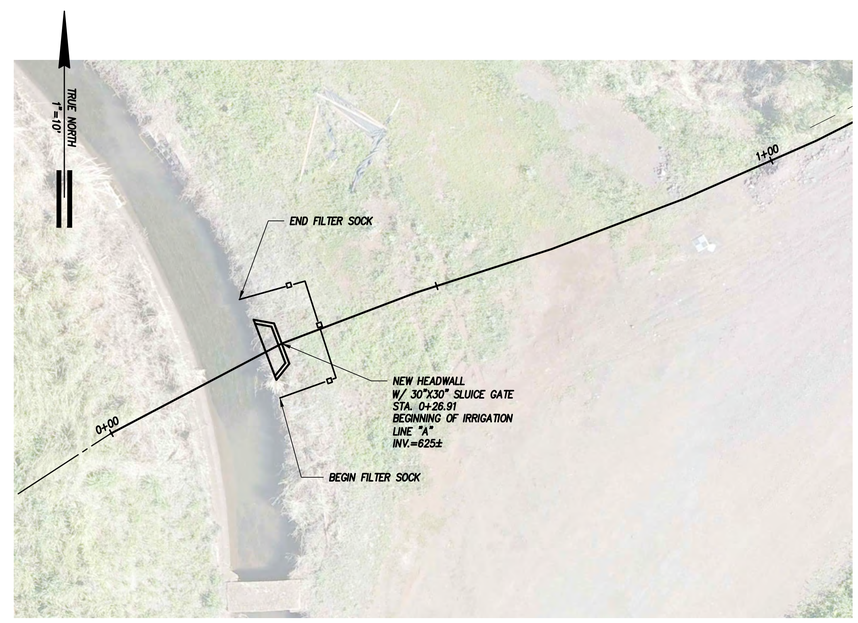
EROSION AND SEDIMENT CONTROL PLAN: DITCH CONNECTION SITE 1

SCALE: 1" = 10'



EROSION AND SEDIMENT CONTROL PLAN: HEADWALL FOR IRRIGATION LINE "D"

SCALE: 1" = 10'



EROSION AND SEDIMENT CONTROL PLAN: DITCH CONNECTION SITE 2

SCALE: 1" = 10'

GRAPHIC SCALE:
1" = 10' 10' 5' 0 10' 20'
SCALES IN FEET

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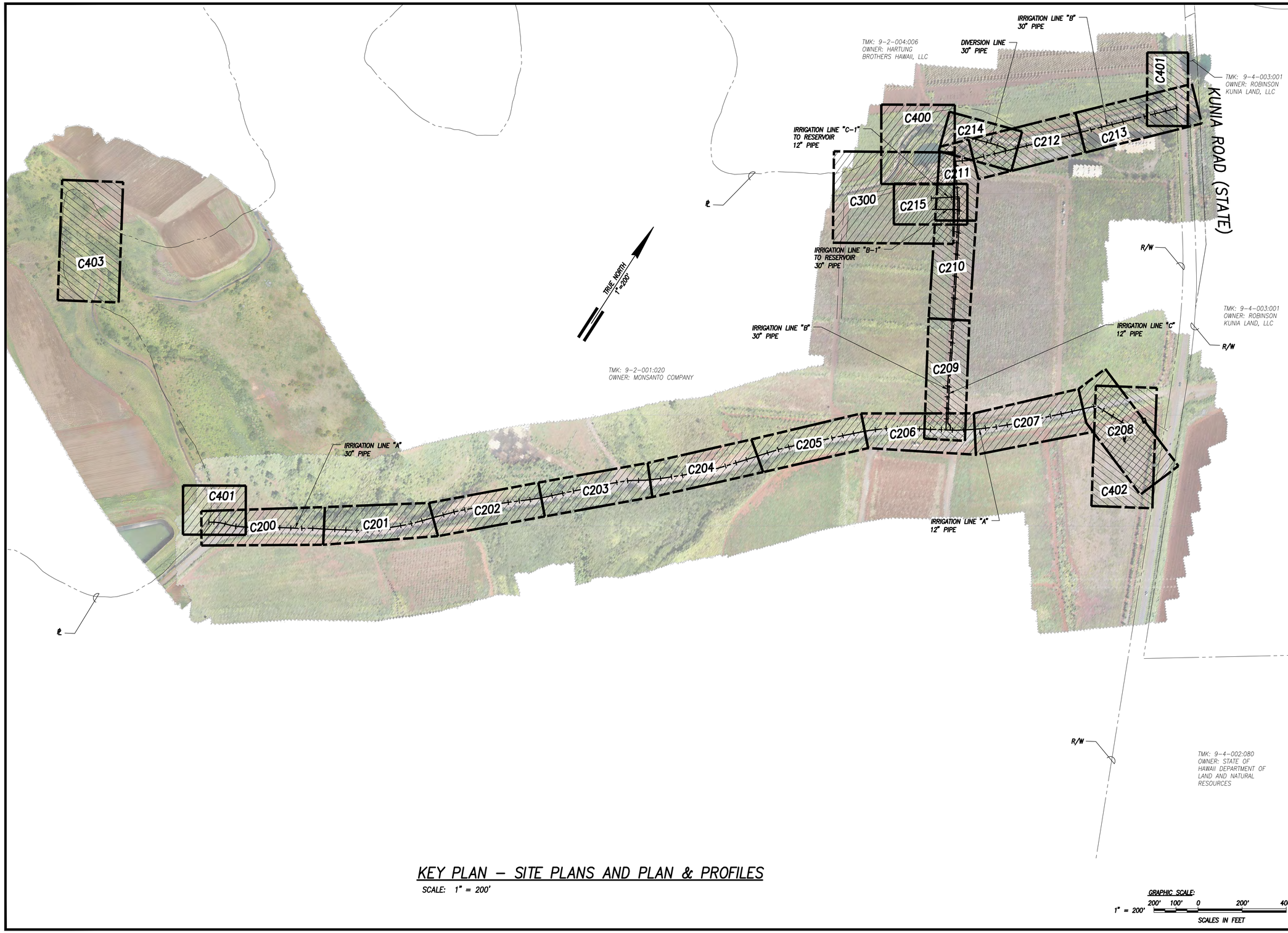
APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

EROSION AND SEDIMENT CONTROL PLAN – 3 (DITCH CONNECTION SITES)

RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



KEY PLAN – SITE PLANS AND PLAN & PROFILES

SCALE: 1" = 200'

GRAPHIC SCALE:
1" = 200' 200' 100' 0 200' 400'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

R. M. TOWILL CORPORATION
Planning • Engineering • Environmental Services • Photogrammetry • Surveying • Construction Management
2024 North King Street Suite 200
Honolulu Hawaii 96819

WALTER G. C. CHONG
LICENSED PROFESSIONAL ENGINEERS
No. 8882-C
HAWAII, U.S.A.

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Signature — 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	BY

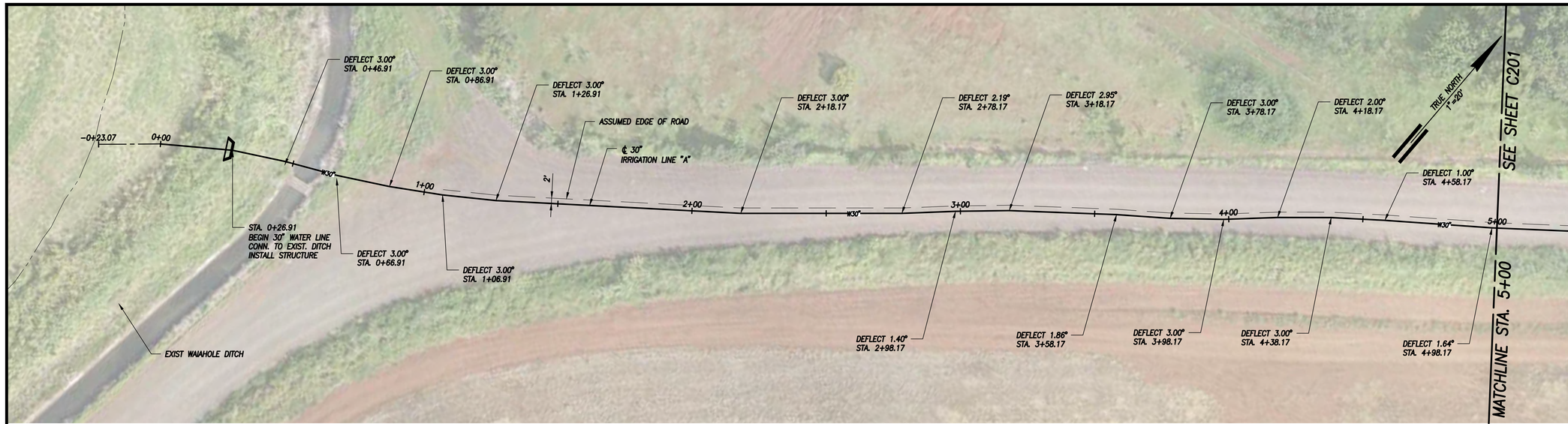
APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

KEY PLAN – SITE PLANS AND PLAN & PROFILES

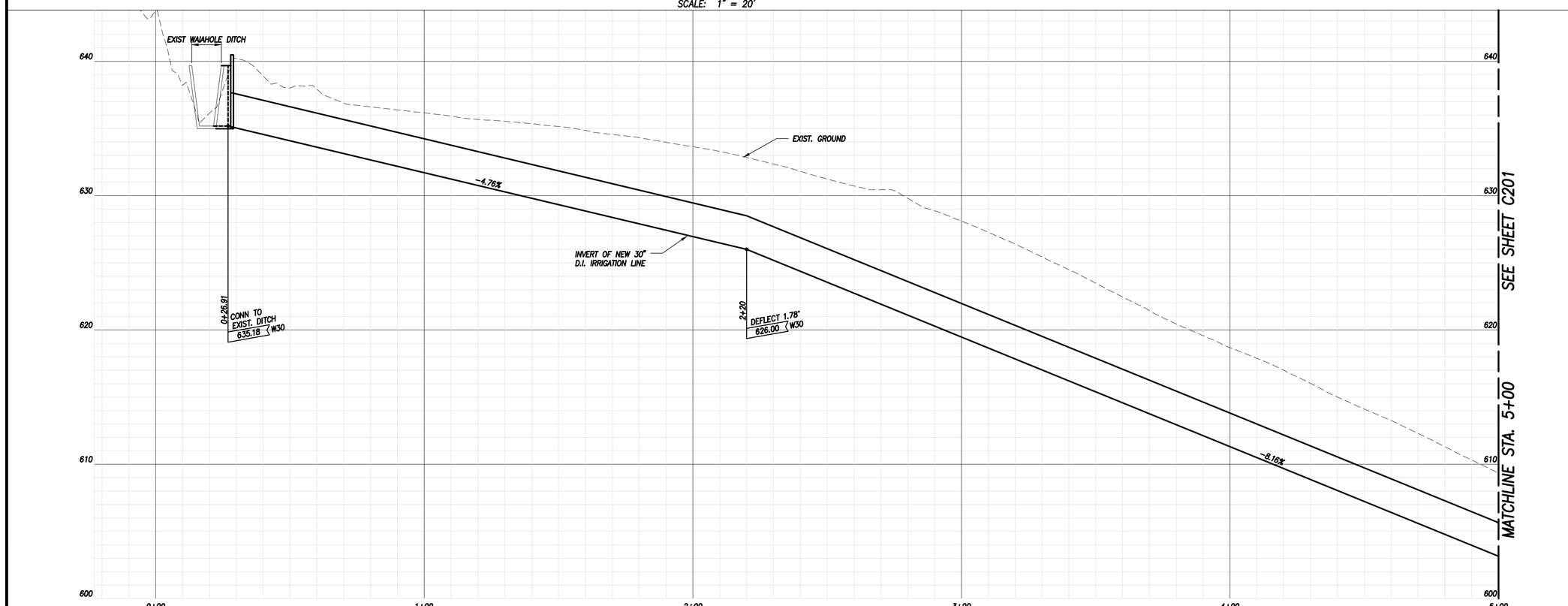
RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "A"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "A"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:

1" = 20' 20' 10' 0 20' 40'

1" = 4' 4' 2' 0 4' 8'

SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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DRAFTSMAN	
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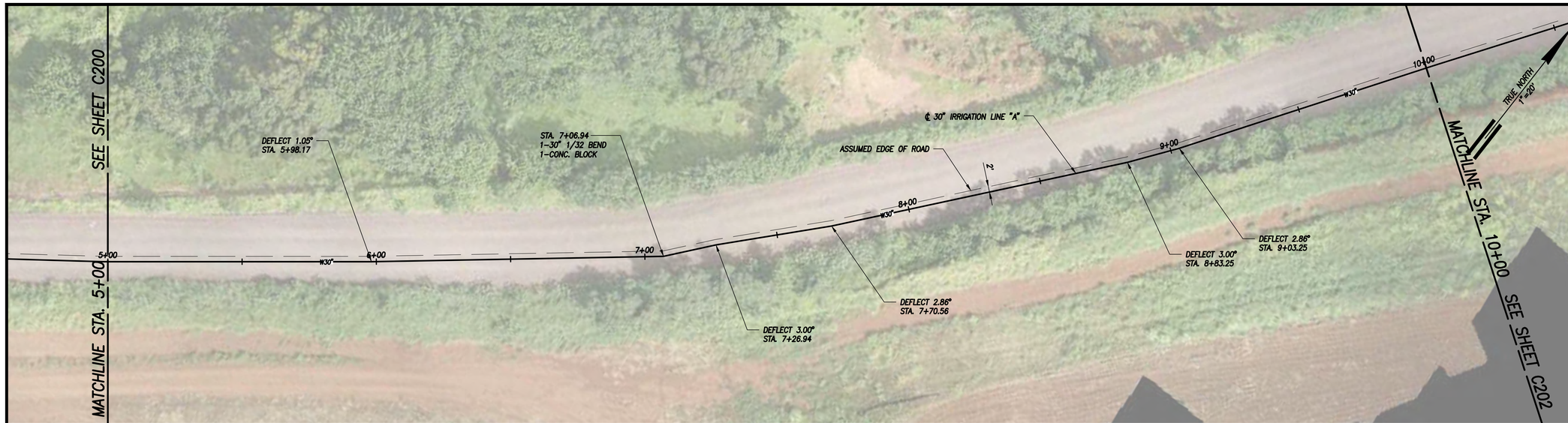
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "A"
PLAN & PROFILE – 1
(STA. 0+00 TO 5+00)

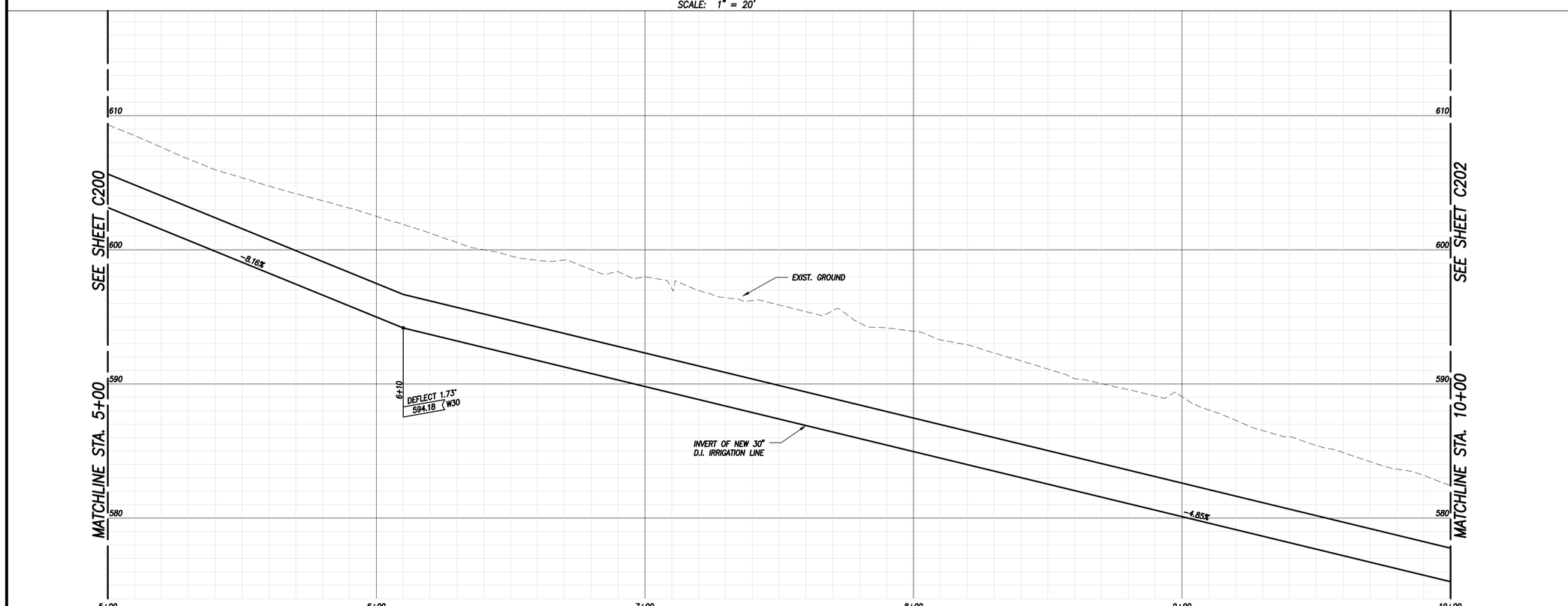
RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "A"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "A"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:

1" = 20' 20' 10' 0 20' 40'

1" = 4' 4' 2' 0 4' 8'

SCALES IN FEET

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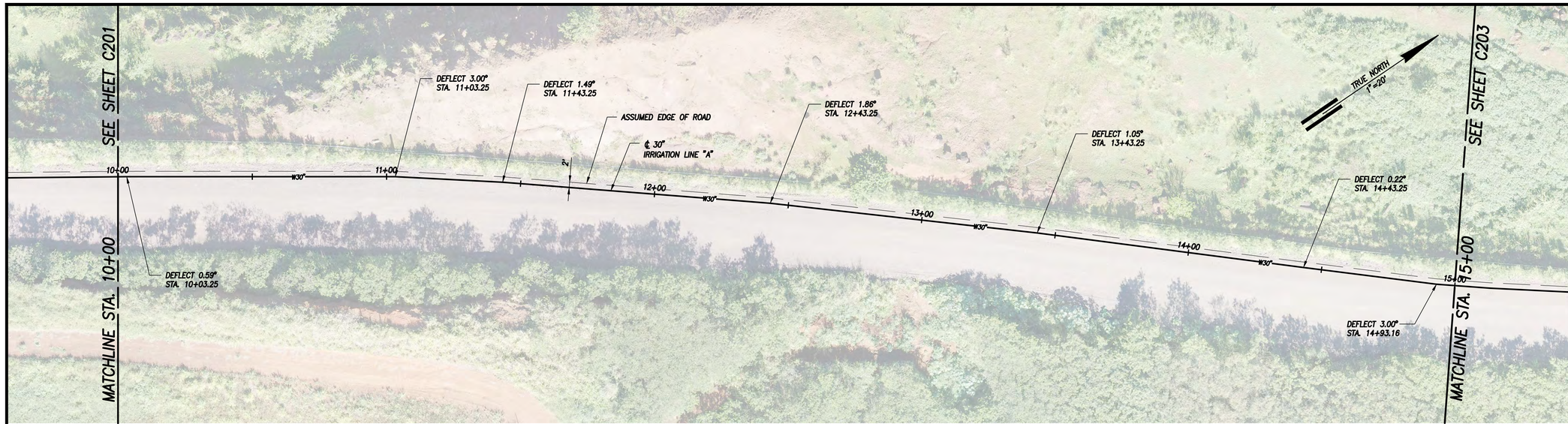
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "A"
PLAN & PROFILE – 2
(STA. 5+00 TO 10+00)

RMTC JOB NO.: 1-23196-OE

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "A"

SCALE: 1" = 20'

PROFILE: IRRIGATION LINE "A"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:

1" = 20' 20' 10' 0 20' 40'

1" = 4' 4' 2' 0 4' 8'

SCALES IN FEET

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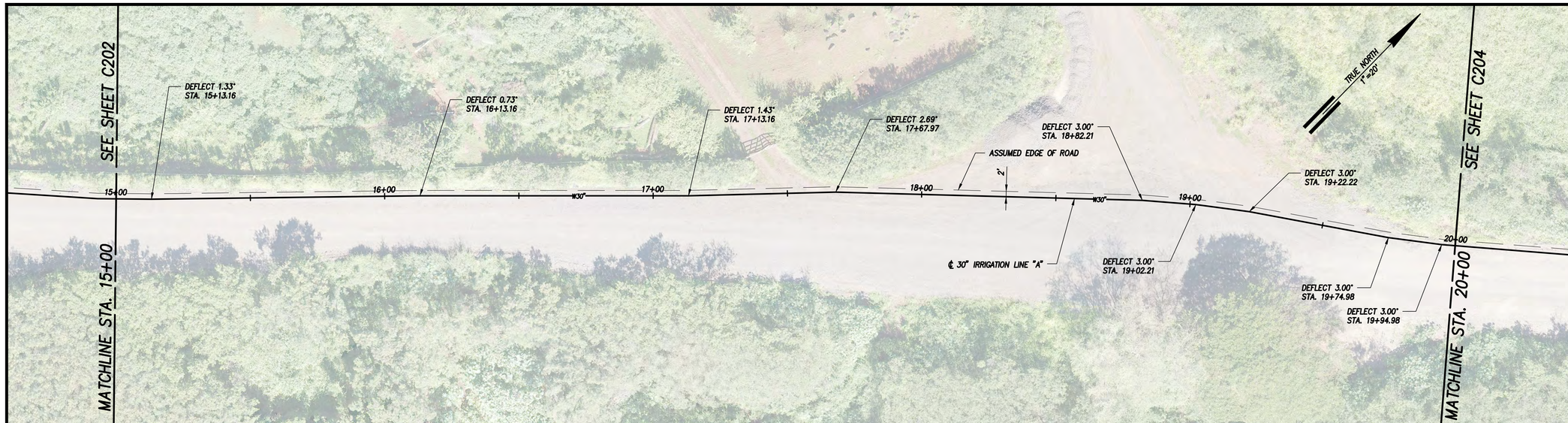
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "A"
PLAN & PROFILE – 3
(STA. 10+00 TO 15+00)

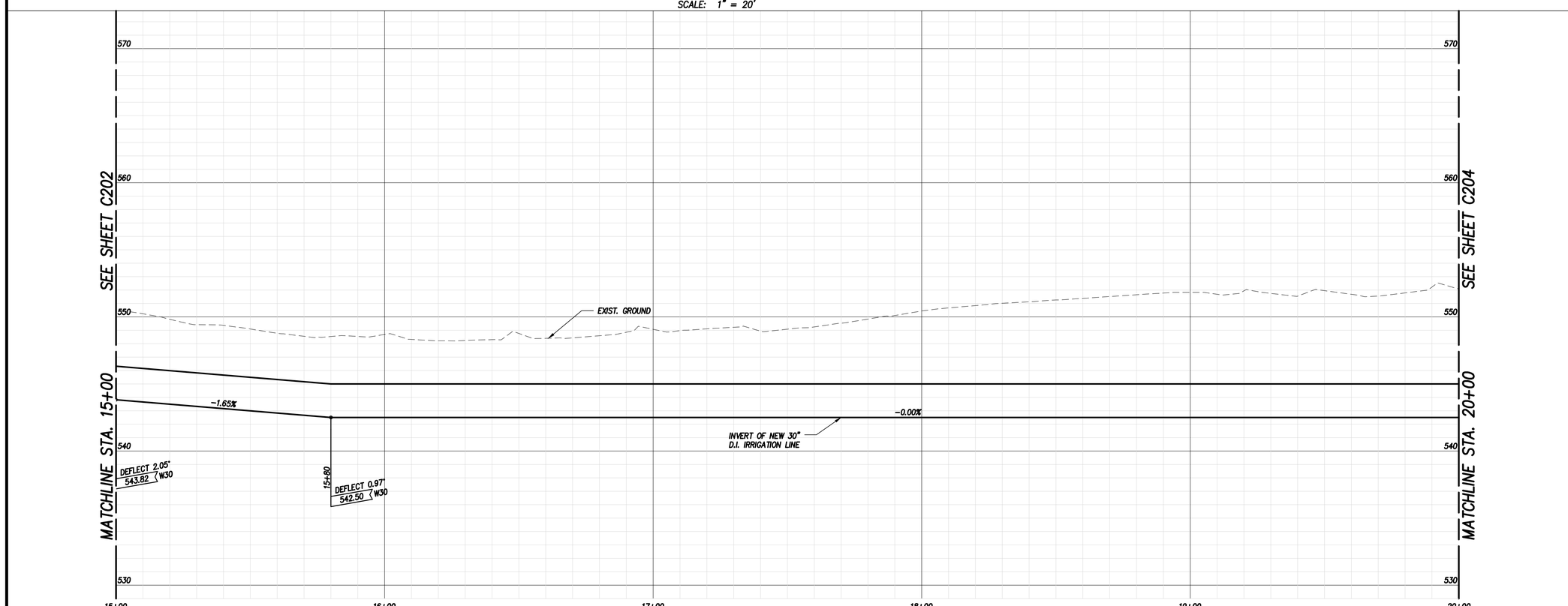
RMTC JOB NO.: 1-23196-OE

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "A"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "A"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:
1" = 20' 20' 10' 0 20' 40'
1" = 4' 4' 2' 0 4' 8'
SCALES IN FEET

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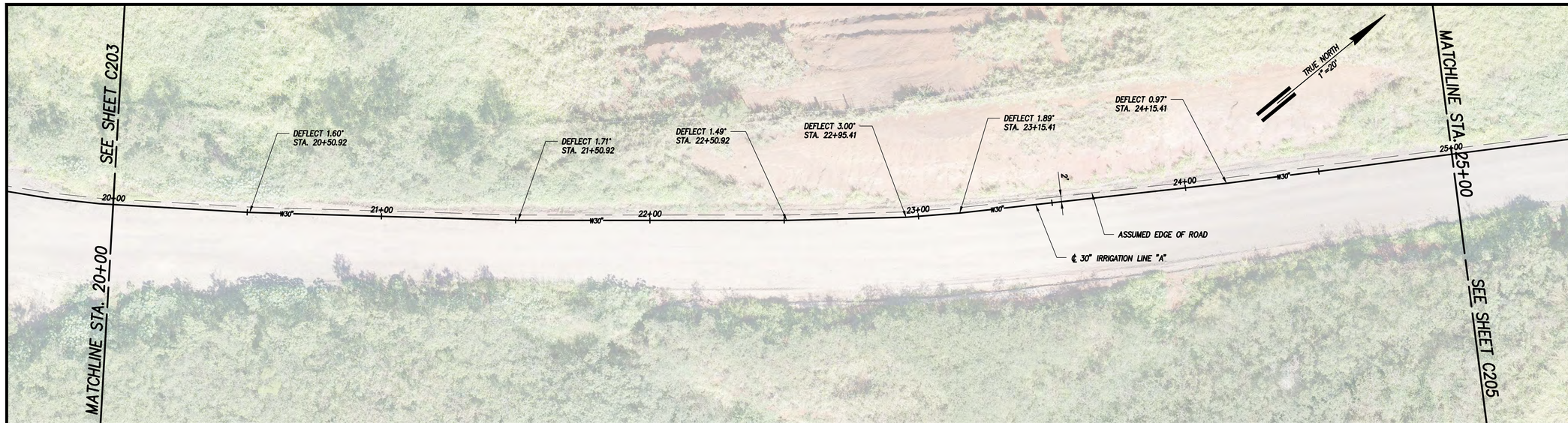
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "A"
PLAN & PROFILE – 4
(STA. 15+00 TO 20+00)

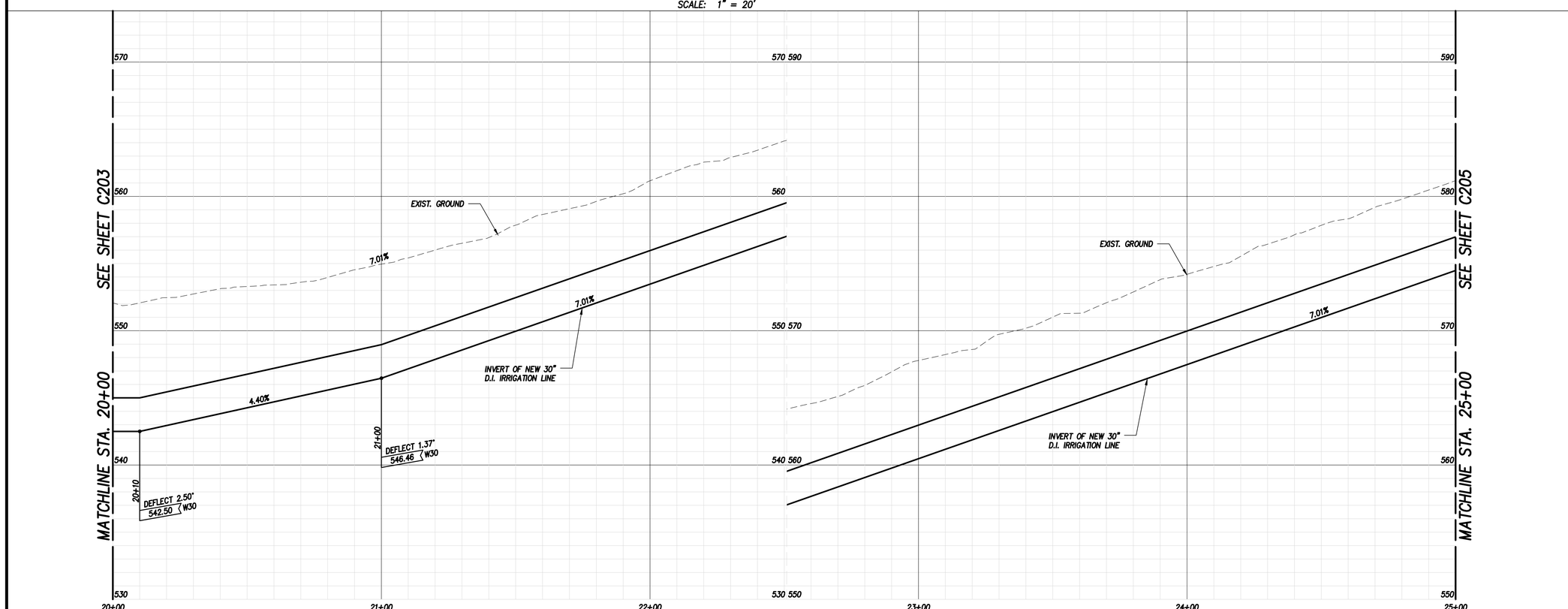
RMTC JOB NO.: 1-23196-OE

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "A"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "A"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:
1" = 20' 20' 10' 0 20' 40'
1" = 4' 4' 2' 0 4' 8'
SCALES IN FEET

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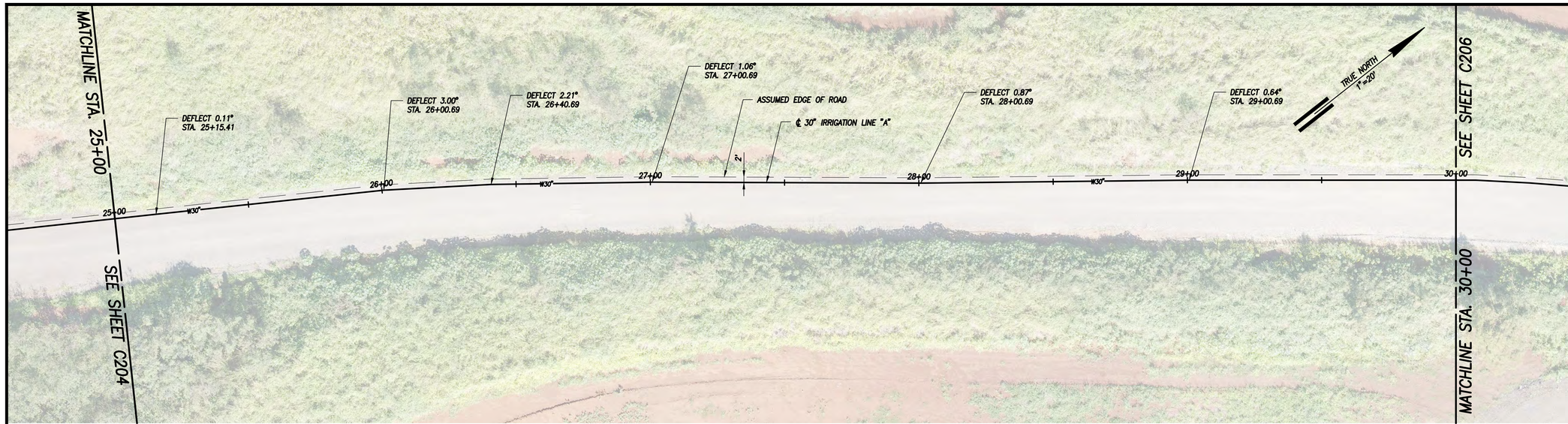
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "A"
PLAN & PROFILE – 5
(STA. 20+00 TO 25+00)

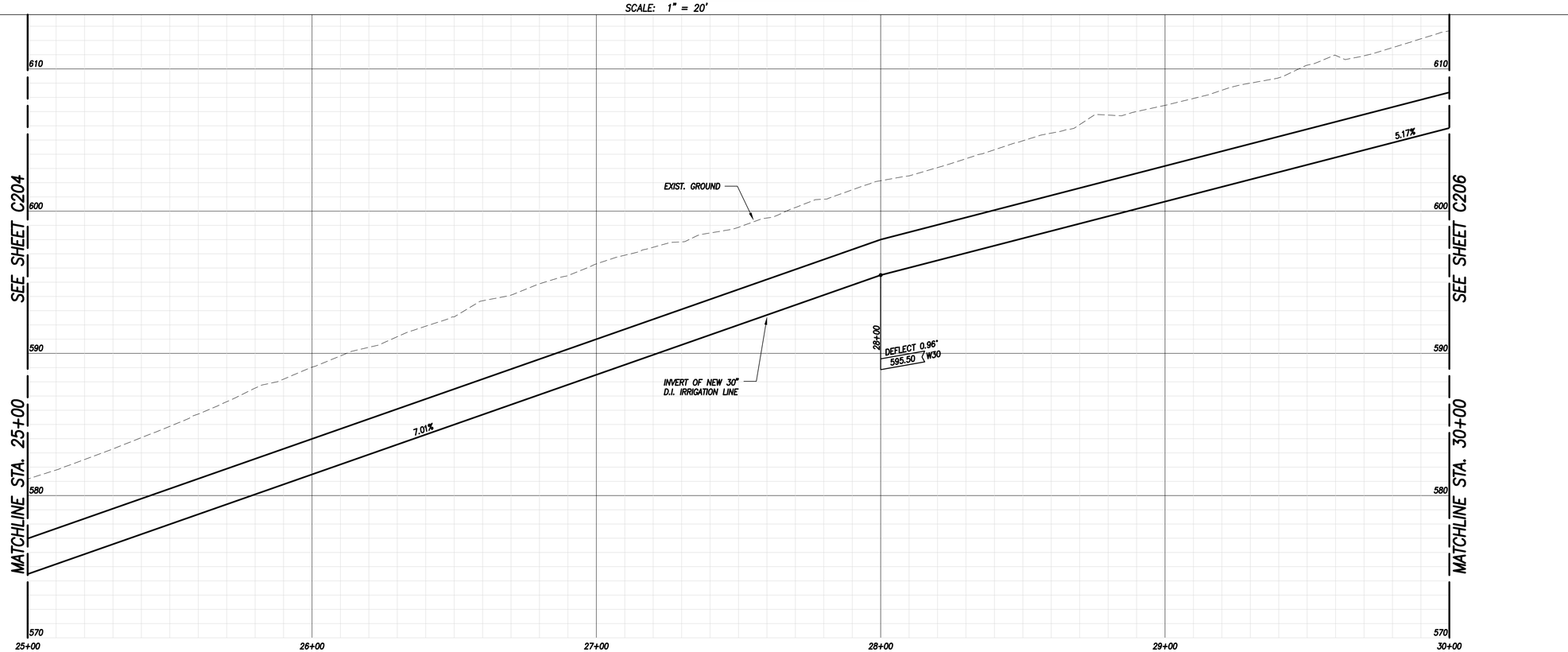
RMTC JOB NO.: 1-23196-OE

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "A"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "A"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:

1" = 20' 20' 10' 0 20' 40'

1" = 4' 4' 2' 0 4' 8'

SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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REVISION	DATE	BRIEF	BY

APPROVED BY

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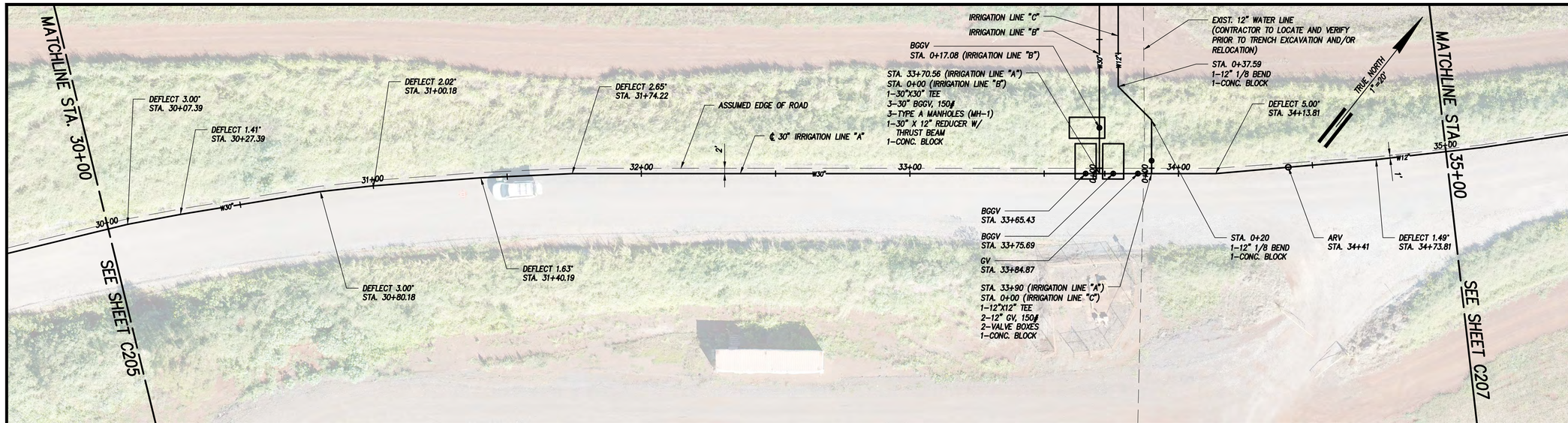
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "A"
PLAN & PROFILE – 6
(STA. 25+00 TO 30+00)

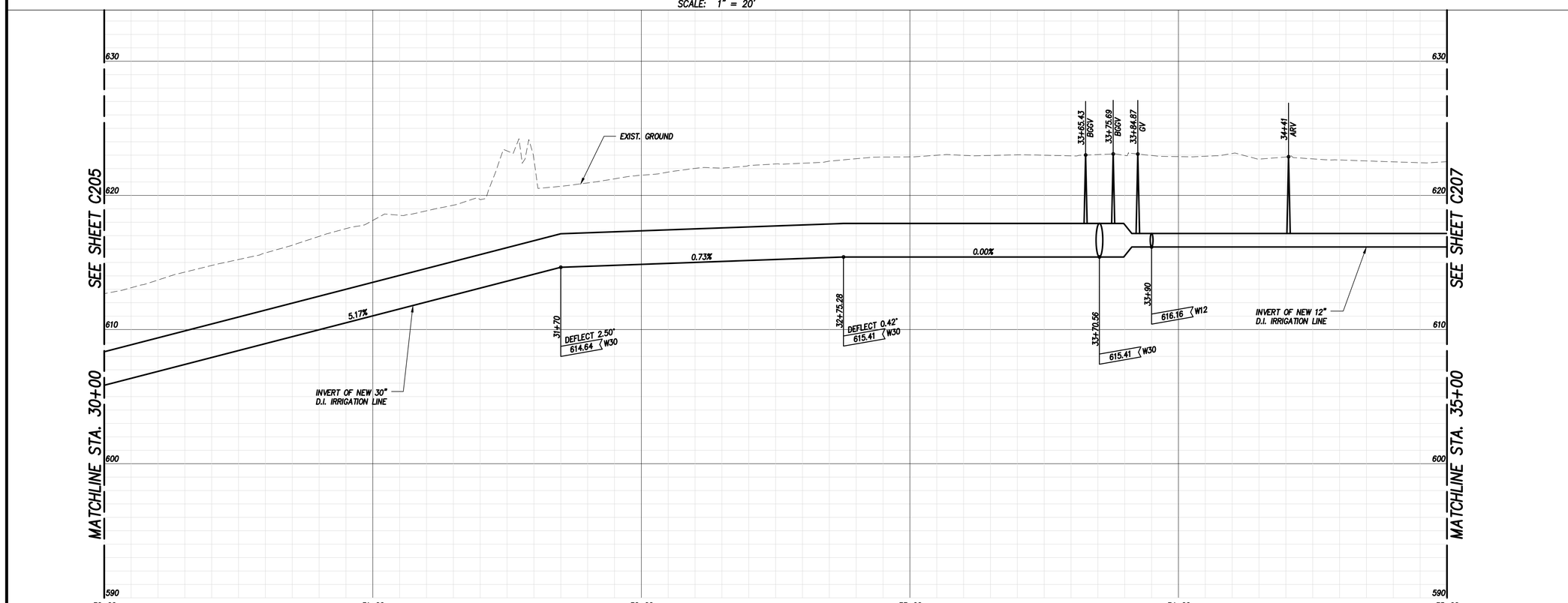
RMTC JOB NO.: 1-23196-OE

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "A"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "A"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:

1" = 20' 20' 10' 0 20' 40'

1" = 4' 4' 2' 0 4' 8'

SCALES IN FEET

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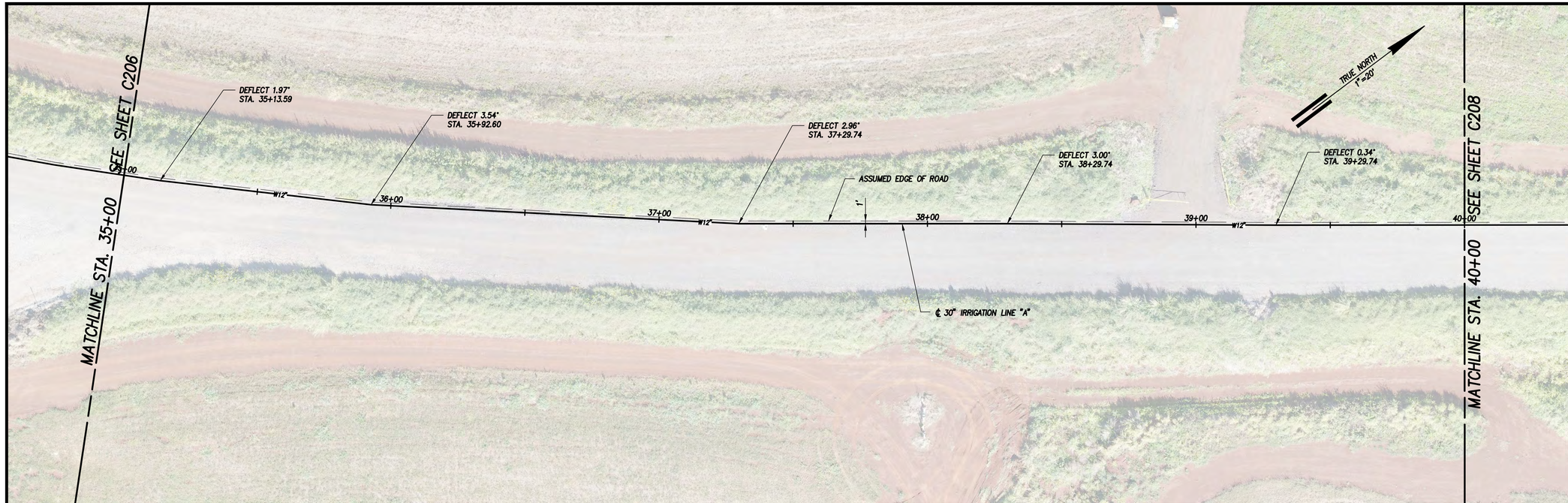
ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "A"
PLAN & PROFILE – 7
(STA. 30+00 TO 35+00)

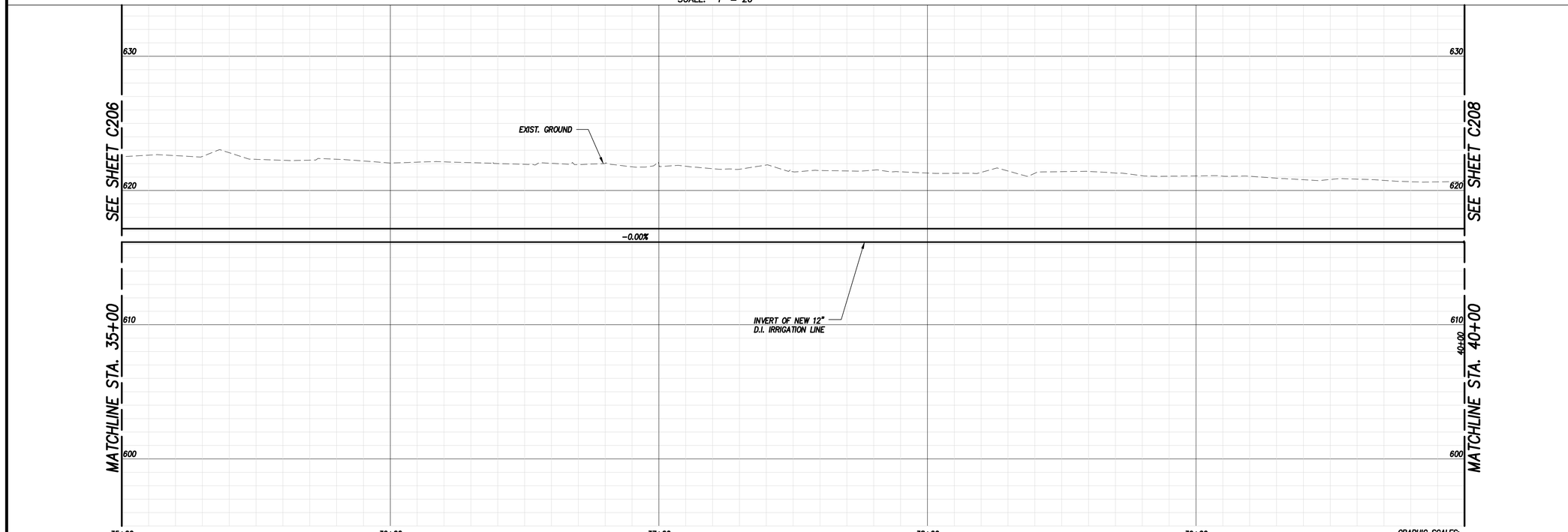
RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "A"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "A"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:
1" = 20' 20' 10' 0 20' 40'
1" = 4' 4' 2' 0 4' 8'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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DRAFTSMAN	
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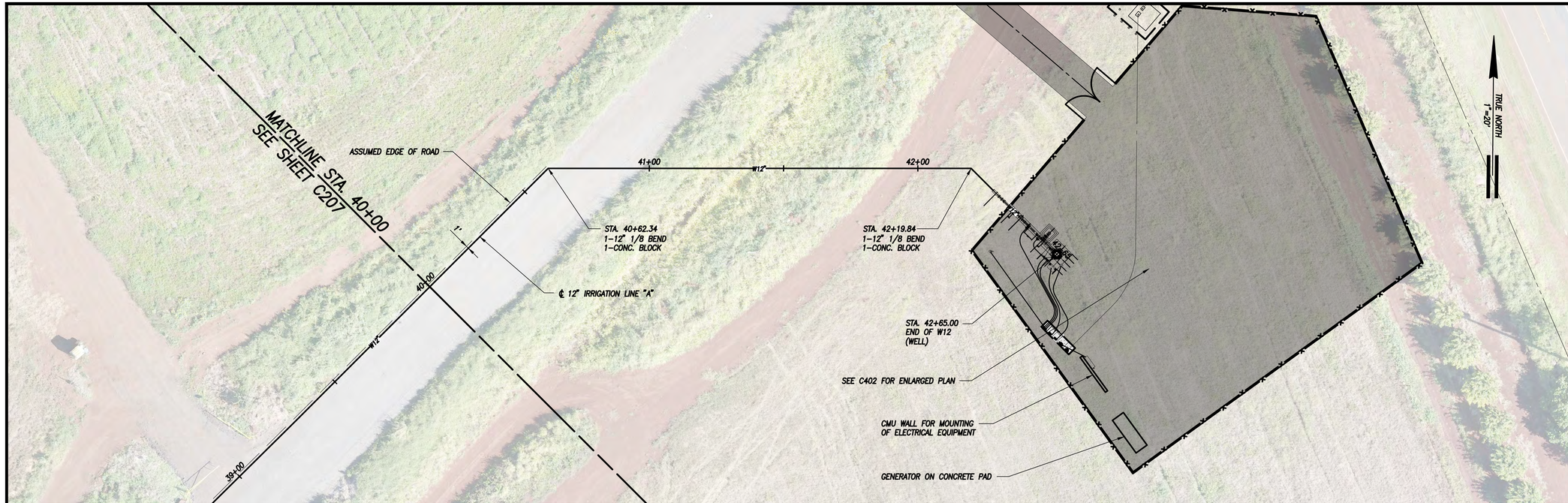
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "A"
PLAN & PROFILE – 8
(STA. 35+00 TO 40+00)

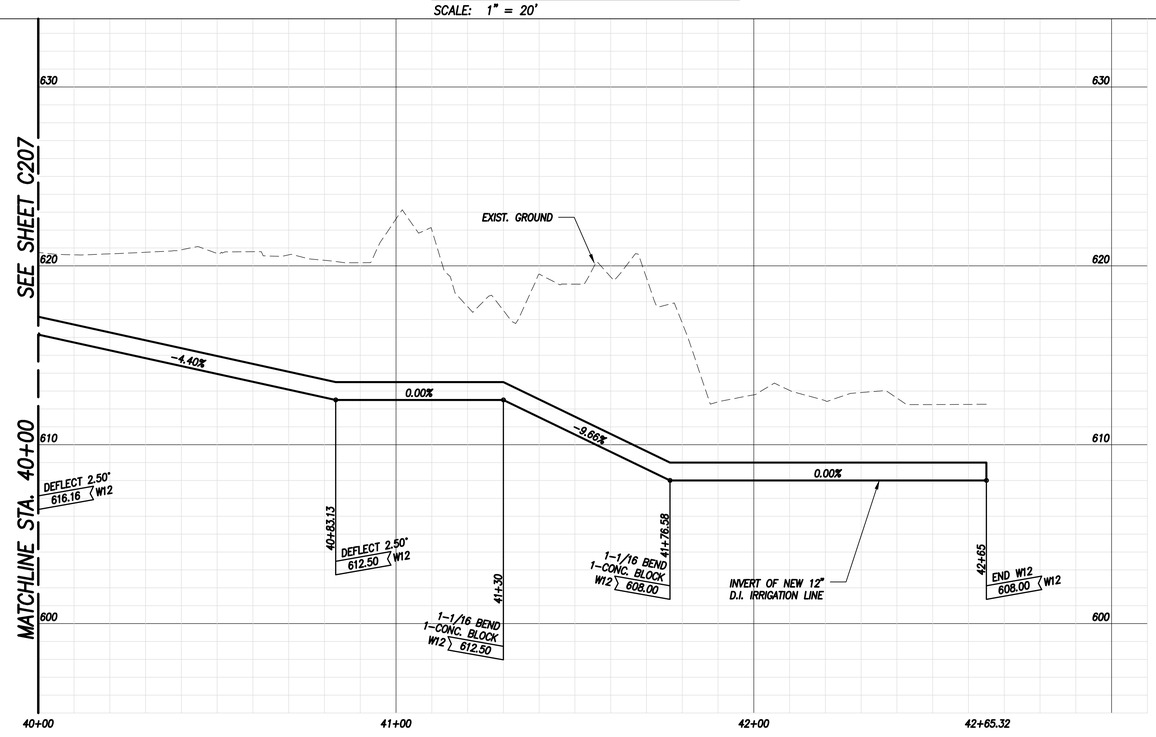
RMTC JOB NO.: 1-23196-OE

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "A"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "A"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:
1" = 20' 20' 10' 0 20' 40'
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SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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APPROVED BY

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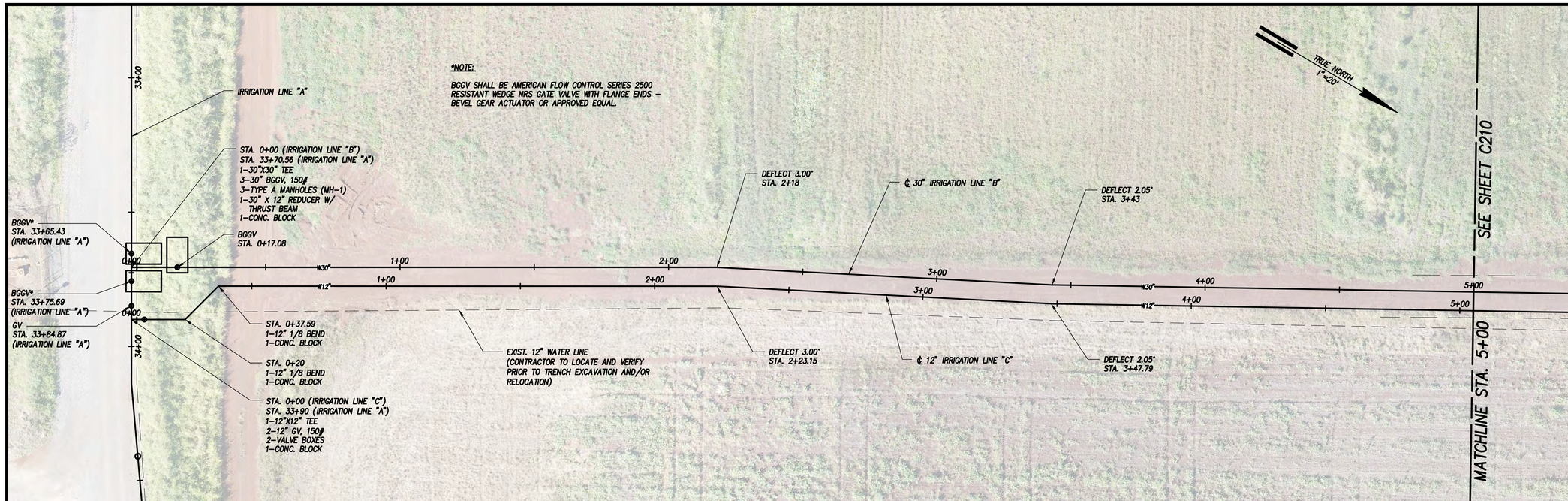
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "A"
PLAN & PROFILE – 9
(STA. 40+00 TO 43+80.82)

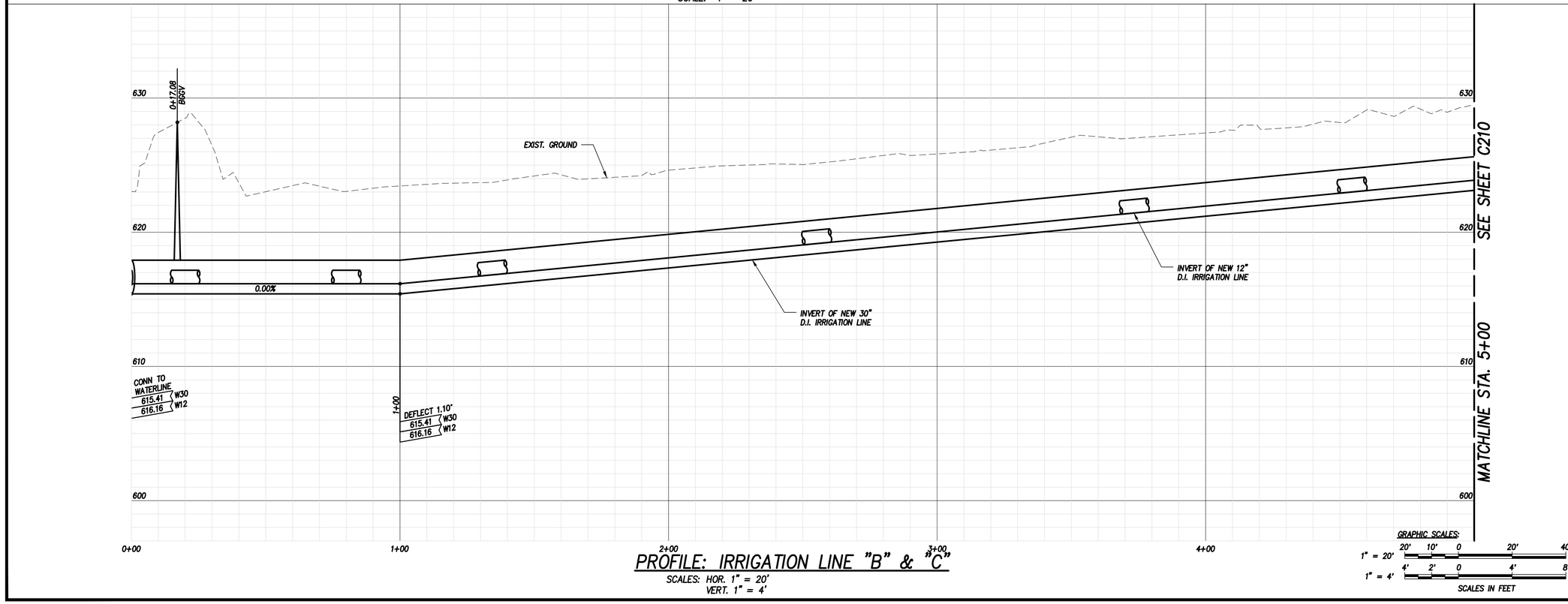
RMTC JOB NO.: 1-23196-OE

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "B" & "C"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "B" & "C"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:
1" = 20' 20' 10' 0 20' 40'
1" = 4' 4' 2' 0 4' 8'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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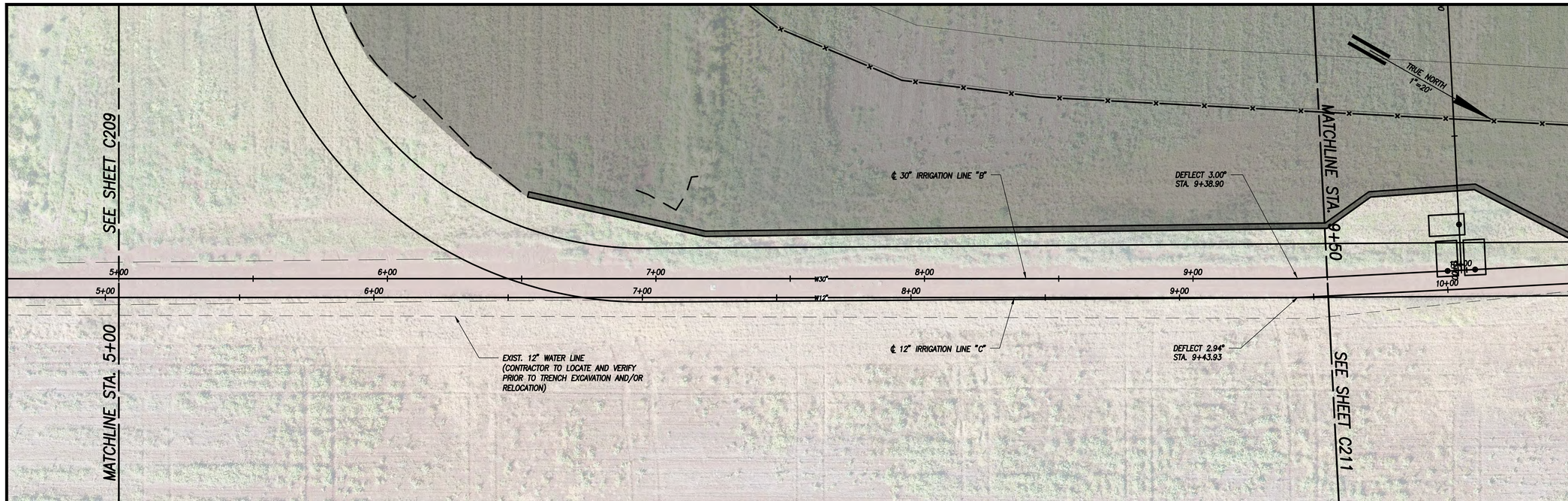
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP–XX

IRRIGATION LINE "B" & "C"
PLAN & PROFILE – 1
(STA. 0+00 TO 5+00)

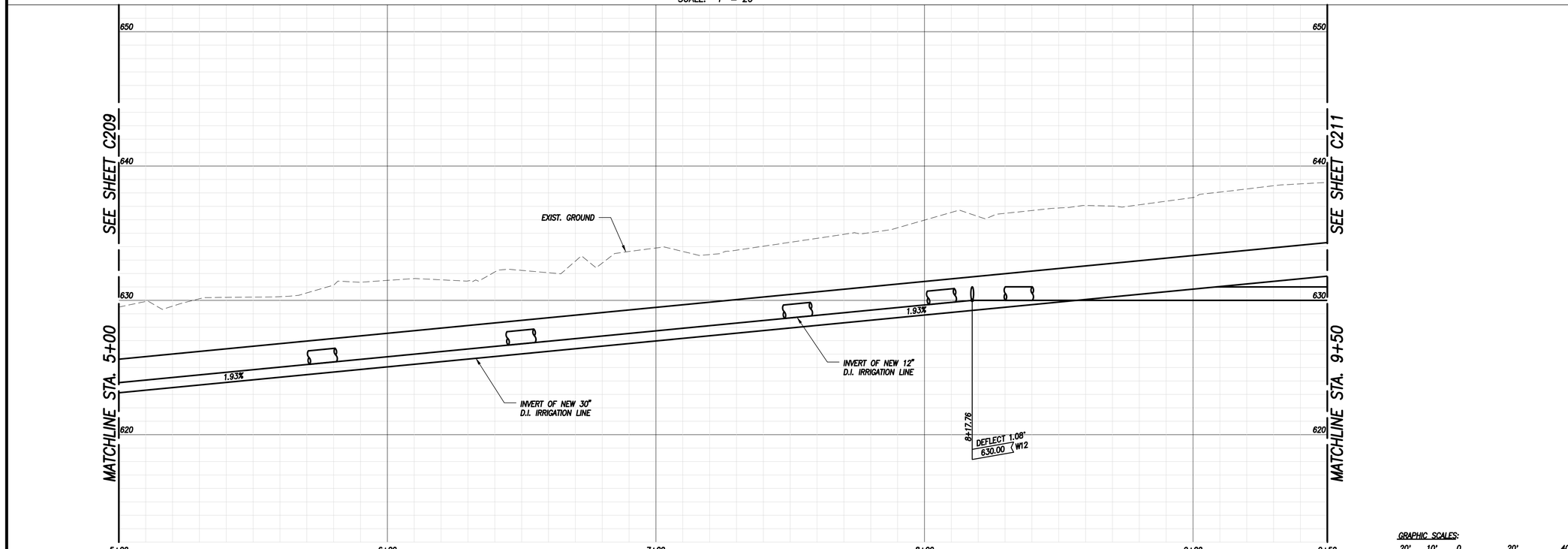
RMTC JOB NO.: 1–23196–0E

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "B" & "C"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "B" & "C"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:

1" = 20' 20' 10' 0 20' 40'

1" = 4' 4' 2' 0 4' 8'

SCALES IN FEET

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APPROVED BY

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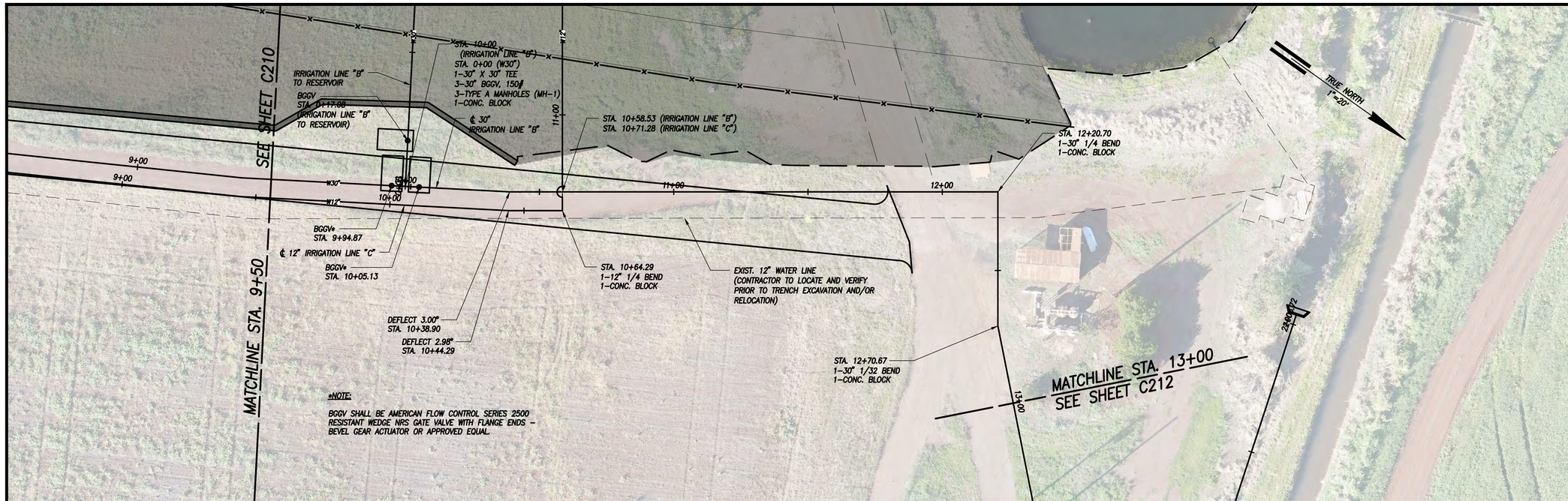
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "B" &"C"
PLAN & PROFILE – 2
(STA. 5+00 TO 9+50)

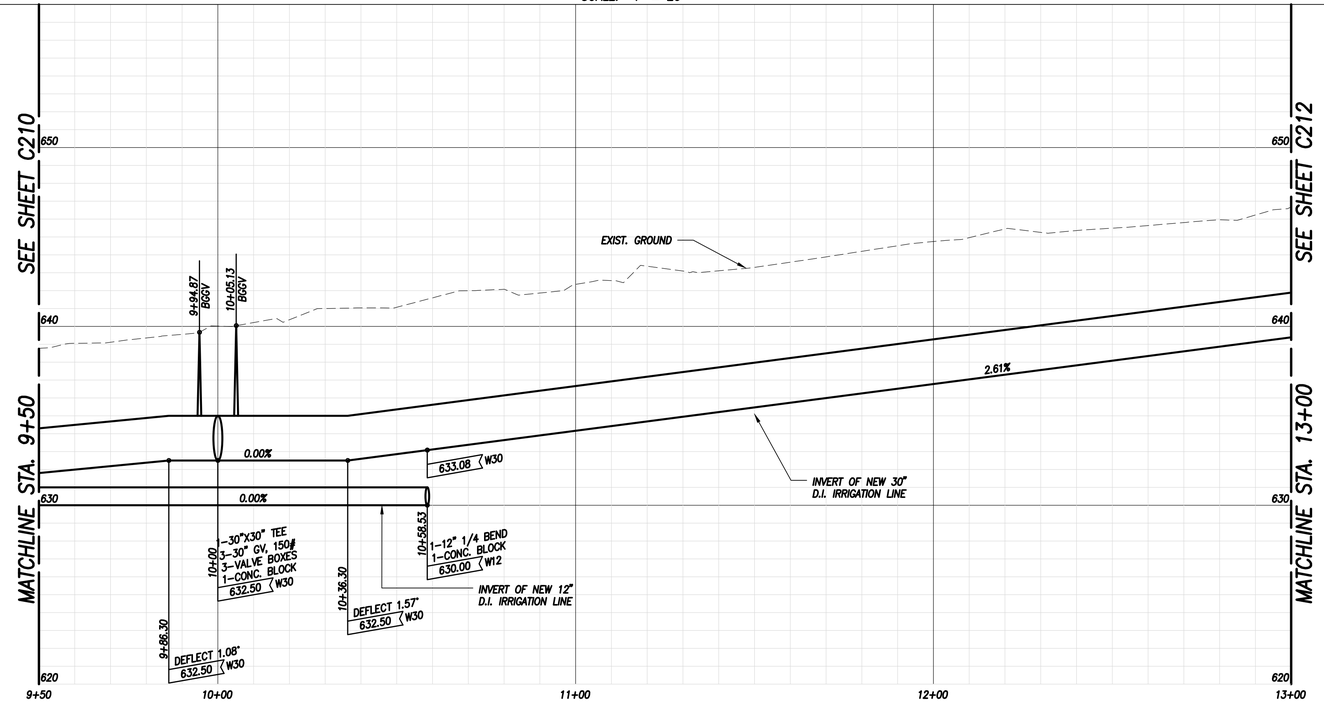
RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "B" & "C"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "B" & "C"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:
1" = 20' 20' 10' 0 20' 40'
1" = 4' 4' 2' 0 4' 8'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

R. M. TOWILL CORPORATION
Planning • Engineering • Environmental Services • Photogrammetry • Surveying • Construction Management
2024 North King Street Suite 200
Honolulu Hawaii 96819

WALTER G. C. CHONG
LICENSED PROFESSIONAL ENGINEERS
No. 8882-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

Signature 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	BY	APPROVED

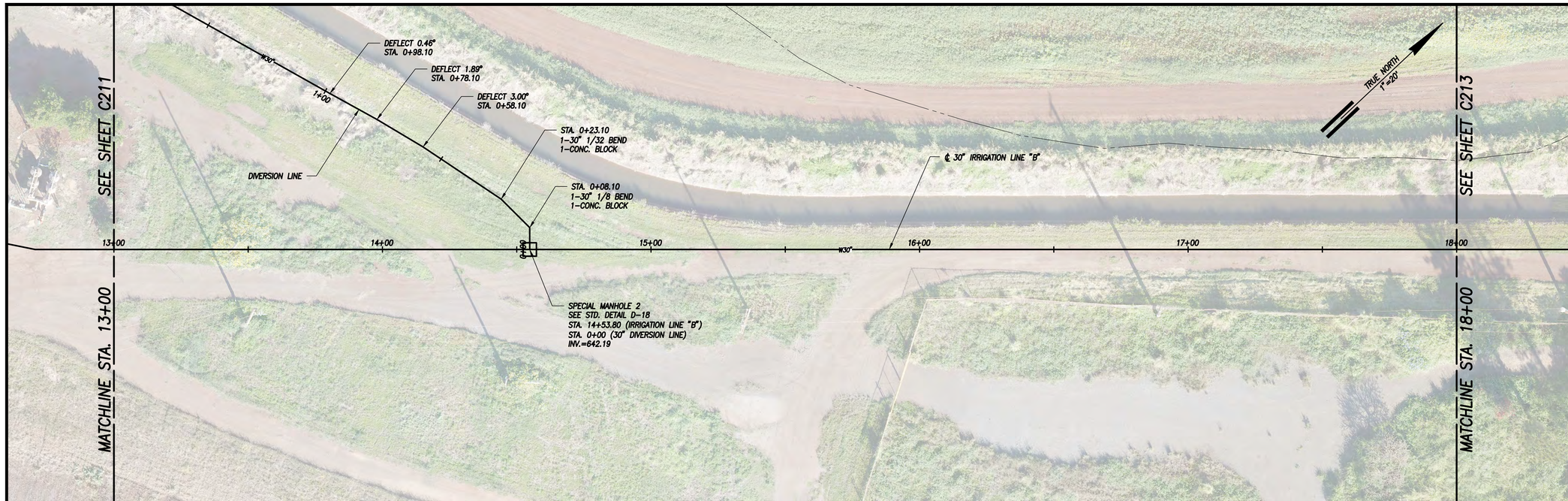
APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "B" &"C"
PLAN & PROFILE - 3
(STA. 9+50 TO 13+00)

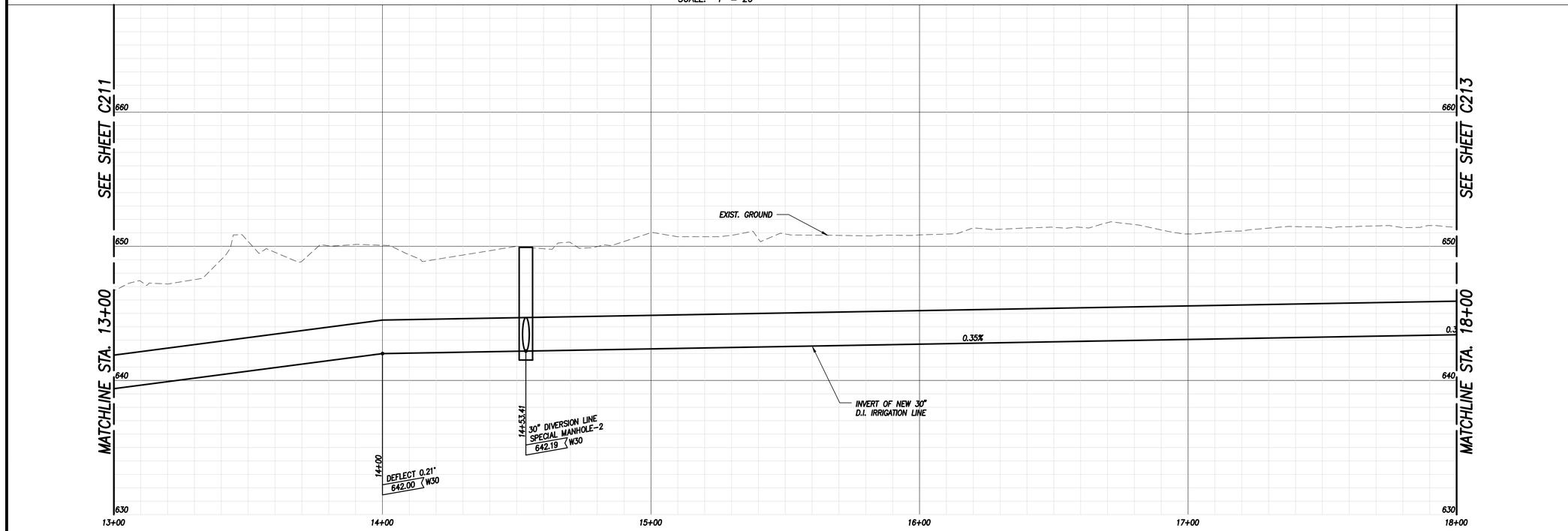
RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "B"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "B"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:
1" = 20' — 20' 10' 0 20' 40'
1" = 4' — 4' 2' 0 4' 8'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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REVISION	DATE	BRIEF	BY

APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

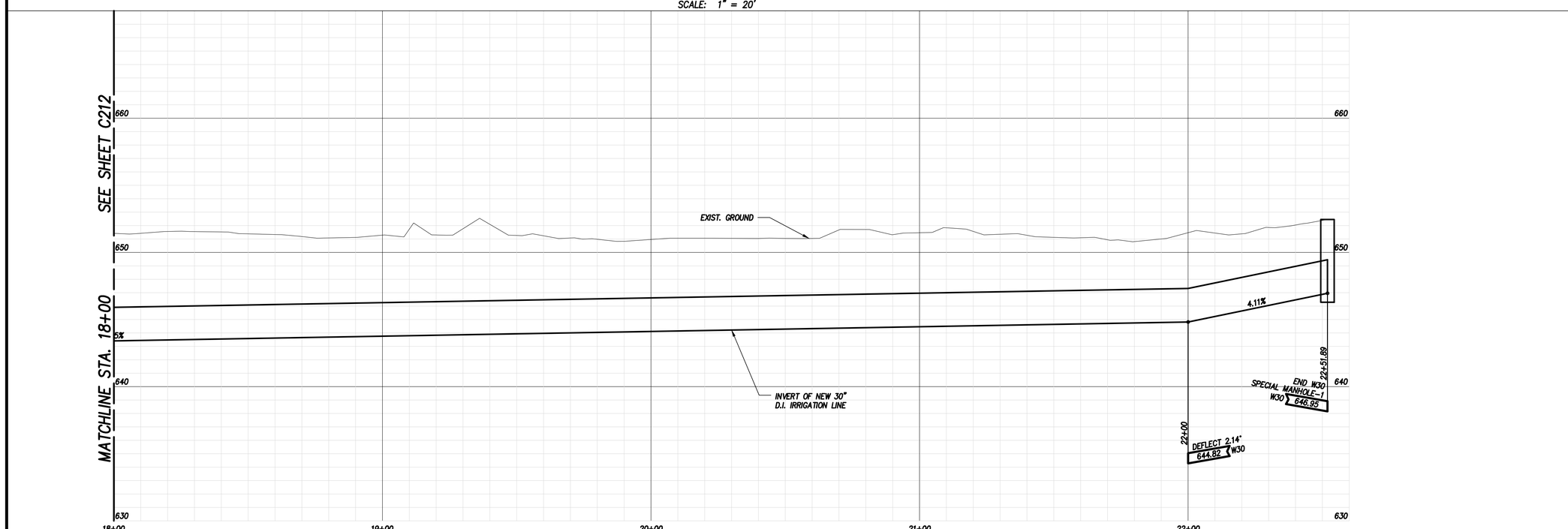
IRRIGATION LINE "B"
PLAN & PROFILE – 4
(STA. 13+00 TO 18+00)

RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.

PLAN: IRRIGATION LINE "B"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "B"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:

1" = 20' 20' 10' 0 20' 40'

1" = 4' 4' 2' 0 4' 8'

SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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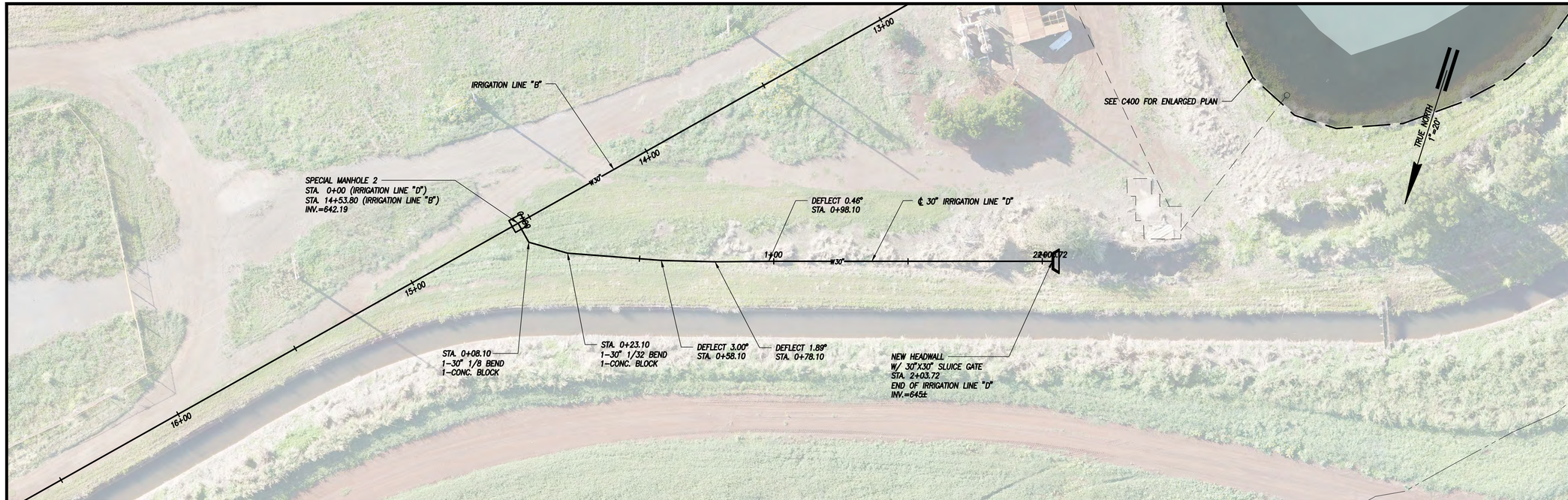
ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "B"
PLAN & PROFILE – 5
(STA. 18+00 TO 22+51.33)

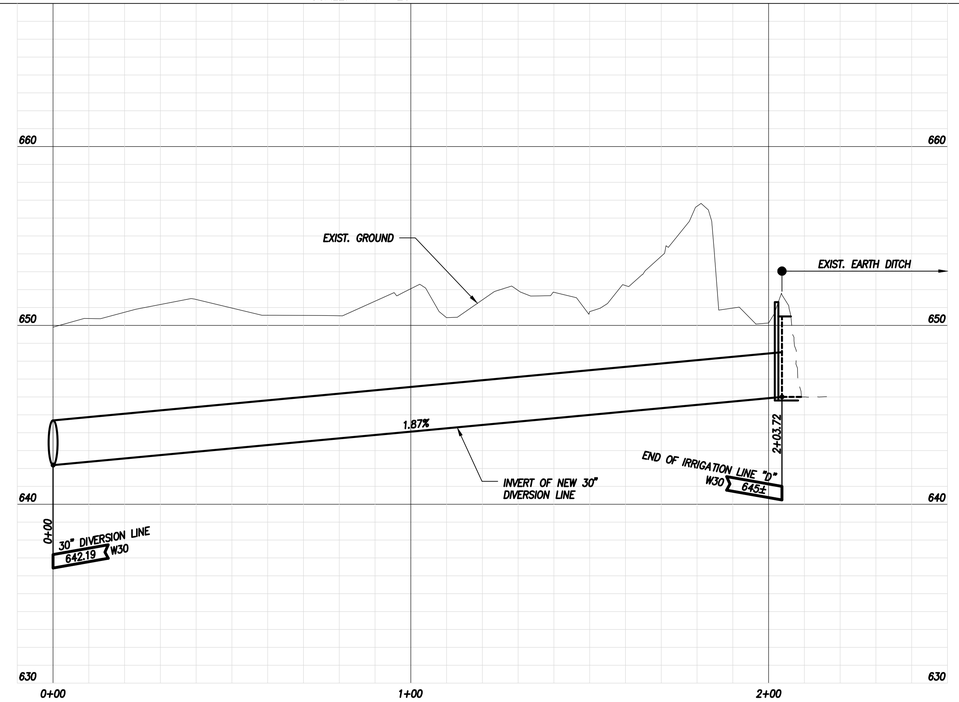
RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



PLAN: IRRIGATION LINE "D"

SCALE: 1" = 20'



PROFILE: IRRIGATION LINE "D"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:

1" = 20' 20' 10' 0 20' 40'

1" = 4' 4' 2' 0 4' 8'

SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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REVISION	DATE	BRIEF	BY

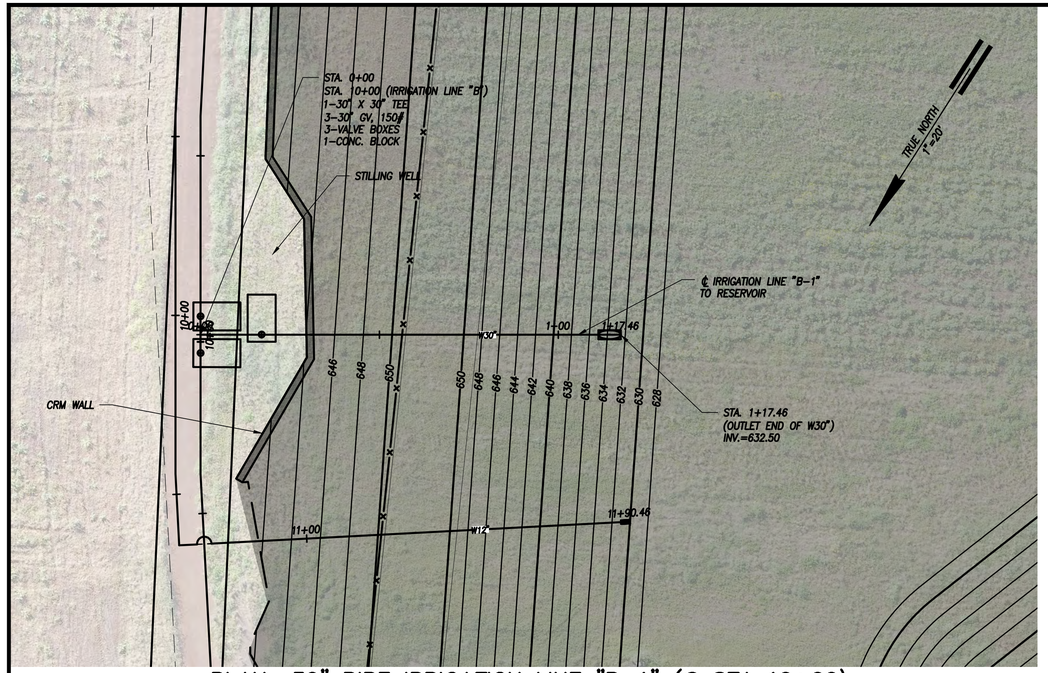
APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

IRRIGATION LINE "D"
(DIVERSION LINE)
PLAN & PROFILE

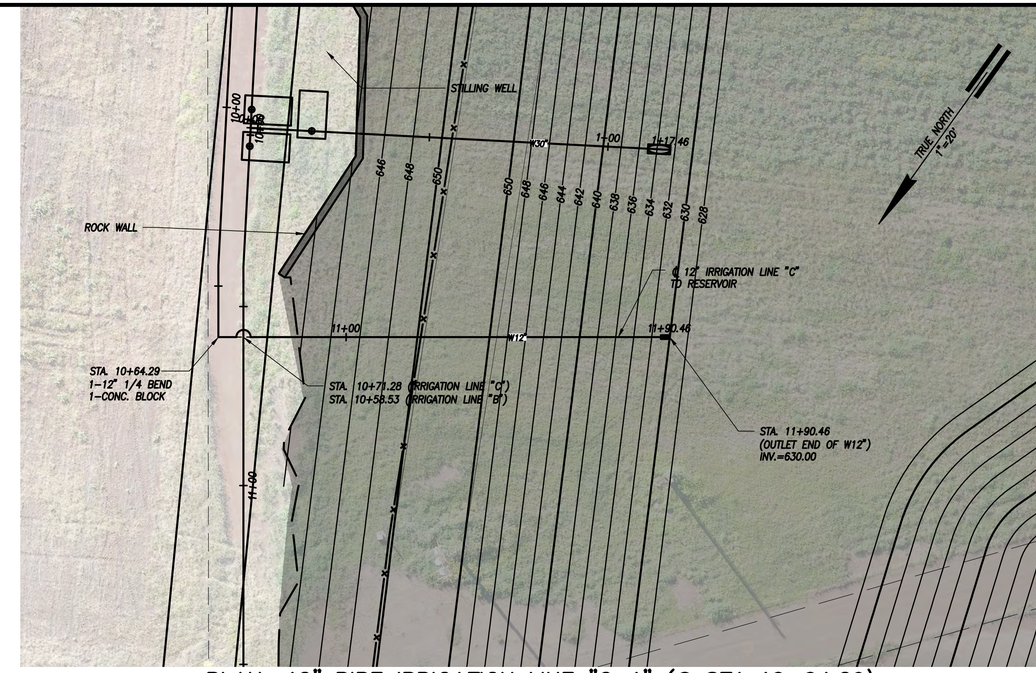
RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



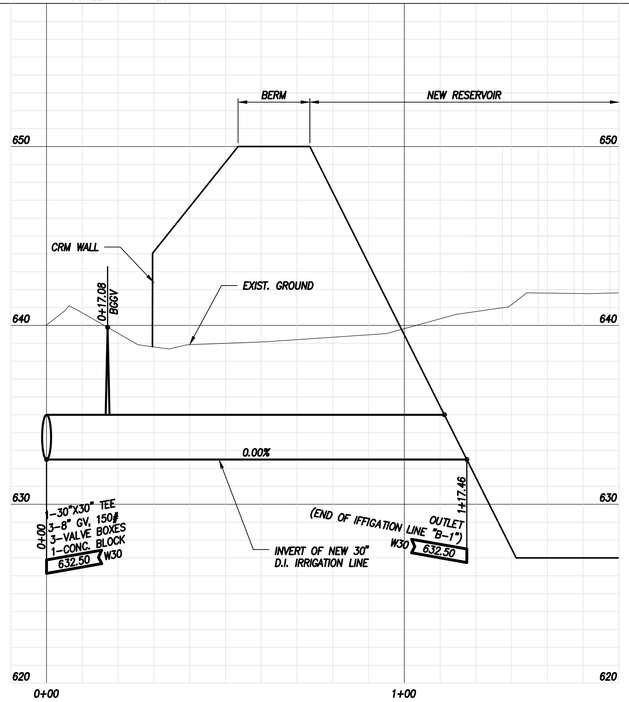
PLAN: 30" PIPE IRRIGATION LINE "B-1" (@ STA 10+00)

SCALE: 1" = 20'



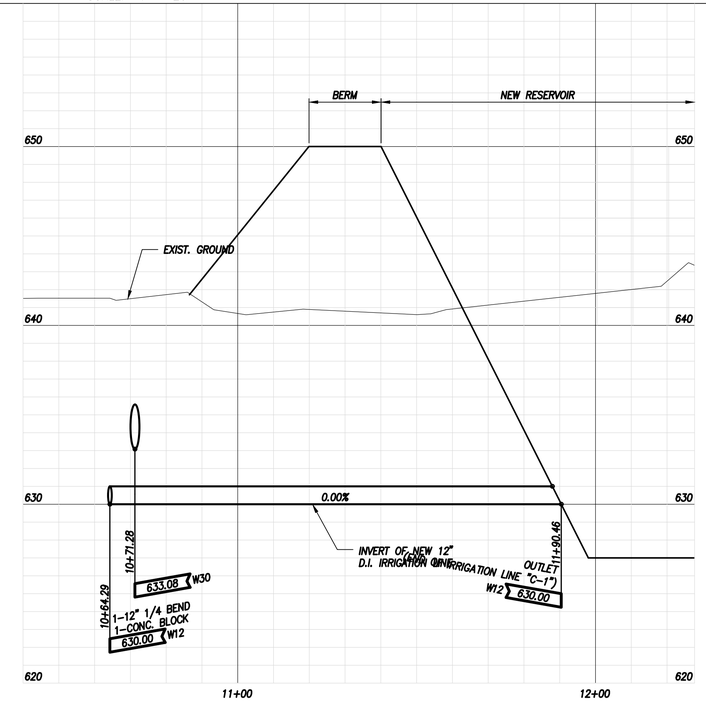
PLAN: 12" PIPE IRRIGATION LINE "C-1" (@ STA 10+64.29)

SCALE: 1" = 20'



PROFILE: 30" PIPE IRRIGATION LINE "B-1"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'



PROFILE: 12" PIPE IRRIGATION LINE "C-1"

SCALES: HOR. 1" = 20'
VERT. 1" = 4'

GRAPHIC SCALES:

1" = 20' — 20' 10' 0 20' 40'

1" = 4' — 4' 2' 0 4' 8'

SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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APPROVED BY

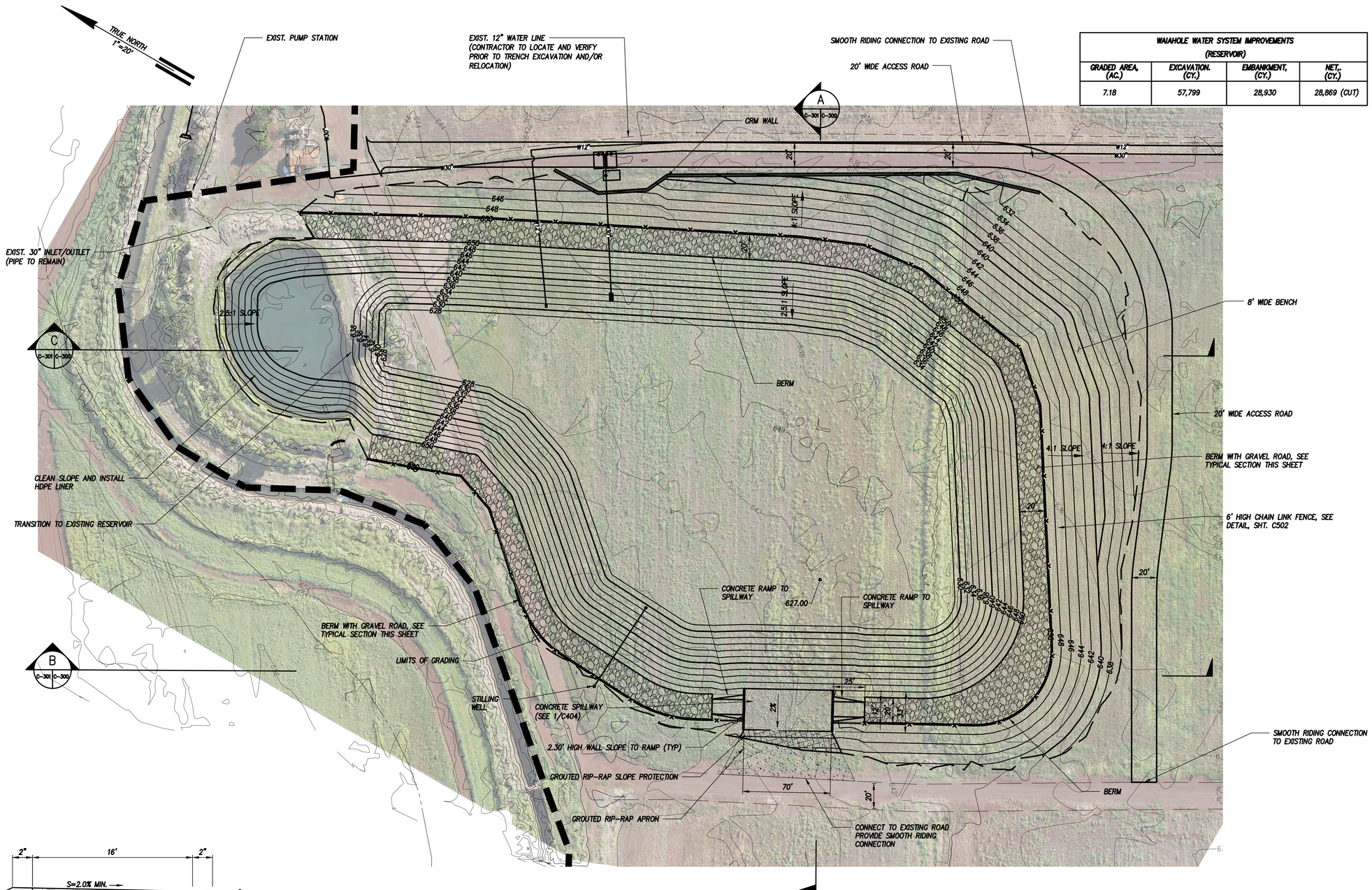
ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

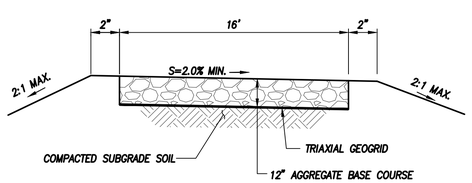
IRRI. LINES "B-1"&"C-1"
CONNECTION TO RESERVOIR
PLAN & PROFILE

RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.

WAIAHOLE WATER SYSTEM IMPROVEMENTS (RESERVOIR)			
GRADED AREA, (AC.)	EXCAVATION. (CY.)	EMBANKMENT, (CY.)	NET., (CY.)
7.18	57,799	28,930	28,869 (CUT)





TYPICAL RESERVOIR GRAVEL ROAD SECTION

NOT TO SCALE

NOTE:

FOR RESERVOIR GRADING SEE SHEET C04 CONSTRUCTION NOTES 3, GEOTECHNICAL ASSUMPTIONS

RESERVOIR SITE & GRADING PLAN

SCALE: 1" = 40'

GRAPHIC SCALE:
1" = 40' 40' 20' 0 40' 80'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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Signature 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	BY	APPROVED

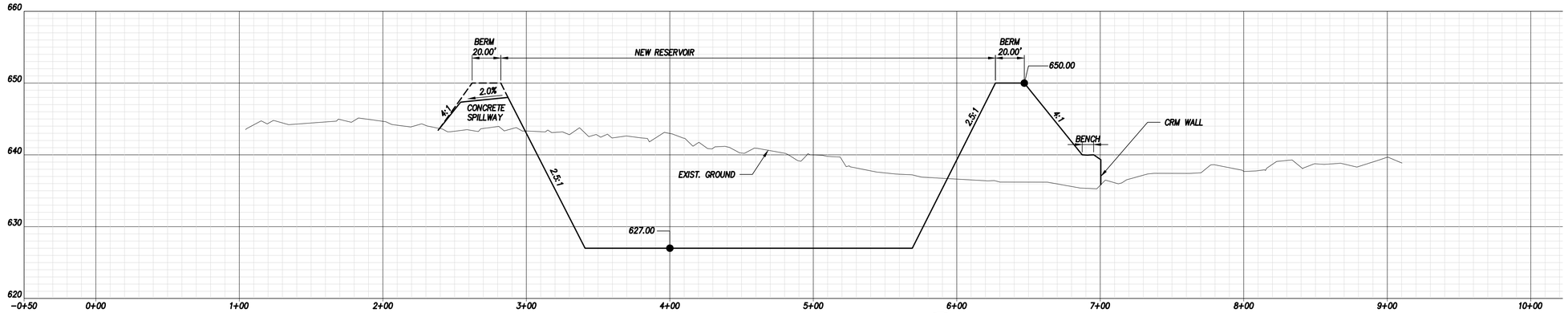
APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

RESERVOIR SITE & GRADING PLAN

RMTC JOB NO.: 1-23196-OE

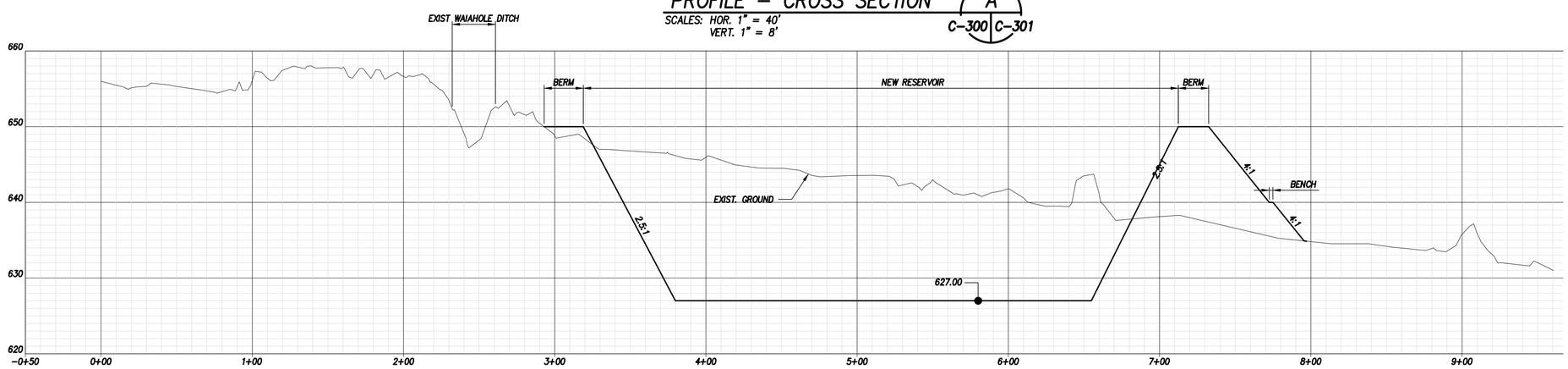
FILE	POCKET	FOLDER	NO.



PROFILE – CROSS SECTION A

SCALES: HOR. 1" = 40'
VERT. 1" = 8'

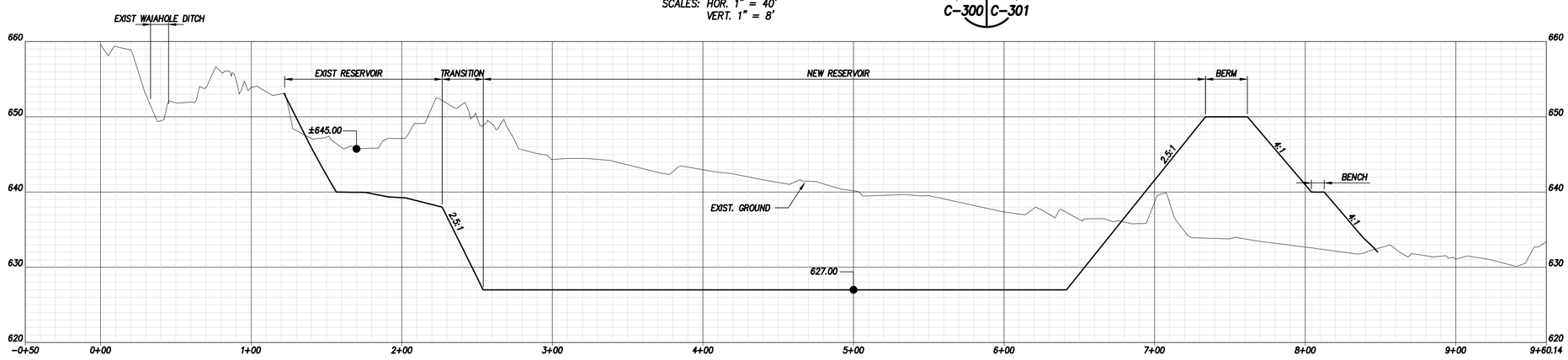
C-300 | C-301



PROFILE – CROSS SECTION B

SCALES: HOR. 1" = 40'
VERT. 1" = 8'

C-300 | C-301



PROFILE – CROSS SECTION C

SCALES: HOR. 1" = 40'
VERT. 1" = 8'

C-300 | C-301

GRAPHIC SCALES:

1" = 40' 40' 20' 0 40' 80'

1" = 8' 8' 4' 0 8' 16'

SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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REVISION	DATE	BRIEF	BY	APPROVED

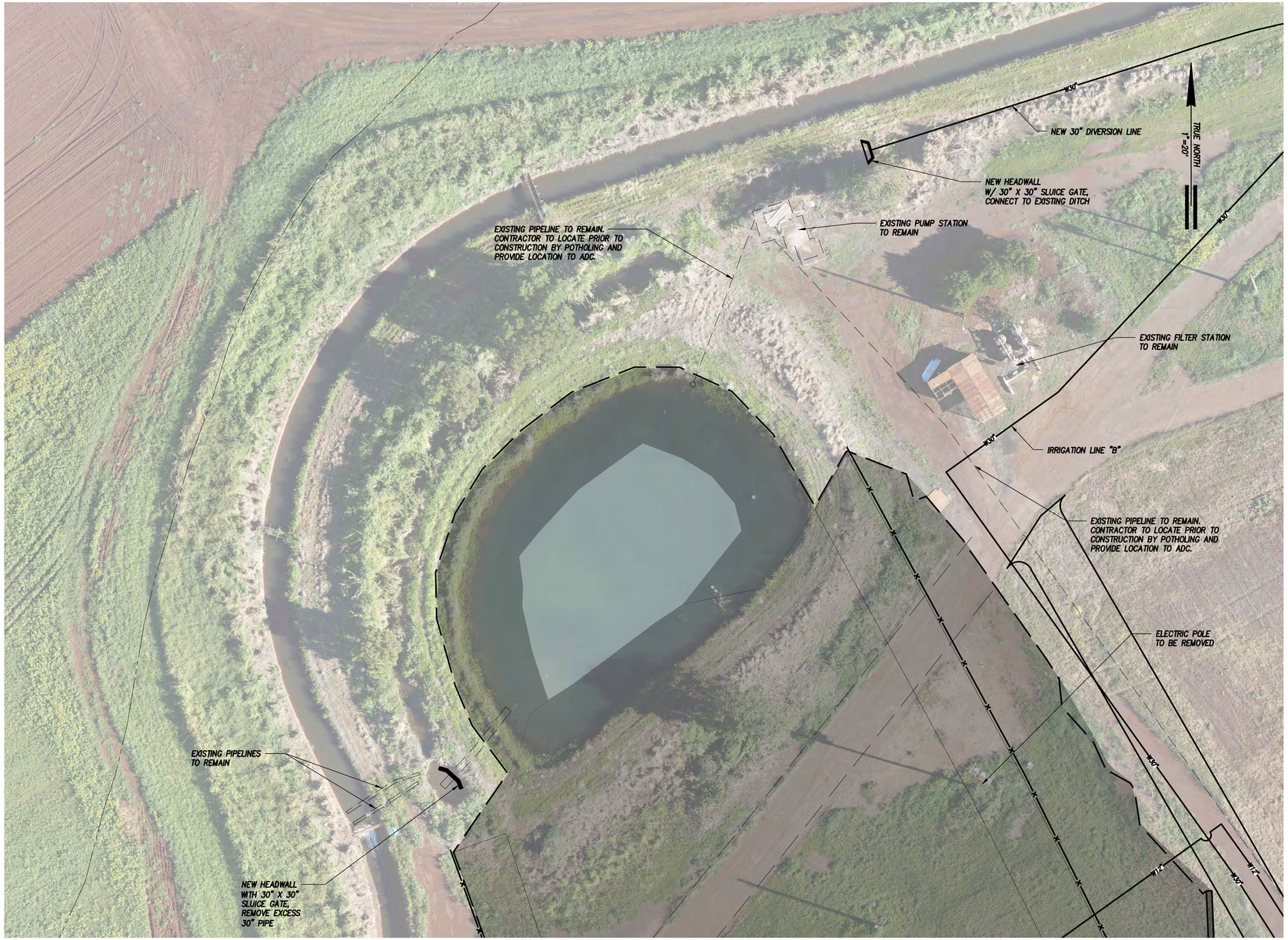
APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

RESERVOIR CROSS SECTIONS

RMTC JOB NO.: 1-23196-OE

FILE	POCKET	FOLDER	NO.



EXISTING RESERVOIR SITE

SCALE: 1" = 20'

GRAPHIC SCALE:
1" = 20' 20' 10' 0 20' 40'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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APPROVED BY

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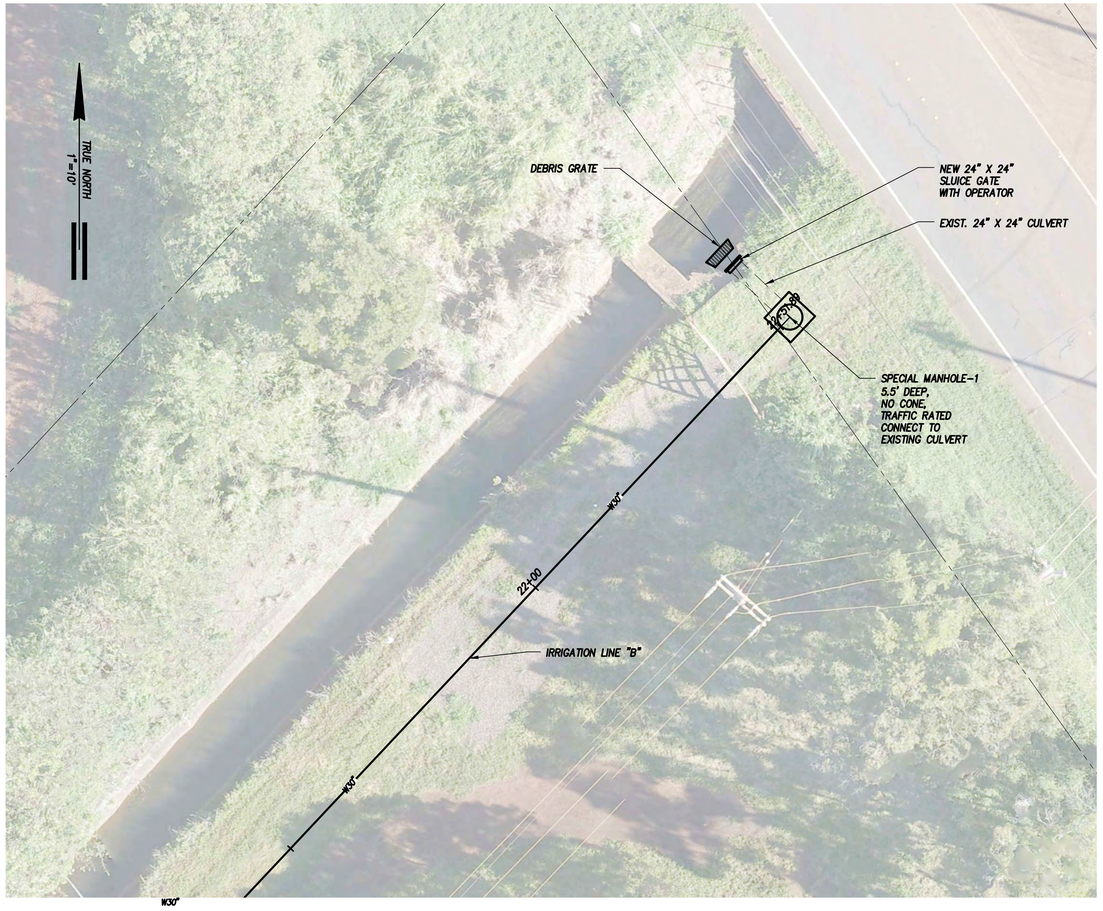
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

EXISTING RESERVOIR SITE

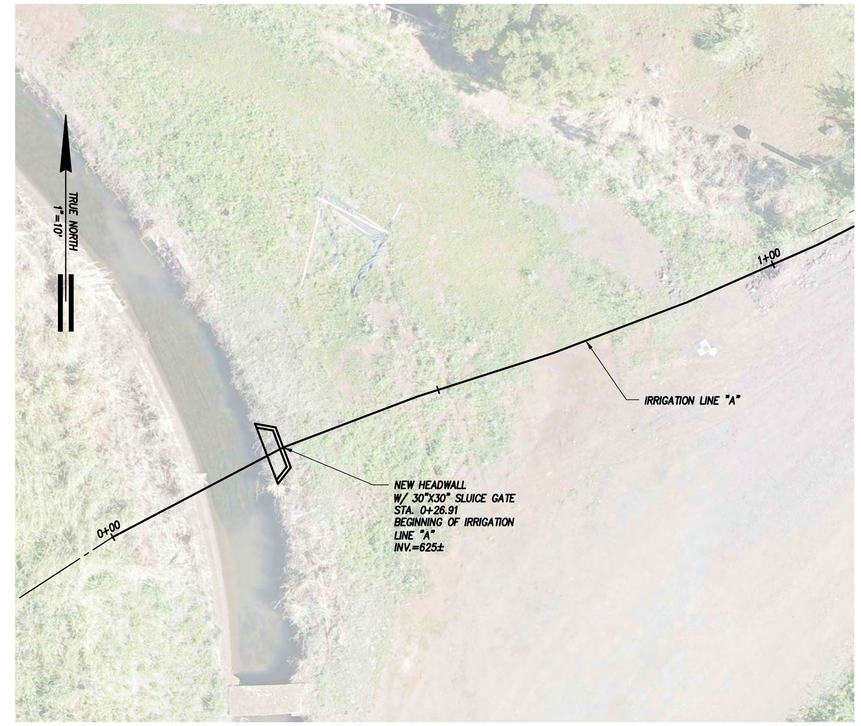
RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



DITCH CONNECTION SITE 1

SCALE: 1" = 10'



DITCH CONNECTION SITE 2

SCALE: 1" = 10'

GRAPHIC SCALE:

1" = 10' 10' 5' 0 10' 20'

SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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APPROVED BY

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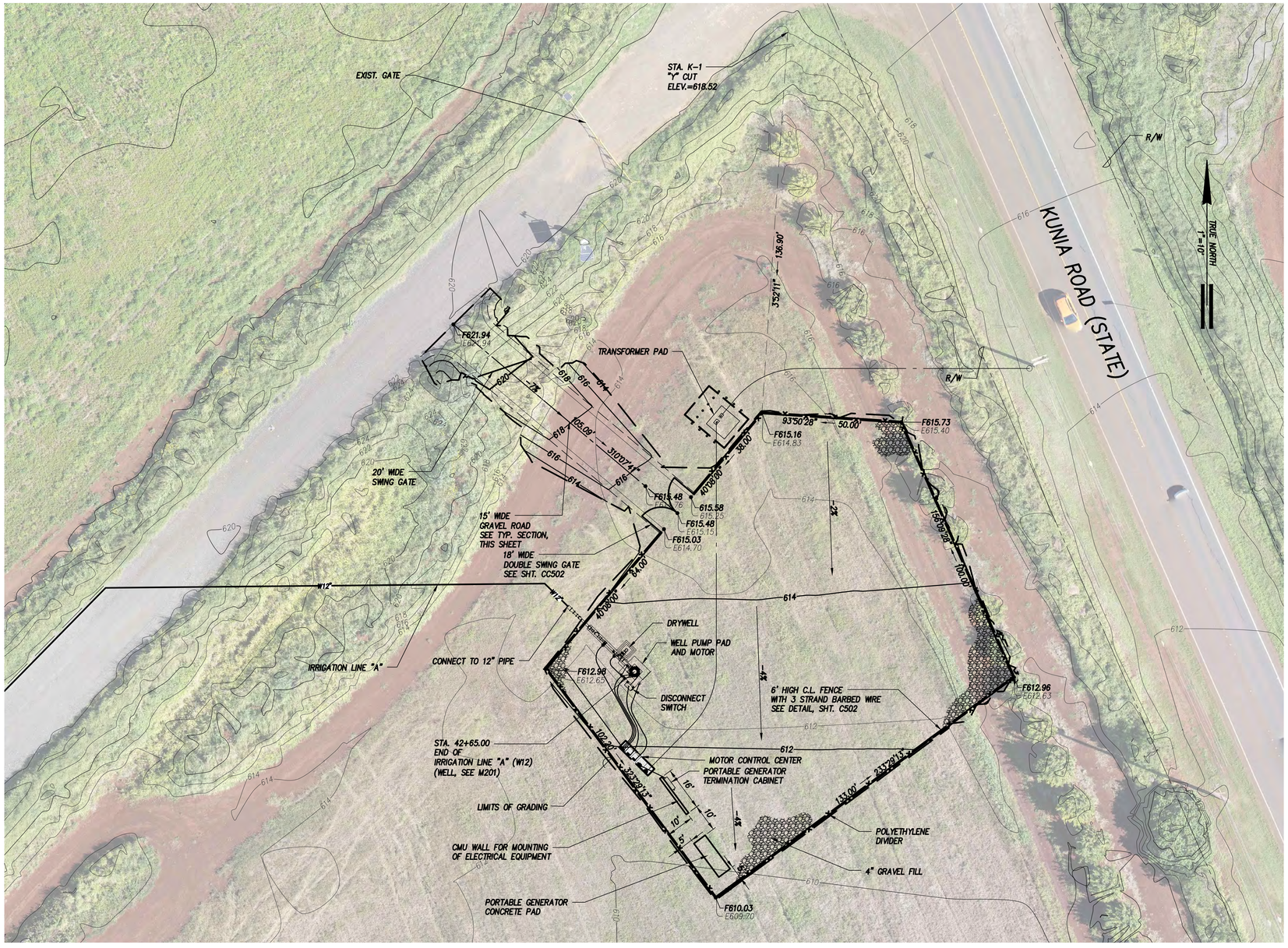
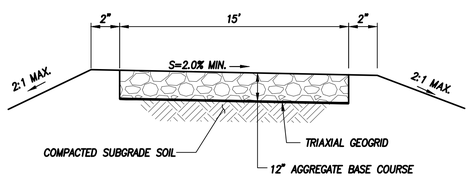
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

DITCH CONNECTION SITES 1 AND 2

RMTC JOB NO.: 1-23196-OE

FILE	POCKET	FOLDER	NO.





TYPICAL GRAVEL ROAD SECTION (PRIVATE)

NOT TO SCALE

WAIAHOLE WATER SYSTEM IMPROVEMENTS (WELL SITE)			
GRADED AREA, (AC.)	EXCAVATION, (CY.)	EMBANKMENT, (CY.)	NET, (CY.)
0.47	57	505	448 (FILL)

WELL SITE & GRADING PLAN

SCALE: 1" = 20'

GRAPHIC SCALE:
1" = 20' — 20' 10' 0 20' 40'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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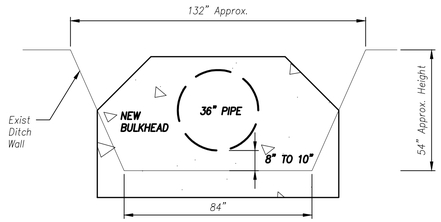
ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

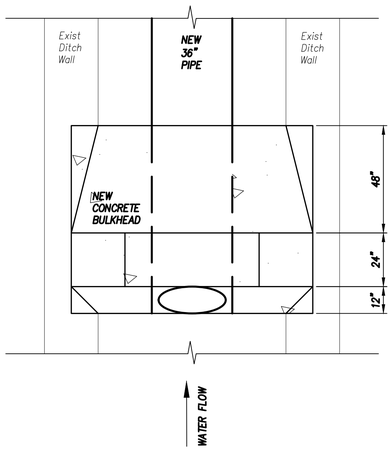
WELL SITE & GRADING PLAN

RMTC JOB NO.: 1-23196-0E

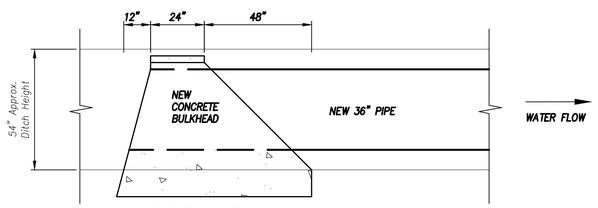
FILE	POCKET	FOLDER	NO.



FRONT VIEW



TOP VIEW



SIDE VIEW

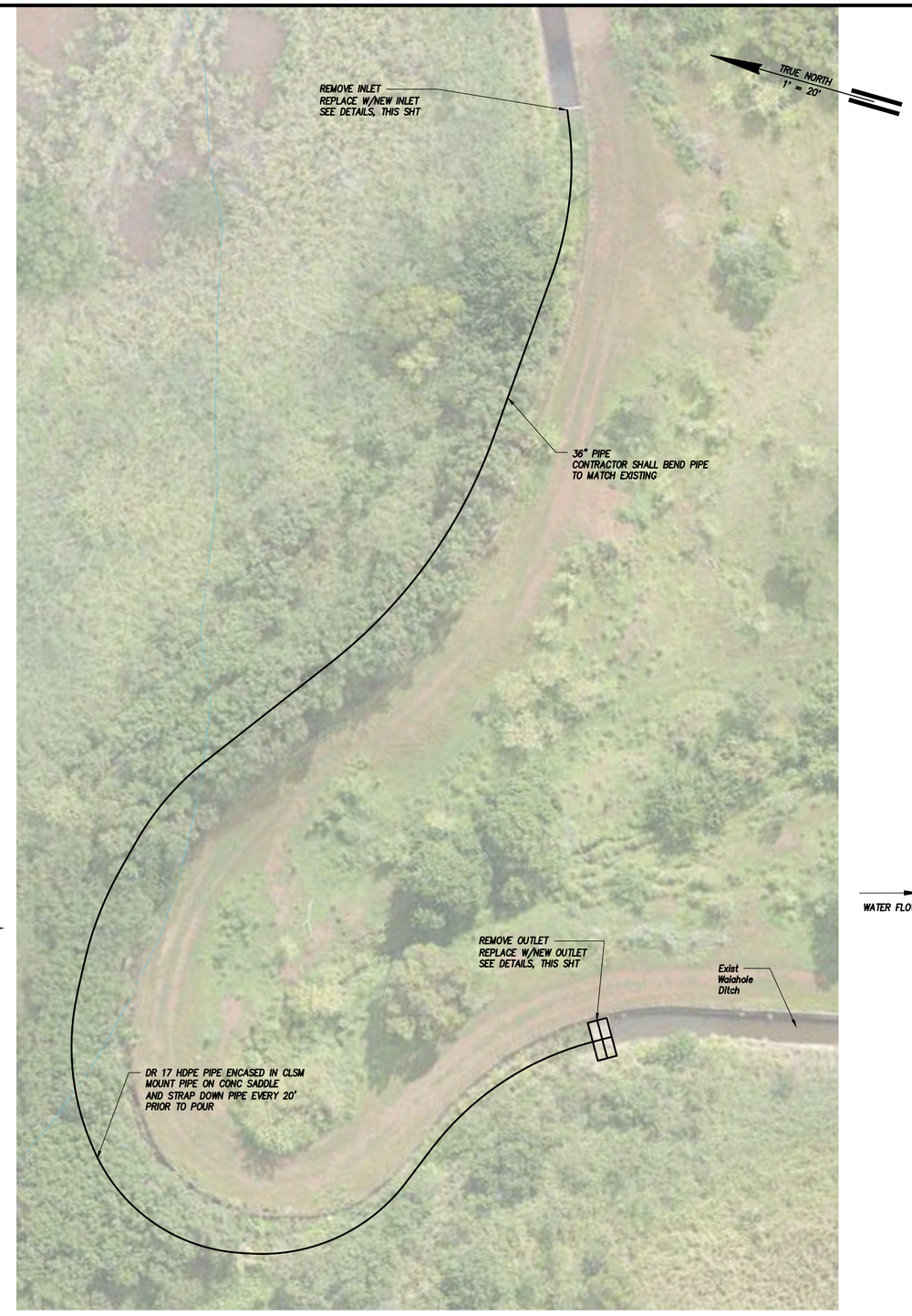
INLET

SCALE: 3/8" = 1'-0"

GRAPHIC SCALES:

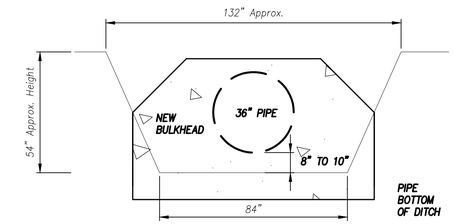
3/8" = 1'-0" 2' 0 2' 4' 6'

1" = 20' 20' 10' 0 20' 40'

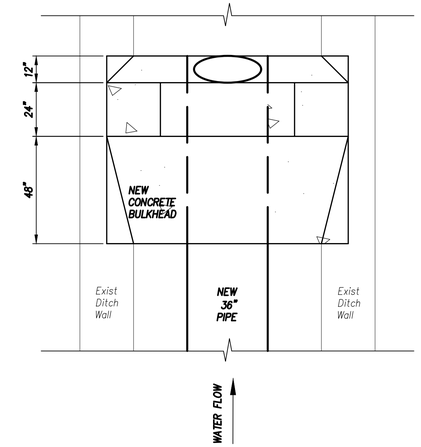


HAIRPIN TURN SITE

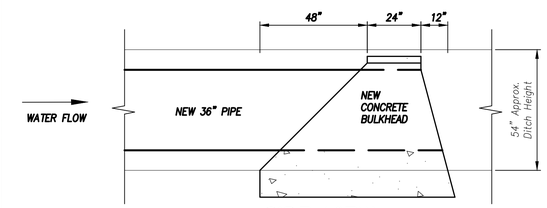
SCALE: 1" = 20"



FRONT VIEW



TOP VIEW



SIDE VIEW

OUTLET

SCALE: 3/8" = 1'-0"

GENERAL NOTES:

1. MINIMIZE DISTURBANCE TO EXISTING WAIAHOLE DITCH STRUCTURES. COORDINATE ALL WORK WITH THE OWNER'S REPRESENTATIVE.
2. ALL NEW CONCRETE SHALL HAVE A MINIMUM REINFORCING OF #4 @ 12" O.C. HORIZONTAL AND #4 @ 12" O.C. VERTICAL, EACH FACE.
3. ALL NEW CONCRETE SHALL INCLUDE A MINIMUM 5 LB PER CUBIC YARD OF SIKAFLEX FIBERMESH 650S OR APPROVED EQUAL. FOLLOW MANUFACTURER'S MIXING RECOMMENDATIONS.
4. REINFORCING AND FIBER MESH NOT REQUIRED FOR CLSM.

WAIAHOLE WATER SYSTEM IMPROVEMENTS

R. M. TOWILL CORPORATION
Planning • Engineering • Environmental Services • Photogrammetry • Surveying • Construction Management
2024 North King Street Suite 200
Honolulu Hawaii 96819

WALTER G. C. CHONG
LICENSED PROFESSIONAL ENGINEERS
No. 8882-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

Signature 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	BY

APPROVED BY

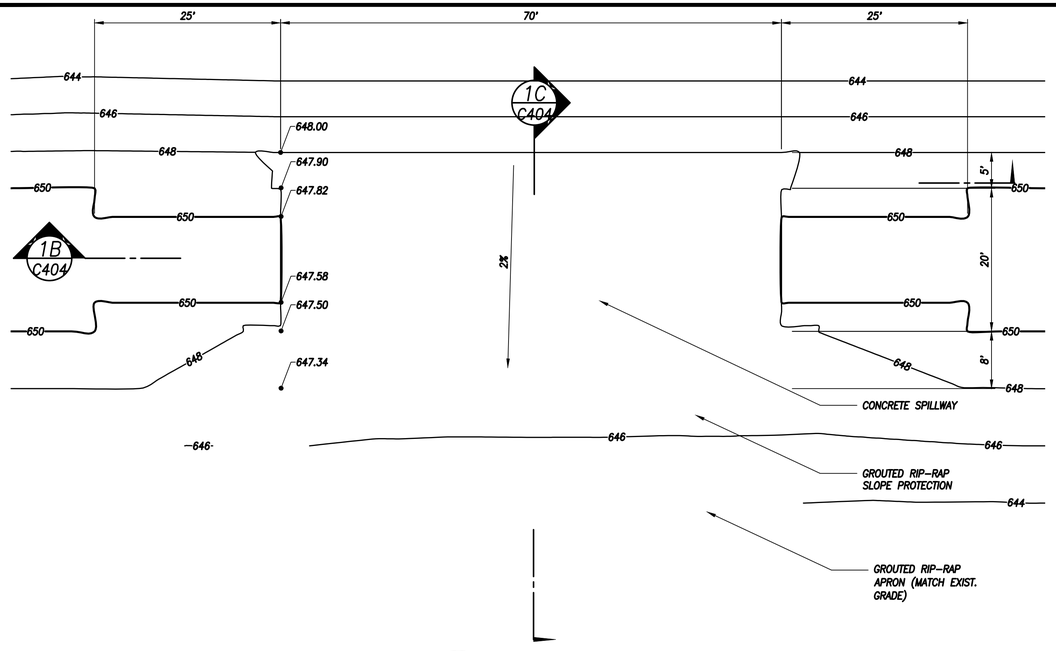
ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

HAIRPIN TURN SITE PLAN & DETAILS

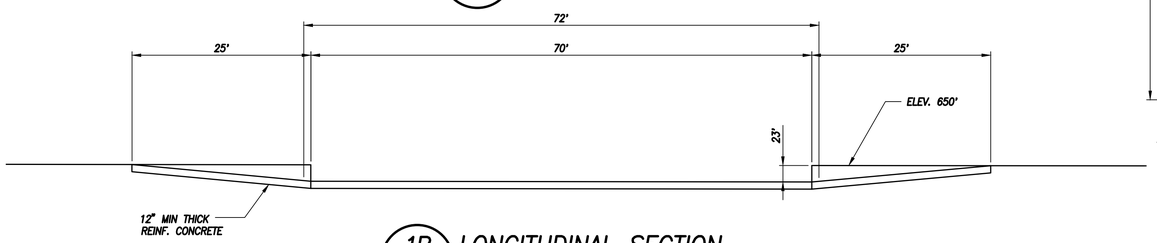
RMTC JOB NO.: 1-23196-0E

K:\civil\23620 Waiahole Water System Impr\Drawings\Construction Dwgs\C403 Hairpin turn Site Plan.dwg April 6, 2020 11:00pm AnthonyS

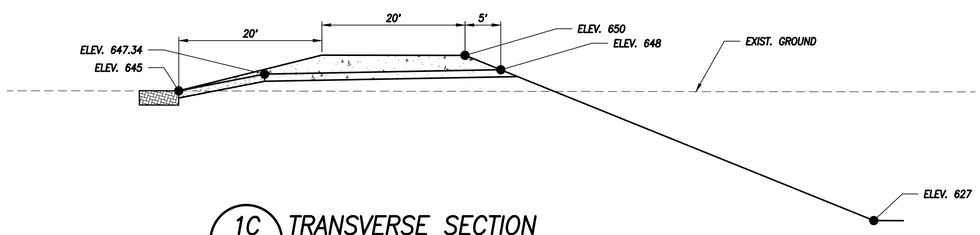
FILE	POCKET	FOLDER	NO.



1A PLAN
SCALE: 1" = 10"

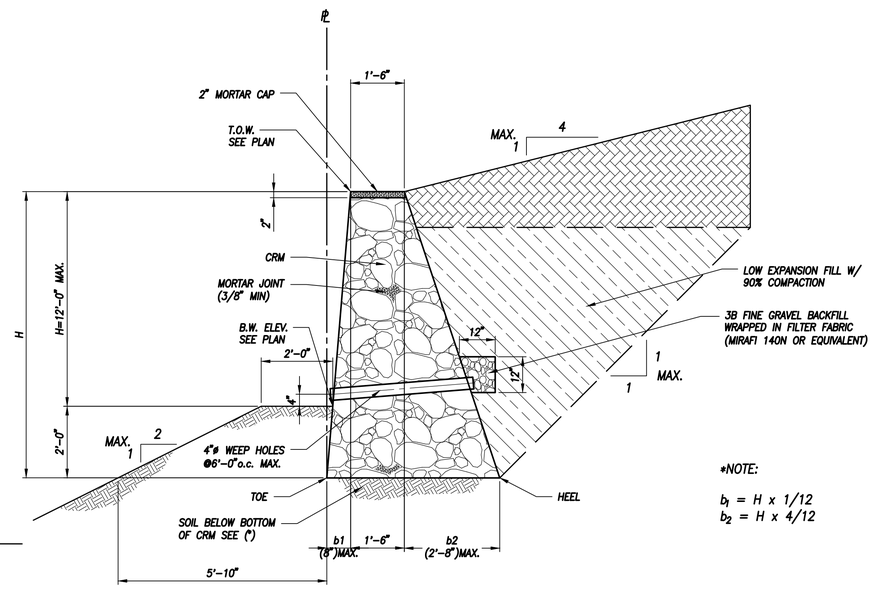


1B C404 LONGITUDINAL SECTION
SCALE: 1" = 10"



1C C404 TRANSVERSE SECTION
SCALE: 1" = 10"

1 SPILLWAY LAYOUT
SCALE: 1" = 10"



*NOTE:

$b_1 = H \times 1/12$
$b_2 = H \times 4/12$

*THE BOTTOM OF CRM WALL SHALL BEAR ON UNDISTURBED FIRM SOIL OR HARD COMPACTED FILL, WHICH WILL PROVIDE AN ALLOWABLE BEARING PRESSURE OF 3,000 p.s.f.

2 CRM WALL SECTION
SCALE: 1/2" = 1'-0"

GRAPHIC SCALES:
1/2" = 1'-0" 2' 0 2' 4'
1" = 10' 10' 5' 0 10' 20'
SCALES IN FEET

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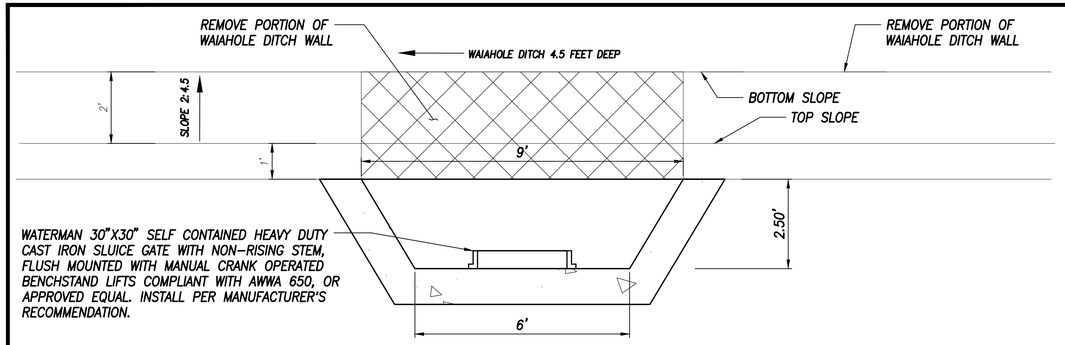
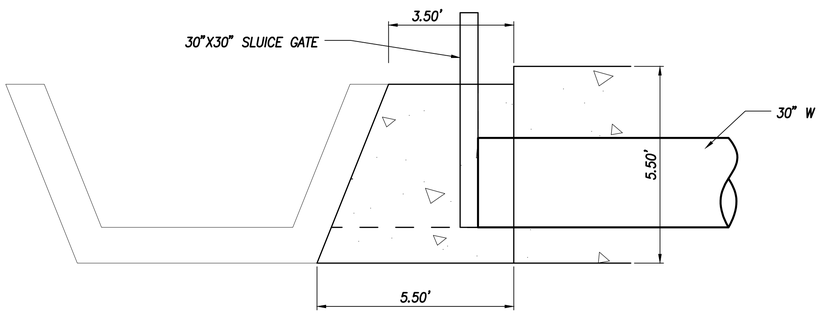
RESERVOIR DETAILS

RMTC JOB NO: 1-23196-OE

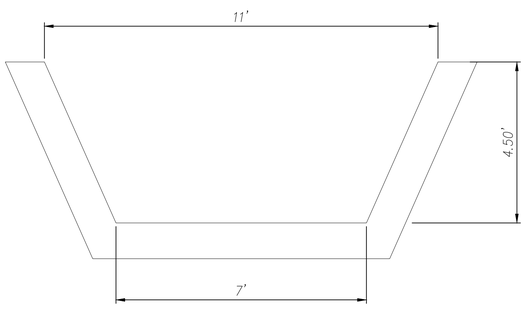
FILE	POCKET	FOLDER	NO.



HEADWALL PLAN
SCALE: 1/2" = 1'-0"

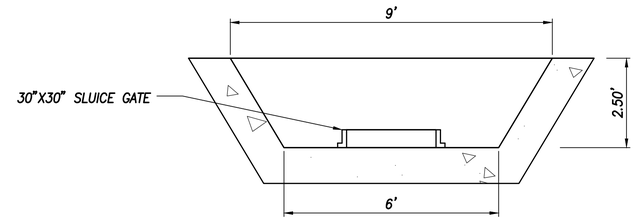


HEADWALL SECTION
SCALE: 1/2" = 1'-0"

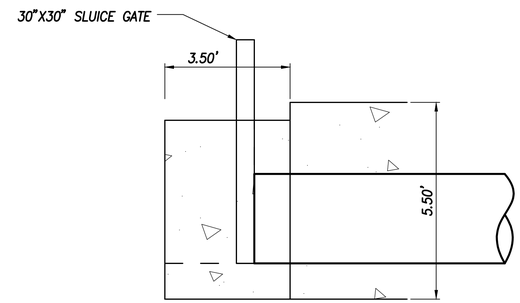


EXISTING DITCH SECTION
SCALE: 1/2" = 1'-0"

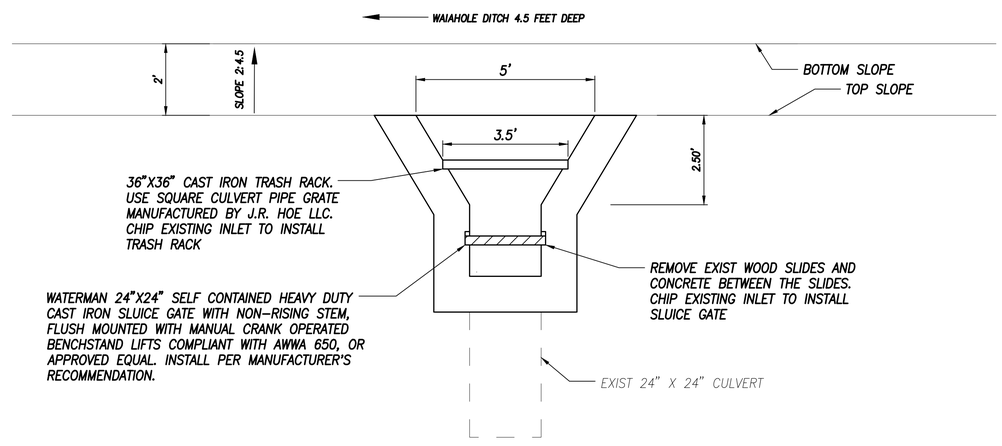
DITCH CONNECTION 2 (DOWN STREAM OF HAIRPIN TURN)



HEADWALL PLAN – DIVERSION PIPE
SCALE: 1/2" = 1'-0"



HEADWALL SECTION – DIVERSION PIPE
SCALE: 1/2" = 1'-0"



INLET AT KUNIA ROAD
SCALE: 1/2" = 1'-0"

DITCH CONNECTION 1

GENERAL NOTES:

1. MINIMIZE DISTURBANCE TO EXISTING WAIAHOLE DITCH STRUCTURES. COORDINATE ALL WORK WITH THE OWNER'S REPRESENTATIVE
2. ALL NEW CONCRETE SHALL HAVE A MINIMUM REINFORCING OF #4 @ 12" O.C. HORIZONTAL AND #4 @ 12" O.C. VERTICAL, EACH FACE
3. ALL NEW COCNRETE SHALL INCLUDE A MINIMUM 5 LB PER CUBIC YARD OF SIKAFLEX FIBERMESH 650S OR APPROVED EQUAL. FOLLOW MANUFACTURER'S MIXING RECOMMENDATIONS.
4. MAINTAIN THE FLOW IN WAIAHOLE DITCH AT ALL TIMES. COORDINATE PROPOSED BY-PASS WITH THE OWNERS REPRESENTATIVE.

GRAPHIC SCALES:
1/2" = 1'-0" 2' 0 2' 4'
SCALES IN FEET

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
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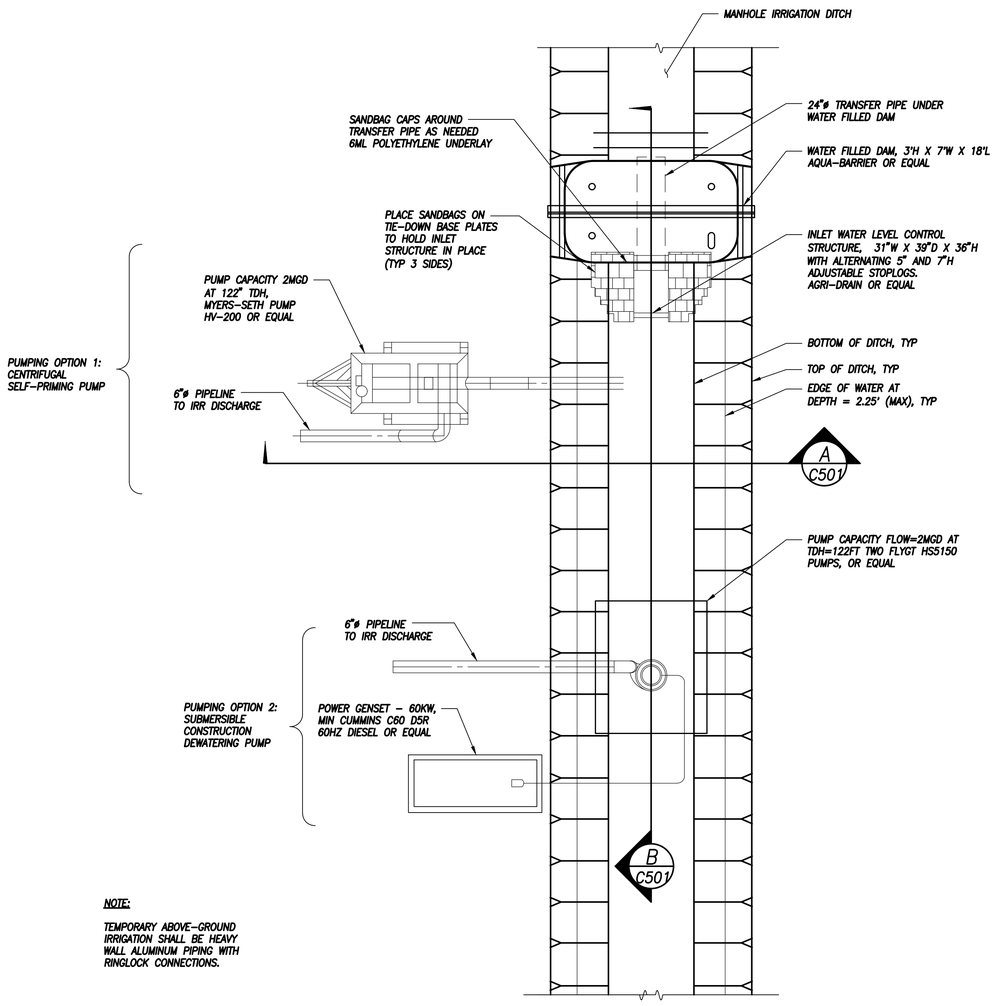
DPP FILE NO.	2020/CP-XX

DITCH CONNECTION DETAILS

RMTC JOB NO.: 1-23196-0E

K:\civil\23620 Waiahole Water System Impr\Drawings\Construction Dwgs\C405 DITCH CONNECTION DETAILS.dwg April 6, 2020 11:00pm AnthonyS

FILE	POCKET	FOLDER	NO.

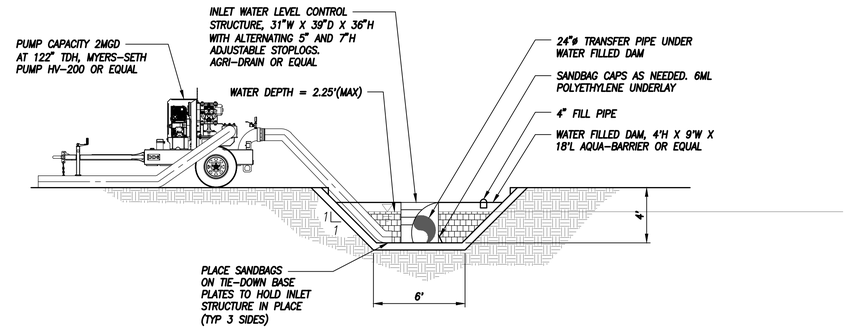


NOTE:

TEMPORARY ABOVE-GROUND IRRIGATION SHALL BE HEAVY WALL ALUMINUM PIPING WITH RINGLOCK CONNECTIONS.

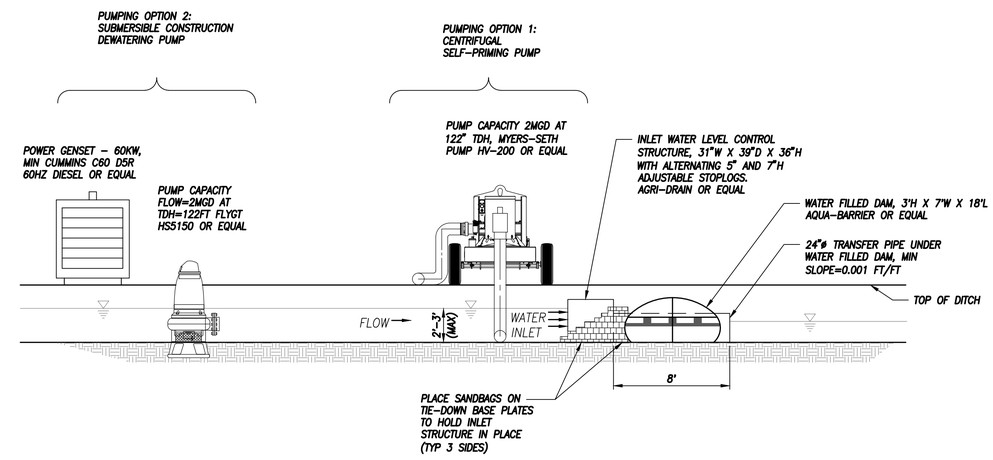
1 TEMPORARY WATER SUPPLY AND DIVERSION PLAN

NOT TO SCALE



A C501 TEMPORARY WATER SUPPLY AND DIVERSION DETAIL

NOT TO SCALE



B C501 TEMPORARY WATER SUPPLY AND DIVERSION DETAIL

NOT TO SCALE

SAMPLE – NOT FOR CONSTRUCTION

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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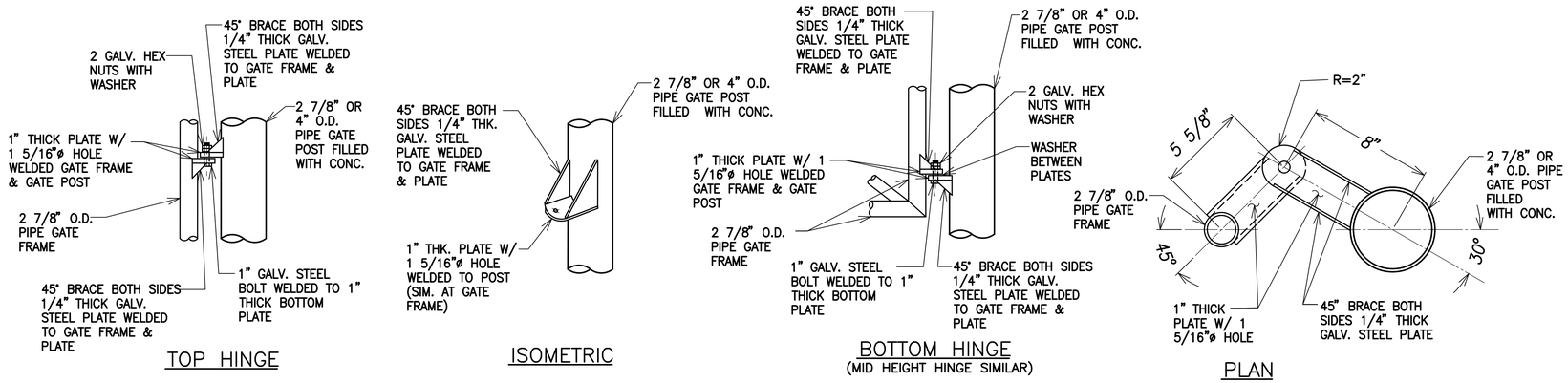
TEMPORARY WATER SUPPLY DETAILS
(SAMPLE–NOT FOR CONSTRUCTION)

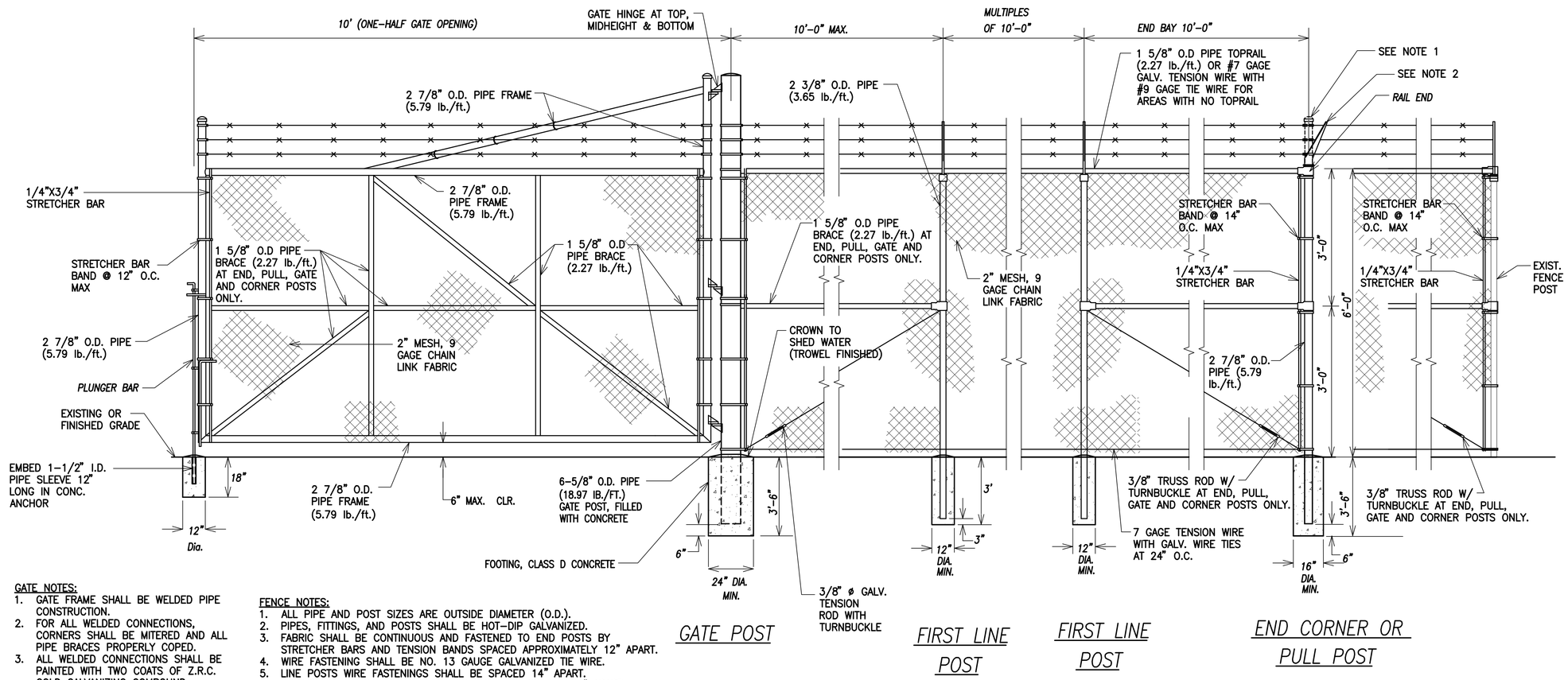
RMTC JOB NO.: 1-23196-OE

FILE	POCKET	FOLDER	NO.



GATE HINGE DETAIL

NOT TO SCALE



GATE NOTES:

1. GATE FRAME SHALL BE WELDED PIPE CONSTRUCTION.
2. FOR ALL WELDED CONNECTIONS, CORNERS SHALL BE MITERED AND ALL PIPE BRACES PROPERLY COPED.
3. ALL WELDED CONNECTIONS SHALL BE PAINTED WITH TWO COATS OF Z.R.C. COLD GALVANIZING COMPOUND.
4. GATE HINGES SHALL BE TACK WELDED TO POST.
5. PIPES, FITTINGS, AND POSTS SHALL BE HOT-DIP GALVANIZED.
6. TOP AND BOTTOM SELVAGES SHALL BE KNUCKLED FINISH.

FENCE NOTES:

1. ALL PIPE AND POST SIZES ARE OUTSIDE DIAMETER (O.D.).
2. PIPES, FITTINGS, AND POSTS SHALL BE HOT-DIP GALVANIZED.
3. FABRIC SHALL BE CONTINUOUS AND FASTENED TO END POSTS BY STRETCHER BARS AND TENSION BANDS SPACED APPROXIMATELY 12" APART.
4. WIRE FASTENING SHALL BE NO. 13 GAUGE GALVANIZED TIE WIRE.
5. LINE POSTS WIRE FASTENINGS SHALL BE SPACED 14" APART.
6. HORIZONTAL RAILS WIRE FASTENNINGS SHALL BE SPACED 24" APART.
7. NO SPLICING SHALL BE ALLOWED ON ALL STRAIGHT-RUN PIPES.
8. TOP AND BOTTOM SELVAGES SHALL BE TWISTED AND BARBED FINISH.
9. AT FENCE END ONLY, EXCLUDE BARBED WIRE EXTENSION ARM AND EXTEND POST. FASTEN BARBED WIRE TO POST.
10. POINT EXTENSION OUTWARD OR AWAY FROM PROPERTY LINE AT AN ANGLE OF 45° FROM VERTICAL.

CHAIN LINK BARBED WIRE FENCE WITH DOUBLE SWING GATE AND BARBED WIRE

NOT TO SCALE

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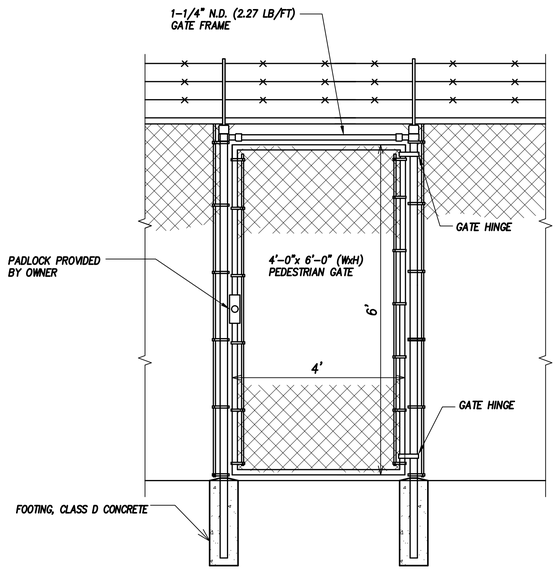
MISCELLANEOUS DETAILS – 1

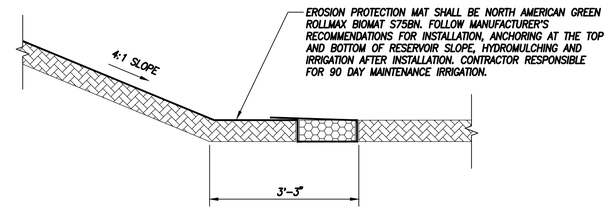
RMTC JOB NO.: 1-23196-0E

FILE	POCKET	FOLDER	NO.



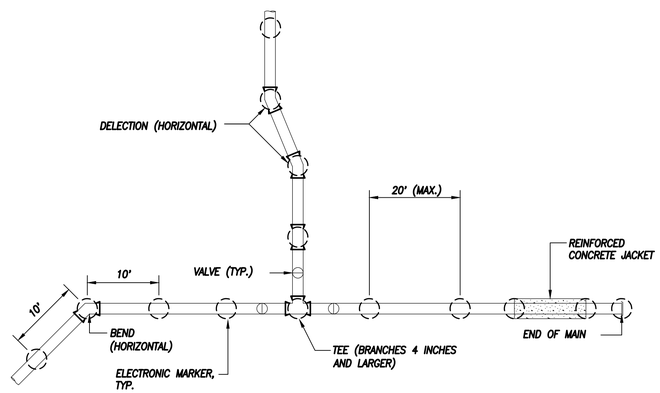
PEDESTRIAN GATE DETAIL

NOT TO SCALE

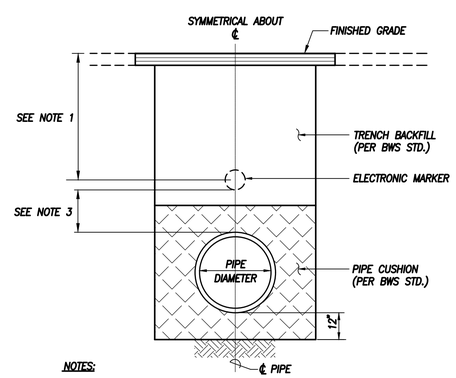


RESERVOIR SLOPE EROSION PROTECTION

NOT TO SCALE



PLAN

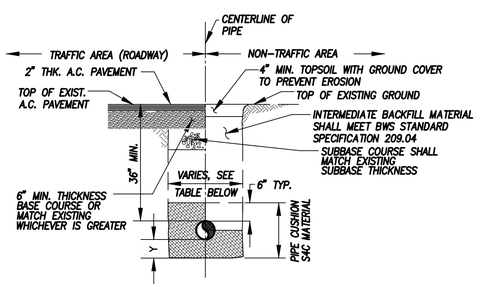


NOTES:

1. INSTALL ELECTRONIC MARKER OVER CENTER LINE OF PIPE AT A MINIMUM DEPTH OF 2 FEET AND A MAXIMUM DEPTH OF 3 FEET FROM FINISH GRADE.
2. INSTALL TRENCH BACKFILL AND PIPE CUSHION MATERIAL IN ACCORDANCE TO THE PLANS AND SPECIFICATIONS.
3. INSTALL ELECTRONIC MARKERS AT A MINIMUM CLEARANCE OF 6-INCHES ABOVE THE PIPE OR CONCRETE JACKET.

TYPICAL ELECTRONIC MARKER INSTALLATION

NOT TO SCALE



PIPE SIZE	TRENCH WIDTH	"Y" MIN.
6"	24"	6"
8"	24"	6"
12"	24"	12"
30"	48"	12"

1) PAVEMENT STRUCTURE SHALL BE EQUAL OR BETTER THAN EXISTING IN THICKNESS AND QUALITY.

2) COMPACTION SHALL BE 95% ASTM 1557D, 1557D, METHOD "D" FOR COHESIONLESS SOILS AND 90% MAX. DENSITY FOR COHESIVE SOILS.

PIPE TRENCH FOR A SINGULAR PIPE (PRIVATE)

NOT TO SCALE

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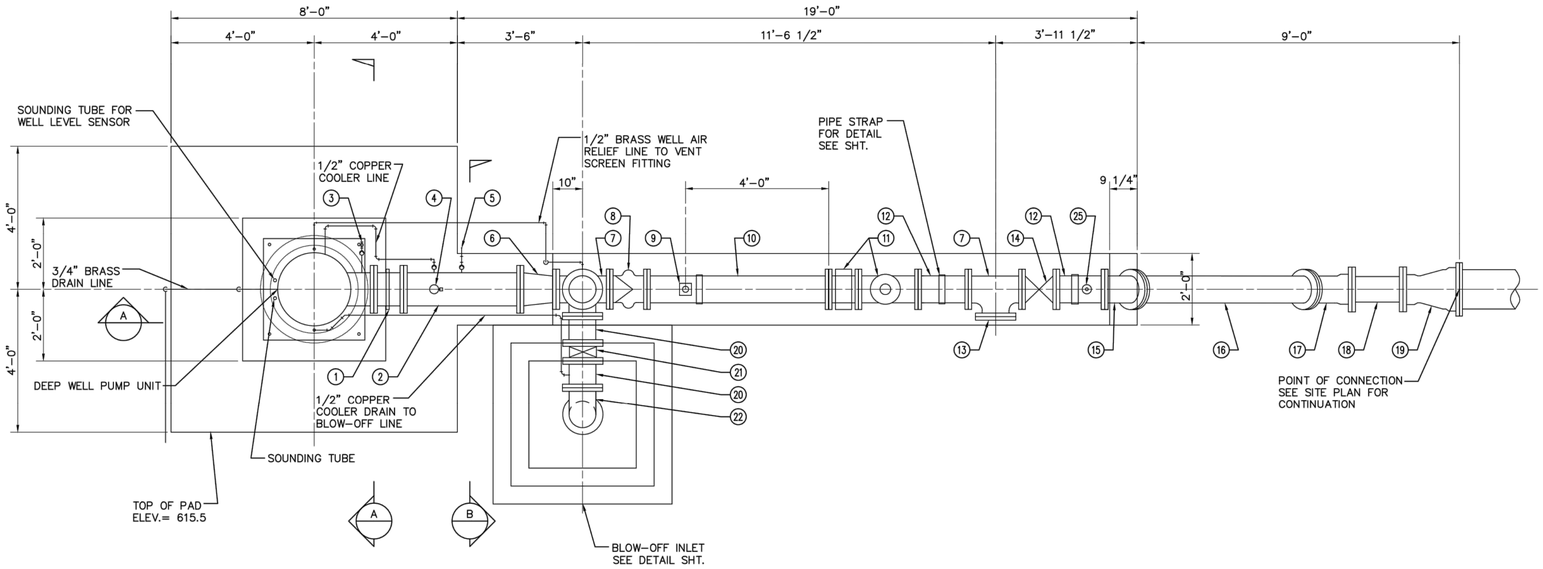
MISCELLANEOUS DETAILS – 2

RMTC JOB NO: 1-23196-OE

FILE	POCKET	FOLDER	NO.



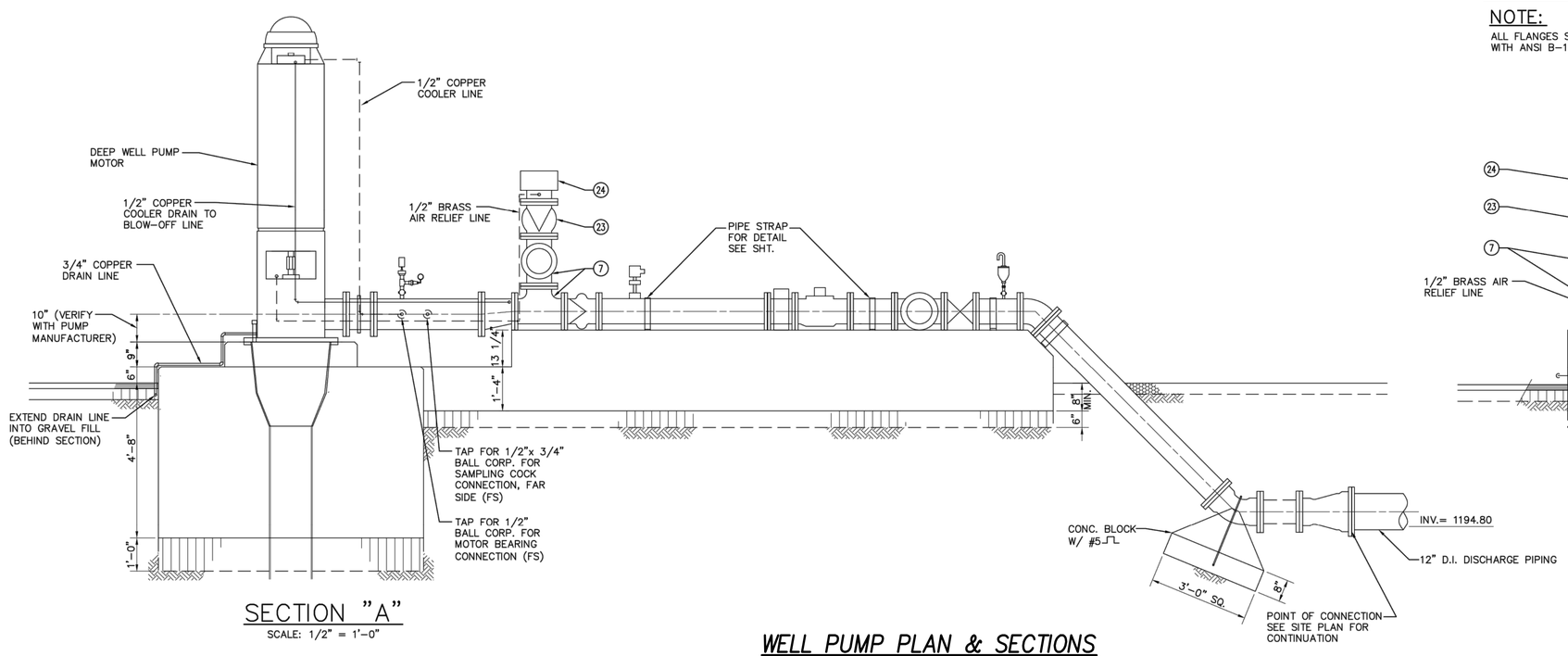
PLAN

SCALE: 1/2" = 1'–0"

ITEM NO.	DESCRIPTION
1	10" DISMANTLING JOINT, ROMAC MODEL NO. DJ400
2	10" D.I. PIPE, FE, LENGTH TO FIT
3	TEST GAUGE CONNECTION, SEE DETAIL SHT. C-11
4	PRESSURE SWITCH UNIT, SEE DETAIL SHT. C-11
5	SAMPLING COCK, SEE DETAIL SHT. C-11
6	10"x8" D.I. REDUCER, FE
7	8" D.I. TEE, FE
8	8" CENTER-GUIDED CHECK VALVE, FE
9	1 1/2" FLOW SWITCH
10	8" D.I. PIPE, FE, LENGTH TO FIT, W/ 1 1/2" BOSS
11	8" TURBINE METER W/ STRAINER, FE, WITH FLOW TRANSMITTER
12	8" D.I. PIPE, FE, 1'-4" LONG
13	8" D.I. BLIND FLANGE
14	8" GATE VALVE, FE
15	8" 1/8 D.I. BEND, FE
16	8" D.I. PIPE, FExPE, LENGTH TO FIT
17	8" 1/8 D.I. BEND, MJ
18	8" D.I. PIPE, PE, LENGTH TO FIT
19	8"X12" D.I. INCREASER, MJ
20	8" D.I. PIPE, FE, 0'-9" LONG (W/ 1/2" BOSS AT DOWNSTREAM SIDE OF BUTTERFLY VALVE)
21	8" RUBBER-SEATED BUTTERFLY VALVE,FE, W/ ELECTRIC ACTUATOR
22	8" 1/4 D.I. BEND, FE
23	8" PUMP VACUUM RELEASE VALVE, FE
24	8" VENT SCREEN & FITTING, SEE DETAIL SHT. C-11
25	3/4" ARV UNIT, SEE DETAIL SHT. C-11
26	8" TIDEFLEX CHECK VALVE, FE, SERIES 35

NOTE:

ALL FLANGES SHALL BE FACED AND DRILLED IN ACCORDANCE WITH ANSI B–16.1 CLASS 125.



SECTION "A"

SCALE: 1/2" = 1'–0"

SECTION "B"

SCALE: 1/2" = 1'–0"

1/2" = 1' 1' 6" 0 1' 2' 3' 4' 5'

WELL PUMP PLAN & SECTIONS

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WELL PUMP PLAN & SECTIONS

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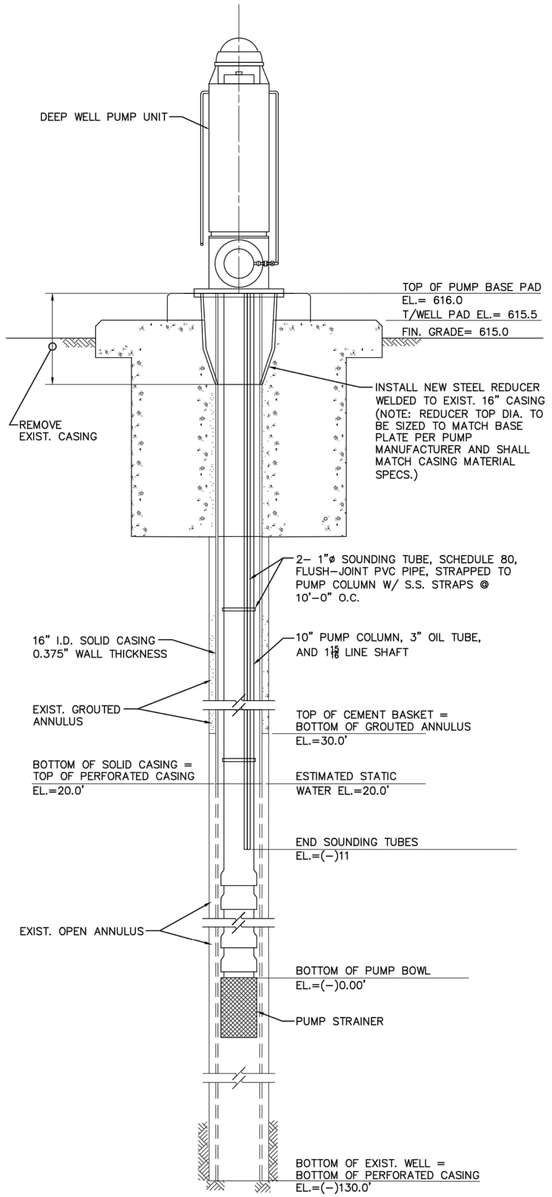
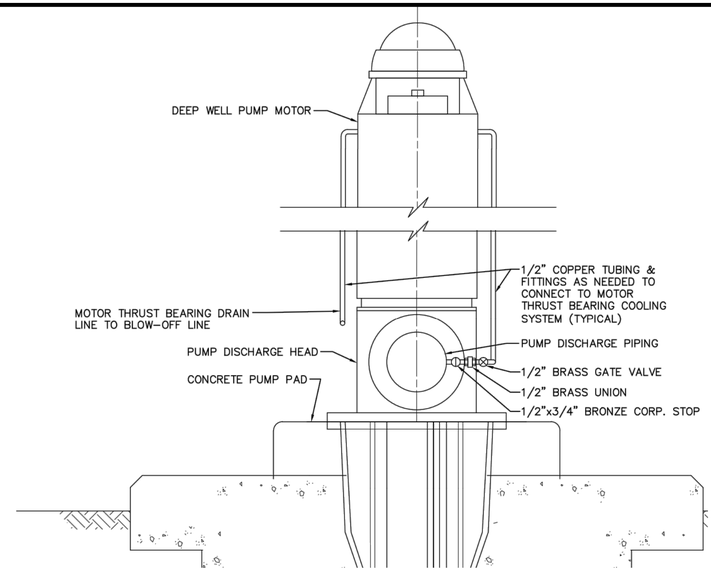


SECTION A–A

NOT TO SCALE

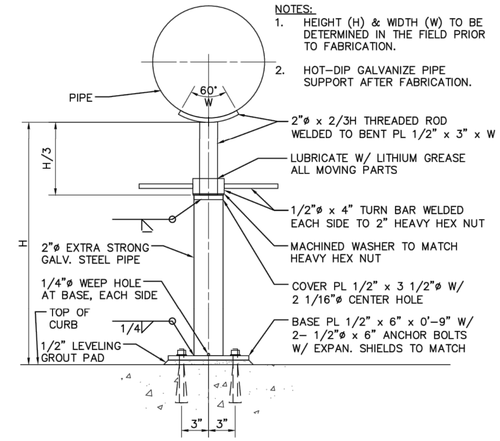


MOTOR THRUST BEARING COOLING SYSTEM DETAIL

NOT TO SCALE

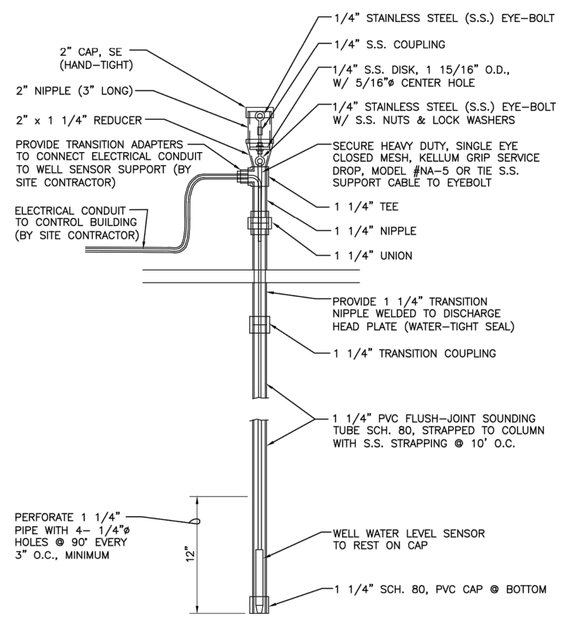
NOTES:

1. HEIGHT (H) & WIDTH (W) TO BE DETERMINED IN THE FIELD PRIOR TO FABRICATION.
2. HOT–DIP GALVANIZE PIPE SUPPORT AFTER FABRICATION.



STEEL PIPE SUPPORT DETAIL

NOT TO SCALE

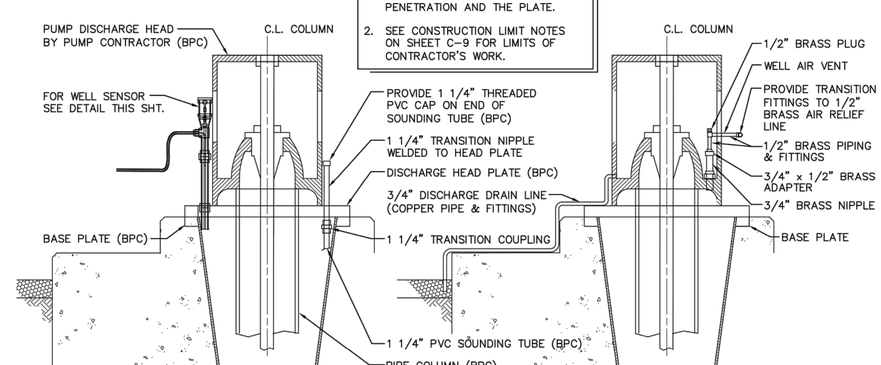


WELL SENSOR (BPC) DETAIL

NOT TO SCALE

NOTES:

1. ALL PENETRATIONS THROUGH THE DISCHARGE PLATE SHALL PROVIDE A WATERTIGHT SEAL BETWEEN THE PENETRATION AND THE PLATE.
2. SEE CONSTRUCTION LIMIT NOTES ON SHEET C–9 FOR LIMITS OF CONTRACTOR'S WORK.



WELL SENSOR & SOUNDING TUBE SECTION

DISCHARGE DRAIN & AIR VENT SECTION

SOUNDING TUBE, WELL SENSOR & AIR VENT DETAIL

NOT TO SCALE

WAIAHOLE WATER SYSTEM IMPROVEMENTS

R. M. TOWILL CORPORATION
Planning • Engineering • Environmental Services • Photogrammetry • Surveying • Construction Management
2024 North King Street Suite 200
Honolulu Hawaii 96819

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Signature — 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	BY	APPROVED

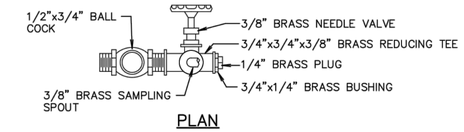
APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP–XX

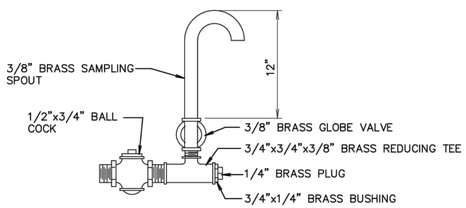
WELL PUMP SECTIONS & DETAILS

RMTC JOB NO: 1–23196–OE

FILE	POCKET	FOLDER	NO.



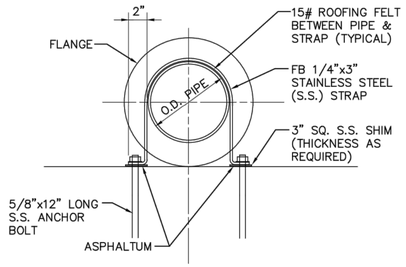
PLAN



ELEVATION

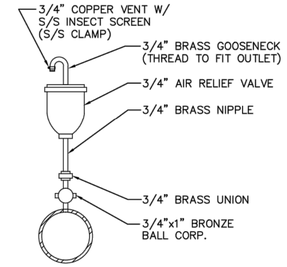
SAMPLING COCK DETAIL

NOT TO SCALE



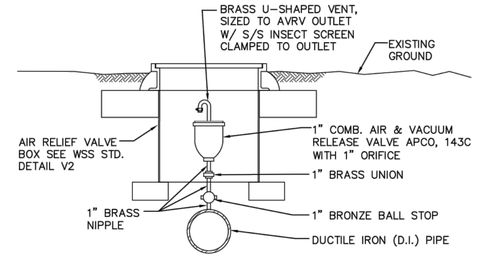
PIPE STRAP DETAIL

NOT TO SCALE



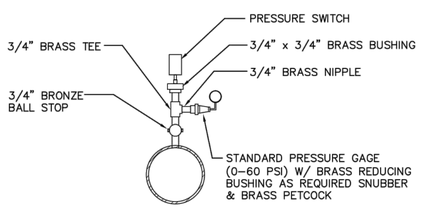
3/4" ARV UNIT

NOT TO SCALE



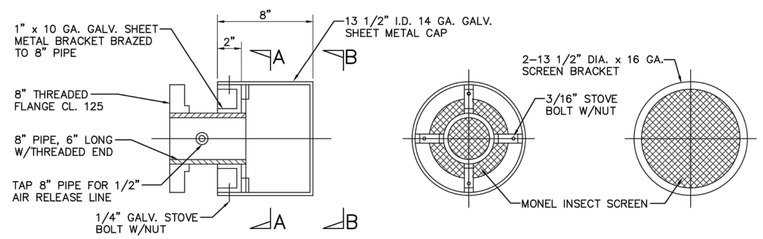
COMBINATION AIR & VACUUM RELEASE VALVE UNIT

NOT TO SCALE



PRESSURE SWITCH UNIT

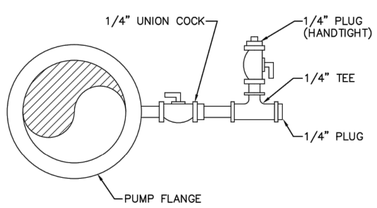
NOT TO SCALE



TYPICAL SECTION SECTION A-A SECTION B-B

SCREEN & FITTING DETAIL

NOT TO SCALE



TEST GAGE AT PUMP FLANGE

NOT TO SCALE

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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Signature 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	BY

APPROVED BY

ENGINEER	
DRAFTSMAN	
CHECKED BY	
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

WELL PUMP DETAILS

RMTC JOB NO.: 1-23196-QE

FILE	POCKET	FOLDER	NO.

ELECTRICAL SYMBOLS

SYMBOL	DESCRIPTION
	DUPLEX RECEPTACLE, NEMA 5-15R, 120V, MTD. +18" OR AS NOTED
	DUPLEX RECEPTACLE, WITH GROUND FAULT CIRCUIT INTERRUPTER, NEMA 5-20R, 120V, MTD. +18" OR AS NOTED
	DUPLEX RECEPTACLE, WITH GROUND FAULT CIRCUIT INTERRUPTER, NEMA 5-20R, 120V, CHANNEL MOUNTED IN WEATHERPROOF HOUSING
	ELECTRICAL PANELBOARD
J	JUNCTION BOX, CEIL. MTD., 4-11/16" NOM.
J	JUNCTION BOX, WALL MTD., 4-11/16" NOM.
	JUNCTION BOX MTD. ON CHANNEL SUPPORT, SEE DETAIL 1/E401
$a	LT. SW., 1P, CONTROLLING OUTLET(S) "a", MTD. +48" OR AS NOTED
E	EQUIPMENT CONNECTION
M/H	MOTOR AND MOTOR HEATER CONNECTIONS
BFV	BUTTERFLY VALVE CONNECTION
HDPS	HIGH DISCHARGE PRESSURE SWITCH CONNECTION
FS	FLOW SWITCH CONNECTION
LS	LIMIT SWITCH CONNECTION
OLS	OIL LUBE SOLENOID CONNECTION
WFT	WELL FLOW TRANSMITTER CONNECTION
WLT	WELL LEVEL TRANSDUCER CONNECTION

SYMBOL	DESCRIPTION
	FLEXIBLE CONDUIT, LIQUIDTIGHT
	EXPOSED CONDUIT
	CONDUIT OR DUCTLINE BELOW REF. FL. OR GROUND
	CONDUIT CONCEALED ABOVE REF. FL., 3 WIRES WITH GROUND WIRE
	EXISTING UTILITY OVERHEAD LINES
	EXISTING DUCTLINE
A S 1-4E 1-1C	ELECTRIC/SIGNAL DUCTLINE WITH DESIGNATORS; ITEMS IN CIRCLE INDICATES DUCT SECTION TYPE, WITH DUCT COMPLEMENTS NOTED BELOW (TYPE "A" DUCT INDICATED WITH 1-4"E DUCT, AND TYPE "S" DUCT WITH 1-1"C DUCT; E=ELECTRIC, T=TELEPHONE, C=CONTROLS, I=INSTRUMENTATION, A=ANTENNA); SEE SHEET E004 FOR DUCT SECTION DETAILS
	3'X5' HECO CONCRETE HANDHOLE PER HECO REQUIREMENTS AND APPROVAL
SPD	DENOTES "SURGE PROTECTIVE DEVICE"
WP	DENOTES "WEATHERPROOF"
SS	DENOTES "TYPE 316 STAINLESS STEEL"

NOTE:

NO HASH MARKS ON CONDUITS INDICATE 2 WIRES; INDICATES 3 WIRES; INDICATES 4 WIRES, ETC.

GENERAL CONSTRUCTION NOTES

1. CONTRACTOR SHALL COORDINATE ALL WORK WITH THE HAWAII ELECTRIC LIGHT COMPANY.
2. PROVIDE POLYOLEFIN 200LB TEST PULLCORD IN ALL EMPTY CONDUITS, UNLESS OTHERWISE NOTED.
3. ALL ELECTRICAL EQUIPMENT ENCLOSURES AND EQUIPMENT MOUNTING HARDWARE AND FASTENERS FOR OUTDOOR INSTALLATION SHALL BE TYPE 316 STAINLESS STEEL, UNLESS OTHERWISE NOTED.

CITY AND COUNTY OF HONOLULU
REVISED ORDINANCE CHAPTER 32,
HONOLULU COUNTY CODE 1990, AS AMENDED

TO THE BEST OF MY KNOWLEDGE, THIS PROJECT'S DESIGN SUBSTANTIALLY CONFORMS TO THE 2015 IECC BUILDING ENERGY CONSERVATION CODE FOR:
COMMERCIAL ELECTRICAL SYSTEMS (SECTION C405) INCLUDING:

ELECTRICAL SYSTEM COMPLIANCE	COMPLIES
LIGHTING CONTROLS LIGHTING CONTROLS AS PER SECTION C405.2.1, C405.2.2, C405.2.3, C405.2.4, AND C405.2.5	N/A
INTERIOR LIGHTING POWER ☐ BUILDING AREA METHOD PER TABLE 405.4.2(I) ☐ SPACE-BY-SPACE METHOD PER TABLE C405.4.2(2)	N/A
EXTERIOR LIGHTING POWER AS PER TABLE C405.5.1(2)	N/A
SEPARATE ELECTRICAL METER FOR EACH DWELLING UNIT IN GROUP R-2 BUILDING	N/A
ELECTRICAL TRANSFORMERS MINIMUM EFFICIENCY PER TABLE C405.7	N/A
ELECTRICAL MOTORS MINIMAL EFFICIENCY PER TABLE C405.8(1) TO C405.8(4)	N/A
SUB-METERING IN NEW BUILDINGS WITH TENANTS, METERING SHALL BE COLLECTED FOR THE ENTIRE BUILDING AND INDIVIDUALLY FOR EACH TENANT OCCUPYING 1,000 SQ. FT. OR MORE.	N/A

SIGNATURE: DATE: 2020.04.15
NAME: BRYCE H. KANEMURA LICENSE NO.: 16360-E
TITLE: ELECTRICAL ENGINEER

WAIAHOLE WATER SYSTEM IMPROVEMENTS

R. M. TOWILL CORPORATION
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2024 North King Street Suite 200
Honolulu Hawaii 96819

BRYCE H. KANEMURA
LICENSED PROFESSIONAL ENGINEER
No. 16360-E
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

SIGNATURE 2020.04.15 EXP. DATE 4/30/22

REVISION	DATE	BREF	BY	APPROVED

APPROVED BY

ENGINEER	BHK
DRAFTSMAN	BHK
CHECKED BY	BO
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

SYMBOLS LIST, GENERAL NOTES

FILE	POCKET	FOLDER	NO.

2020-04-15 11:51 AM Z:\ACAD\PROJECTS\220052\E001_220052-symbols

HAWAIIAN ELECTRIC COMPANY NOTES (REV. 2/05/2020)

1. LOCATION OF HAWAIIAN ELECTRIC FACILITIES

THE LOCATION OF HAWAIIAN ELECTRIC'S OVERHEAD AND UNDERGROUND FACILITIES SHOWN ON THE PLANS ARE FROM EXISTING RECORDS WITH VARYING DEGREES OF ACCURACY AND ARE NOT GUARANTEED AS SHOWN. THE CONTRACTOR SHALL VERIFY IN THE FIELD THE LOCATIONS OF THE FACILITIES AND SHALL EXERCISE PROPER CARE IN EXCAVATING AND WORKING IN THE AREA. WHEREVER CONNECTIONS OF NEW UTILITIES TO EXISTING UTILITIES AND UTILITY CROSSINGS ARE SHOWN, THE CONTRACTOR SHALL EXPOSE THE EXISTING LINES AT THE PROPOSED CONNECTIONS AND CROSSINGS TO VERIFY THE DEPTHS PRIOR TO EXCAVATION FOR THE NEW LINES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGES TO HAWAIIAN ELECTRIC'S FACILITIES WHETHER SHOWN OR NOT SHOWN ON THE PLANS.

2. COMPLIANCE WITH HAWAII OCCUPATIONAL SAFETY AND HEALTH LAWS

THE CONTRACTOR SHALL COMPLY WITH THE STATE OF HAWAII'S OCCUPATIONAL SAFETY AND HEALTH LAWS AND REGULATIONS, INCLUDING WITHOUT LIMITATION, THOSE RELATED TO WORKING ON OR NEAR EXPOSED OR ENERGIZED ELECTRICAL LINES AND EQUIPMENT.

3. EXCAVATION CLEARANCE

THE CONTRACTOR SHALL OBTAIN AN EXCAVATION CLEARANCE FROM HAWAIIAN ELECTRIC'S PLANNING AND DESIGN SECTION OF THE CUSTOMER INSTALLATIONS DIVISION (543-5654) LOCATED AT 820 WARD AVENUE, 4TH FLOOR, A MINIMUM OF TEN (10) WORKING DAYS PRIOR TO STARTING CONSTRUCTION.

4. CAUTION!!! ELECTRICAL HAZARD!!!

EXISTING HAWAIIAN ELECTRIC OVERHEAD AND UNDERGROUND LINES ARE ENERGIZED AND WILL REMAIN ENERGIZED DURING CONSTRUCTION UNLESS PRIOR SPECIAL ARRANGEMENTS HAVE BEEN MADE WITH HAWAIIAN ELECTRIC. ONLY HAWAIIAN ELECTRIC PERSONNEL ARE TO HANDLE THESE ENERGIZED LINES AND ERECT TEMPORARY GUARDS TO PROTECT THESE LINES FROM DAMAGE. THE CONTRACTOR SHALL WORK CAUTIOUSLY AT ALL TIMES TO AVOID ACCIDENTS AND DAMAGE TO EXISTING HAWAIIAN ELECTRIC FACILITIES, WHICH CAN RESULT IN ELECTROCUTION.

5. OVERHEAD LINES

STATE LAW (OSHA) REQUIRES THAT A WORKER AND THE LONGEST OBJECT HE OR SHE MAY CONTACT CANNOT COME CLOSER THAN A SPECIFIED MINIMUM RADIAL CLEARANCE WHEN WORKING CLOSE TO OR UNDER ANY OVERHEAD LINES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE INFORMED OF AND COMPLY WITH THE LAW.

AT ANY TIME SHOULD THE CONTRACTOR ANTICIPATE THAT HIS WORK WILL RESULT IN THE NEED TO ENCROACH WITHIN THE MINIMUM REQUIRED CLEARANCE AS STATED IN THE LAW, THE CONTRACTOR SHALL NOTIFY HAWAIIAN ELECTRIC AT LEAST THREE (3) MONTHS PRIOR TO THE PLANNED ENCROACHMENT SO THAT, IF FEASIBLE, THE NECESSARY PROTECTIONS (E.G. RELOCATE OR DE-ENERGIZE HAWAIIAN ELECTRIC LINES) CAN BE INVESTIGATED. HAWAIIAN ELECTRIC MAY ALSO BE ABLE TO BLANKET ITS DISTRIBUTION (12KV AND BELOW) LINES TO PROVIDE A VISUAL AID IN PREVENTING ACCIDENTAL CONTACT. HAWAIIAN ELECTRIC'S COST OF SAFEGUARDING OR IDENTIFYING ITS LINES WILL BE CHARGED TO THE CONTRACTOR.

CONTACT HAWAIIAN ELECTRIC'S CUSTOMER INSTALLATIONS DIVISION AT 543-7070 FOR ASSISTANCE IN IDENTIFYING AND SAFEGUARDING OVERHEAD POWER LINES.

6. POLE BRACING

CONTRACTOR SHALL NOT EXCAVATE WITHIN 10 FEET OF HAWAIIAN ELECTRIC'S UTILITY POLES OR ANY ANCHOR SYSTEM SUPPORTING THE UTILITY POLE. IF CONTRACTOR MUST EXCAVATE AN AREA MORE THAN 12 INCHES DEEP BY 12 INCHES WIDE, AND CLOSER THAN 10 FEET FROM A UTILITY POLE OR ITS ANCHOR SYSTEM, CONTRACTOR WILL BE RESPONSIBLE FOR PROTECTING, SUPPORTING, SECURING AND TAKING ALL PRECAUTIONS TO PREVENT DAMAGE TO OR LEANING OF EXISTING POLES. BEFORE COMMENCING SUCH EXCAVATION, CONTRACTOR MUST NOTIFY HAWAIIAN ELECTRIC WHICH MAY LEAD TO IMPLEMENTING POLE BRACING REQUIREMENTS. HAWAIIAN ELECTRIC REQUIRES A MINIMUM OF TEN (10) WORKING DAYS TO CONDUCT THE REVIEW OF CONTRACTOR'S SUBMITTAL. CONTRACTOR SHALL SUBMIT ITS BRACING CALCULATIONS AND DRAWINGS, PREPARED AND STAMPED BY A LICENSED STRUCTURAL ENGINEER, TO HAWAIIAN ELECTRIC'S CUSTOMER INSTALLATIONS DIVISION (543-7070) FOR REVIEW. CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, INSTALLATION, AND REMOVAL OF THE TEMPORARY POLE BRACING SYSTEM, AS WELL AS ALL COSTS INCURRED BY HAWAIIAN ELECTRIC TO REVIEW CONTRACTOR'S DRAWINGS AND TO REPAIR OR STRAIGHTEN POLES IMPACTED BY CONTRACTOR'S ACTIVITIES, INCLUDING RESPONSE AND RESTORATION COSTS INCURRED BY HAWAIIAN ELECTRIC ARISING OUT OF OR RELATED TO OUTAGES CAUSED BY CONTRACTOR'S FAILURE TO MEET THE FOREGOING REQUIREMENTS. HAWAIIAN ELECTRIC'S RECEIPT OF POLE BRACING CALCULATION OR DRAWING SUBMITTALS OF ANY CONTRACTOR, INCLUDING WORK PROCEDURE, SHALL NOT RELIEVE CONTRACTOR FROM ANY LIABILITY RESULTING FROM CONTRACTOR'S EXCAVATION NEAR OR AROUND HAWAIIAN ELECTRIC'S UTILITY POLES.

7. UNDERGROUND LINES

THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION WHENEVER CONSTRUCTION CROSSES OR IS IN CLOSE PROXIMITY OF UNDERGROUND LINES. HAWAIIAN ELECTRIC'S EXISTING ELECTRICAL CABLES ARE ENERGIZED AND WILL REMAIN ENERGIZED DURING CONSTRUCTION. ONLY HAWAIIAN ELECTRIC PERSONNEL ARE TO BREAK INTO EXISTING HAWAIIAN ELECTRIC FACILITIES, HANDLE THESE CABLES, AND ERECT TEMPORARY GUARDS TO PROTECT THESE CABLES FROM DAMAGE. THE COST OF HAWAIIAN ELECTRIC'S ASSISTANCE IN PROVIDING PROPER SUPPORT AND PROTECTION OF ITS UNDERGROUND LINES WILL BE CHARGED TO THE CONTRACTOR. FOR ASSISTANCE/COORDINATION IN PROVIDING PROPER SUPPORT AND PROTECTION OF THESE LINES, THE CONTRACTOR SHALL CALL HAWAIIAN ELECTRIC'S CUSTOMER INSTALLATIONS DIVISION AT 543-7070 A MINIMUM OF TEN (10) WORKING DAYS IN ADVANCE.

SPECIAL PRECAUTIONS ARE REQUIRED WHEN EXCAVATING NEAR HAWAIIAN ELECTRIC'S 138KV OR 46KV UNDERGROUND LINES (SEE HAWAIIAN ELECTRIC INSTRUCTIONS TO CONSULTANTS/CONTRACTORS ON "EXCAVATION NEAR HAWAIIAN ELECTRIC'S UNDERGROUND 138KV AND/OR 46KV LINES" FOR DETAILED REQUIREMENTS).

FOR VERIFICATION OF UNDERGROUND LINES, THE CONTRACTOR SHALL CALL THE HAWAII ONE CALL CENTER AT 866-423-7287 MINIMUM OF FIVE (5) WORKING DAYS IN ADVANCE.

8. UNDERGROUND FUEL PIPELINES

THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION WHENEVER CONSTRUCTION CROSSES OR IS IN CLOSE PROXIMITY OF HAWAIIAN ELECTRIC'S UNDERGROUND FUEL OIL PIPELINES. SPECIAL PRECAUTIONS ARE REQUIRED WHEN EXCAVATING NEAR HAWAIIAN ELECTRIC'S UNDERGROUND FUEL OIL PIPELINES (SEE HAWAIIAN ELECTRIC'S SPECIFIC FUEL PIPELINE "GUIDELINES" TO CONSULTANTS/CONTRACTORS ON EXCAVATION NEAR HAWAIIAN ELECTRIC'S UNDERGROUND FUEL PIPELINES FOR DETAILED REQUIREMENTS).

9. EXCAVATIONS

WHEN TRENCH EXCAVATION IS ADJACENT TO OR BENEATH HAWAIIAN ELECTRIC'S EXISTING STRUCTURES OR FACILITIES, THE CONTRACTOR IS RESPONSIBLE FOR:

a) ARRANGING FOR HAWAIIAN ELECTRIC STANDBY PERSONNEL TO OBSERVE WORK AT CONTRACTOR'S COST.
b) SHEETING, BRACING, OR OTHERWISE SUPPORTING THE EXCAVATION AND STABILIZING THE EXISTING GROUND TO RENDER IT SAFE AND SECURE AND TO PREVENT POSSIBLE SLIDES, CAVE-INS, AND SETTLEMENTS.
c) PROPERLY SUPPORTING EXISTING STRUCTURES OR FACILITIES WITH BEAMS, STRUTS, UNDER-PINNINGS, OR OTHER NECESSARY METHODS TO FULLY PROTECT IT FROM DAMAGE.
d) BACKFILLING WITH PROPER BACKFILL MATERIAL INCLUDING SPECIAL THERMAL BACKFILL WHERE EXISTING (REFER TO ENGINEERING DIVISION FOR THERMAL BACKFILL SPECIFICATIONS).

10. RELOCATION OF HAWAIIAN ELECTRIC FACILITIES

ANY WORK REQUIRED TO RELOCATE OR MODIFY HAWAIIAN ELECTRIC FACILITIES SHALL BE DONE BY HAWAIIAN ELECTRIC, OR BY THE CONTRACTOR UNDER HAWAIIAN ELECTRIC'S SUPERVISION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COORDINATION, AND SHALL PROVIDE NECESSARY SUPPORT FOR HAWAIIAN ELECTRIC'S WORK, WHICH MAY INCLUDE, BUT NOT BE LIMITED TO, STAKING OF POLE/ANCHOR LOCATIONS, IDENTIFYING RIGHT OF WAY AND PROPERTY LINES, EXCAVATION AND BACKFILL, PERMITS AND TRAFFIC CONTROL, BARRICADING, AND RESTORATION OF PAVEMENT, SIDEWALKS, AND OTHER FACILITIES.

ALL COSTS ASSOCIATED WITH ANY RELOCATION OR MODIFICATION (EITHER TEMPORARY OR PERMANENT) FOR THE CONVENIENCE OF THE CONTRACTOR, OR TO ENABLE THE CONTRACTOR TO PERFORM HIS WORK IN A SAFE AND EXPEDITIOUS MANNER IN FULFILLING HIS CONTRACT OBLIGATIONS SHALL BE BORNE BY THE CONTRACTOR.

11. CONFLICTS

ANY REDESIGN OR RELOCATION OF HAWAIIAN ELECTRIC'S FACILITIES NOT SHOWN ON THE PLANS MAY BE CAUSE FOR LENGTHY DELAYS. THE CONTRACTOR ACKNOWLEDGES THAT HAWAIIAN ELECTRIC IS NOT RESPONSIBLE FOR ANY DELAY OR DAMAGE THAT MAY ARISE AS A RESULT OF ANY CONFLICTS DISCOVERED OR IDENTIFIED WITH RESPECT TO THE LOCATION OR CONSTRUCTION OF HAWAIIAN ELECTRIC'S ELECTRICAL FACILITIES IN THE FIELD, REGARDLESS OF WHETHER THE CONTRACTOR HAS MET THE REQUESTED MINIMUM ADVANCE NOTICES. IN ORDER TO MINIMIZE ANY DELAY OR IMPACT ARISING FROM SUCH CONFLICTS, HAWAIIAN ELECTRIC SHOULD BE NOTIFIED IMMEDIATELY UPON DISCOVERY OR IDENTIFICATION OF SUCH CONFLICT.

12. DAMAGE TO HAWAIIAN ELECTRIC FACILITIES

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL HAWAIIAN ELECTRIC SURFACE AND SUBSURFACE UTILITIES AND SHALL BE RESPONSIBLE FOR ANY DAMAGES TO HAWAIIAN ELECTRIC'S FACILITIES AS A RESULT OF HIS OPERATIONS. THE CONTRACTOR SHALL IMMEDIATELY REPORT SUCH DAMAGES OR ANY HAZARDOUS CONDITIONS RELATED TO HAWAIIAN ELECTRIC'S LINES TO HAWAIIAN ELECTRIC'S TROUBLE DISPATCHER AT 548-7961. REPAIR WORK SHALL BE DONE BY HAWAIIAN ELECTRIC OR BY THE CONTRACTOR UNDER HAWAIIAN ELECTRIC'S SUPERVISION. COSTS FOR DAMAGES TO HAWAIIAN ELECTRIC'S FACILITIES SHALL BE BORNE BY THE CONTRACTOR.

IN CASE OF DAMAGE OR SUSPECTED DAMAGE TO HAWAIIAN ELECTRIC'S FUEL PIPELINE, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY HAWAIIAN ELECTRIC'S SECURITY COMMAND CENTER AT 543-7685 (A 24-HOUR NUMBER) SO HAWAIIAN ELECTRIC PERSONNEL CAN SECURE THE DAMAGED SECTION AND REPORT ANY OIL SPILLS TO THE PROPER AUTHORITIES. ALL COSTS ASSOCIATED WITH THE DAMAGE, REPAIR, AND OIL SPILL CLEANUP SHALL BE BORNE BY THE CONTRACTOR.

13. HAWAIIAN ELECTRIC STAND-BY PERSONNEL

THE CONTRACTOR MAY REQUEST HAWAIIAN ELECTRIC TO PROVIDE AN INSPECTOR TO STAND-BY DURING CONSTRUCTION NEAR HAWAIIAN ELECTRIC'S FACILITIES. THE COST OF SUCH INSPECTION WILL BE CHARGED TO THE CONTRACTOR.

THE CONTRACTOR SHALL CALL HAWAIIAN ELECTRIC'S CUSTOMER INSTALLATIONS DIVISION AT 543-7070 A MINIMUM OF THREE (3) MONTHS IN ADVANCE TO ARRANGE FOR HAWAIIAN ELECTRIC STAND-BY PERSONNEL.

14. CLEARANCES

THE FOLLOWING CLEARANCES SHALL BE MAINTAINED BETWEEN HAWAIIAN ELECTRIC'S DUCTLINE AND ALL ADJACENT STRUCTURES (CHARTED AND UNCHARTED) IN THE TRENCH:

GUIDELINES FOR MINIMUM HORIZONTAL (PARALLEL) CLEARANCES BETWEEN HAWAIIAN ELECTRIC AND OTHER UNDERGROUND UTILITIES

UNDERGROUND UTILITY	HAWAIIAN ELECTRIC DIRECT BURIED CABLE	HAWAIIAN ELECTRIC DIRECT BURIED IN CONDUIT (NO CONCRETE ENCASEMENT)	HAWAIIAN ELECTRIC 3" (MINIMUM) CONCRETE ENCASEMENT	APPLICABLE NOTES:
HAWAIIAN ELECTRIC DB CONDUITS	12"	3"	0"	
HAWAIIAN ELECTRIC 3" ENCASEMENT	0"	0"	0"	
TELEPHONE/CATV DB	12"	12"	6"	
TELEPHONE/CATV DB DUCTS	12"	12"	6"	
TELEPHONE/CATV 3" ENCASEMENT	0"	0"	0"	5
TRAFFIC SIGNAL	12"	12"	12"	
WATER DB (BWS OWNED)	36"	36"	36"	1, 4
CUSTOMER OWNED WATER SERVICE LATERALS	12"	12"	12"	
WATER (CONCRETE JACKETED) (BWS OWNED)	36"	36"	36"	1, 4
GAS DB	12"	12"	12"	1
GAS (CONCRETE JACKETED)	12"	12"	12"	1
SEWER DB	36"	36"	36"	1, 2
SEWER (CONCRETE JACKETED)	36"	36"	36"	1, 2
DRAIN	12"	12"	12"	1
FUEL PIPELINES				3

NOTES:

1. WHERE SPACE IS AVAILABLE, PARALLEL CLEARANCE TO OTHER UTILITIES, OR FOREIGN STRUCTURES OTHER THAN COMMUNICATION OR TRAFFIC SIGNAL SHALL BE 36"
2. IF 36" CLEARANCE CANNOT BE MET:
   - IF CLEARANCE IS LESS THAN 12", JACKET SEWER LINE WITH REINFORCED CONCRETE (PER HAWAIIAN ELECTRIC'S STD. 30-1030) FOR A DISTANCE OF 5' PLUS PIPE DIAMETER.
   - IF CLEARANCE IS BETWEEN 12" AND 36", JACKET SEWER LINE WITH PLAIN CONCRETE.
3. ALL FUEL PIPELINE CROSSINGS SHALL BE REVIEWED AND APPROVED BY THE COMPANY THAT OWNS AND MAINTAINS IT.
4. 5 FEET CLEAR TO WATER MAINS 16" OR LARGER.
5. FOR SITUATIONS WITH 0" MINIMUM SEPARATION, A 6" SEPARATION IS RECOMMENDED.
6. CLEARANCES MEASURED FROM OUTER EDGES OR DIAMETERS OF UTILITIES. WHENEVER CONCRETE JACKETS ARE INVOLVED, CLEARANCES SHALL BE TOTAL CLEAR DISTANCE BETWEEN THE CONCRETE JACKET AND UTILITY CONCERNED.

GUIDELINES FOR MINIMUM VERTICAL (CROSSING) CLEARANCES HAWAIIAN ELECTRIC AND OTHER UNDERGROUND UTILITIES

UNDERGROUND UTILITY	HAWAIIAN ELECTRIC DIRECT BURIED CABLE	HAWAIIAN ELECTRIC DIRECT BURIED IN CONDUIT (NO CONCRETE ENCASEMENT)	HAWAIIAN ELECTRIC 3" (MINIMUM) CONCRETE ENCASEMENT	APPLICABLE NOTES:
HAWAIIAN ELECTRIC DB CONDUITS	6"	3"	0"	
HAWAIIAN ELECTRIC 3" ENCASEMENT	0"	0"	0"	
TELEPHONE/CATV DB	12"	12"	6"	
TELEPHONE/CATV DB DUCTS	12"	12"	6"	
TELEPHONE/CATV 3" ENCASEMENT	0"	0"	0"	3
TRAFFIC SIGNAL	12"	12"	6"	
WATER DB (BWS OWNED)	12"	12"	12"	5
CUSTOMER OWNED WATER SERVICE LATERALS	6"	6"	6"	
WATER (CONCRETE JACKETED) (BWS OWNED)	12"	12"	12"	5
GAS DB	12"	12"	12"	
GAS (CONCRETE JACKETED)	12"	12"	12"	
SEWER DB	24"	24"	24"	1
SEWER (CONCRETE JACKETED)	24"	24"	24"	1
DRAIN	12"	12"	6"	
FUEL PIPELINES				2

NOTES:

1. IF CLEARANCE CANNOT BE MET:
   - IF CLEARANCE IS LESS THAN 12", JACKET SEWER LINE WITH REINFORCED CONCRETE (PER HAWAIIAN ELECTRIC'S STD. 30-1030) FOR A DISTANCE OF 5' PLUS PIPE DIAMETER.
   - IF CLEARANCE IS BETWEEN 12" AND 24", JACKET SEWER LINE WITH PLAIN CONCRETE.
2. ALL FUEL PIPELINE CROSSINGS SHALL BE REVIEWED AND APPROVED BY THE COMPANY THAT OWNS AND MAINTAINS IT.
3. FOR SITUATIONS WITH 0" MINIMUM SEPARATION, A 6" SEPARATION IS RECOMMENDED.
4. CLEARANCES MEASURED FROM OUTER EDGES OR DIAMETERS OF UTILITIES. WHENEVER CONCRETE JACKETS ARE INVOLVED, CLEARANCES SHALL BE TOTAL CLEAR DISTANCE BETWEEN THE CONCRETE JACKET AND UTILITY CONCERNED.
5. 36" CLEARANCE IS REQUIRED FOR TRENCHLESS INSTALLATION WORK.

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HECO NOTES I

E002 SHEET OF SHEETS

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HAWAIIAN ELECTRIC COMPANY NOTES (CONTINUED) (REV. 2/05/2020)

THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER & HAWAIIAN ELECTRIC OF ANY HEAT SOURCES (POWER CABLE DUCT BANK, STEAMLINE, ETC.) ENCOUNTERED THAT ARE NOT PROPERLY IDENTIFIED ON THE DRAWING.

15. INDEMNITY

THE CONTRACTOR SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS HAWAIIAN ELECTRIC FROM AND AGAINST ALL LOSSES, DAMAGES, CLAIMS, AND ACTIONS, INCLUDING BUT NOT LIMITED TO REASONABLE ATTORNEY'S FEES AND COSTS BASED UPON OR ARISING OUT OF DAMAGE TO PROPERTY OR INJURIES TO PERSONS, OR OTHER TORTIOUS ACTS CAUSED OR CONTRIBUTED TO BY CONTRACTOR OR ANYONE ACTING UNDER ITS DIRECTION OR CONTROL OR ON ITS BEHALF; PROVIDED CONTRACTOR'S INDEMNITY SHALL NOT BE APPLICABLE TO ANY LIABILITY BASED UPON THE SOLE NEGLIGENCE OF HAWAIIAN ELECTRIC.

ADDITIONAL NOTES WHEN WORK INVOLVES CONSTRUCTION OF HAWAIIAN ELECTRIC FACILITIES

16. SCHEDULE

CONTRACTOR SHALL FURNISH HIS CONSTRUCTION SCHEDULE SIX (6) MONTHS PRIOR TO STARTING WORK ON HAWAIIAN ELECTRIC FACILITIES. CONTRACTOR SHALL GIVE HAWAIIAN ELECTRIC, IN WRITING, THREE (3) MONTHS NOTICE TO PROCEED WITH HAWAIIAN ELECTRIC'S PORTION OF WORK.

17. AUTHORITY

ALL CONSTRUCTION, RESTORATION WORK, AND INSPECTION SHALL BE SUBJECT TO WHICHEVER GOVERNMENTAL AGENCY HAS AUTHORITY OVER THE WORK.

18. SPECIFICATIONS

CONSTRUCTION OF HAWAIIAN ELECTRIC'S UNDERGROUND FACILITIES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST REVISIONS OF HAWAIIAN ELECTRIC SPECIFICATIONS CS7001, CS7003, CS7202, CS9301, AND CS9401 AND APPLICABLE HAWAIIAN ELECTRIC STANDARDS.

19. CONSTRUCTION

CONTRACTOR SHALL FURNISH ALL LABOR, MATERIALS, EQUIPMENT, AND SERVICES TO PROPERLY PERFORM AND FULLY COMPLETE ALL WORK SHOWN ON THE CONTRACT, DRAWINGS, AND SPECIFICATIONS. ALL MATERIALS SHALL BE NEW AND MANUFACTURED IN THE UNITED STATES OF AMERICA. ALL MANHOLE, HANDHOLE, AND DUCTLINE INSTALLATIONS SHALL BE INSPECTED AND APPROVED BY HAWAIIAN ELECTRIC PRIOR TO EXCAVATION AND PRIOR TO PLACING CONCRETE. CONTRACTOR SHALL NOTIFY HAWAIIAN ELECTRIC'S INSPECTION GROUP AT 543-2567 AT LEAST FIVE (5) WORKING DAYS PRIOR TO INSTALLING FACILITIES OR PLACING CONCRETE.

CONTRACTOR TO COORDINATE WORK TO BREAK INTO HAWAIIAN ELECTRIC'S EXISTING ELECTRICAL FACILITIES WITH HAWAIIAN ELECTRIC'S INSPECTION GROUP AT 543-2567 AT LEAST TEN (10) WORKING DAYS IN ADVANCE.

20. STAKEOUT

THE CONTRACTOR SHALL ARRANGE FOR TONEOUTS OF ALL UNDERGROUND FACILITIES AND SHALL STAKEOUT ALL PROPOSED HAWAIIAN ELECTRIC FACILITIES WITHIN THE PROJECT AREA SO AS TO NOT CONFLICT WITH ANY UTILITY (EXISTING OR PROPOSED) AND ANY PROPOSED CONSTRUCTION OR IMPROVEMENT WORK FOR VERIFICATION BY HAWAIIAN ELECTRIC BEFORE PROCEEDING WITH HAWAIIAN ELECTRIC WORK.

21. DUCTLINES

ALL DUCTLINE INSTALLATIONS SHALL BE PVC SCHEDULE 40 ENCASED IN CONCRETE, UNLESS OTHERWISE NOTED. ALL COMPLETED DUCTLINES SHALL BE MANDREL TESTED BY THE CONTRACTOR IN THE PRESENCE OF HAWAIIAN ELECTRIC'S INSPECTOR USING HAWAIIAN ELECTRIC'S STANDARD PRACTICE. THE CONTRACTOR SHALL INSTALL 1800# TENSILE STRENGTH MULETAPE PULL LINE IN ALL COMPLETED DUCTLINES AFTER MANDREL TESTING IS COMPLETE.

22. JOINT POLE REMOVAL

THE LAST JOINT POLE OCCUPANT OFF THE POLES SHALL REMOVE THE POLES.

23. AS-BUILT PLANS

THE CONTRACTOR SHALL PROVIDE HAWAIIAN ELECTRIC WITH A SET OF ELECTRONIC AND HARD COPY PLANS OF EACH SHEET SHOWING THE OFFSETS, STATIONING, AND VERTICAL ELEVATION OF THE DUCT LINE(S) CONSTRUCTED.

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HECO NOTES II

E003 SHEET OF SHEETS

FILE	POCKET	FOLDER	NO.

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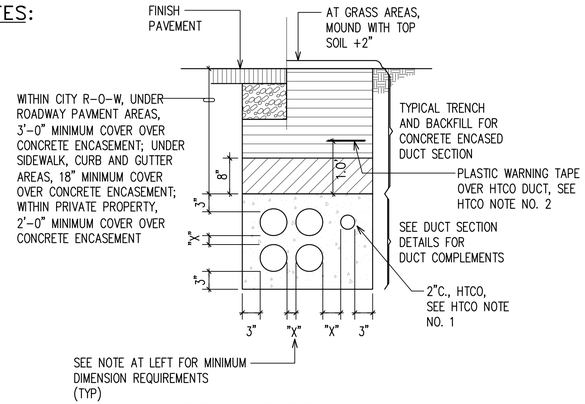
DUCT SECTION BACKFILL NOTES:

TYPE "A" BACKFILL – EARTH & GRAVEL. ROCK SIZE TO BE 1" MAX. & THE MIXTURE TO CONTAIN NOT MORE THAN 50% BY VOLUME OF ROCK PARTICLES. 95% COMPACTION.

TYPE "B" BACKFILL – EARTH & GRAVEL. MIXTURE MUST PASS A 1/2" MESH SCREEN & CONTAIN NOT MORE THAN 20% BY VOLUME OF ROCK PARTICLES. 95% COMPACTION.

NOTE – IF NORMAL MATERIAL AT BOTTOM OF TRENCH IS NOT TYPE "B", AN ADDITIONAL 3" SHALL BE EXCAVATED & TYPE "B" BACKFILL PROVIDED.

CONCRETE – 3" ENCASEMENT, 3000 psi COMPRESSIVE STRENGTH @ 28 DAYS.



TYPICAL DUCT SECTION

DESIGNATION DESCRIPTIONS

ELEC = UTILITY CO. PRIMARY OR SECONDARY ELECTRIC
TEL = UTILITY CO. TELEPHONE
PWR = PRIMARY OR SECONDARY ELECTRIC
CTL = CONTROL
SIG = INSTRUMENTATION OR ANTENNA CABLE

MINIMUM "X" DIMENSION
DUCT SEPARATION REQUIREMENTS

ELEC – ELEC = 1 1/2"

ELEC – TEL = 3"

TEL – TEL = 1 1/2"

ELEC – CTL/SIG = 3"

TEL – CTL/SIG = 1 1/2"

PWR – CTL/SIG = 3"

ELEC – PWR = 3"

TEL – PWR = 3"

PWR – PWR = 1 1/2"

CTL/SIG – CTL/SIG = 1 1/2"

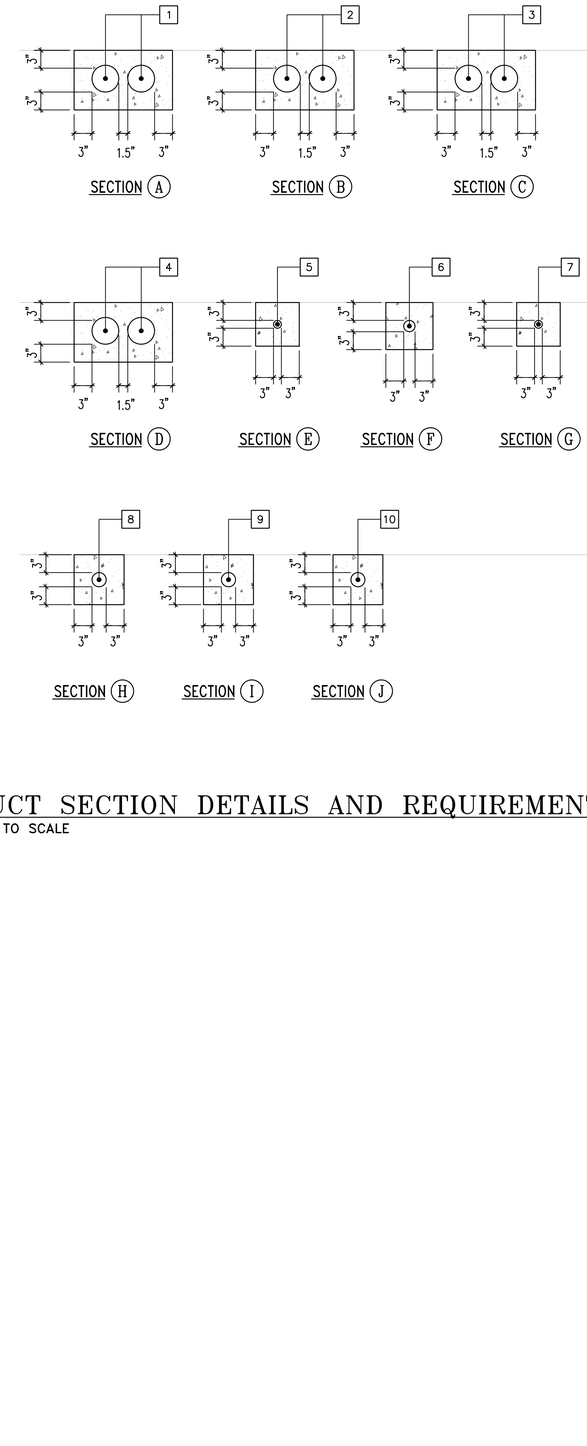
MINIMUM OF 3" CONCRETE ENCASEMENT AROUND DUCTBANK

WHERE DUCTLINE CROSSES OVER WATER LINE, PROVIDE THE FOLLOWING:

1. 6" MINIMUM SEPARATION BETWEEN DUCTLINES AND WATER LINE.
2. PROVIDE CONCRETE JACKET AROUND DUCTLINES.
3. PROVIDE ONLY TYPE "B" BACKFILL AROUND WATER LINE.

HAWAIIAN TELCOM (HTCO) DUCTLINE NOTES:

1. CONTRACTOR SHALL PLACE NEPTCO WP 1800P MULETAPE, OR APPROVED EQUAL, IN EACH DUCT THROUGHOUT ITS ENTIRE LENGTH WITH PROTRUSIONS OF 2 FEET IN MANHOLES AND HANDHOLES AT EACH END, AND 1 FOOT IN PULLBOXES. MULETAPE IS RATED FOR 1800 LB PULL AND HAS FOOTAGE MARKINGS FOR MEASURING DUCT LENGTHS.
2. CONTRACTOR SHALL PLACE 8-MIL ORANGE COLORED PLASTIC DETECTABLE WARNING TAPE, NOT LESS THAN 4" WIDE, ENTIRE LENGTH OF TRENCH FOR ALL UNDERGROUND INSTALLATIONS. TAPE SHOULD READ "WARNING-STOP DIGGING-CALL HTCO, COMMUNICATIONS CABLE BURIED BELOW, FAILURE TO COMPLY COULD RESULT IN LEGAL ACTION".



DUCT AND WIRE SCHEDULE

NO.	DUCT SIZE	WIRE SIZE	DESTINATION OR USE
1	4"	PC	HECO PRIMARY TO HECO PADMOUNTED TRANSFORMER
2	4"	SEE ONE-LINE DIAGRAM	HECO SECONDARY FROM HECO PADMOUNTED TRANSFORMER TO MCC
3	4"	SEE ONE-LINE DIAGRAM	FEEDER TO PORTABLE GENERATOR TERMINATION CABINET
4	4"	SEE ONE-LINE DIAGRAM	FEEDER TO WELL PUMP
5	1"	2#12, 1#12 GND	DUPLEX RECEPTACLE CIRCUIT FROM PANEL "A", CIRCUIT A-9
6	1 1/2"	8#12 CONTROLS (2#12 SPARE)	WELL PUMP CONTROLS
7	1"	4#12 CONTROLS	WELL PUMP CONTROLS
8	2"	1-2/C#14 TWISTED, SHIELDED CABLES W/GND	WELL LEVEL METER SIGNAL TO SCADA CABINET
9	2"	FLOW METER CABLE	FLOW METER SIGNAL TO SCADA CABINET
10	2"	ANTENNA CABLE	SCADA CABINET TO ANTENNA
11			
12			

NOTES:
1. ALL CONCRETE ENCASED DUCTS SHALL BE SCHEDULE 40 PVC.
2. PC INDICATES PROVIDE PULLCORD.

DUCT SECTION DETAILS AND REQUIREMENTS

NOT TO SCALE

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DUCT SECTION DETAILS AND REQUIREMENTS

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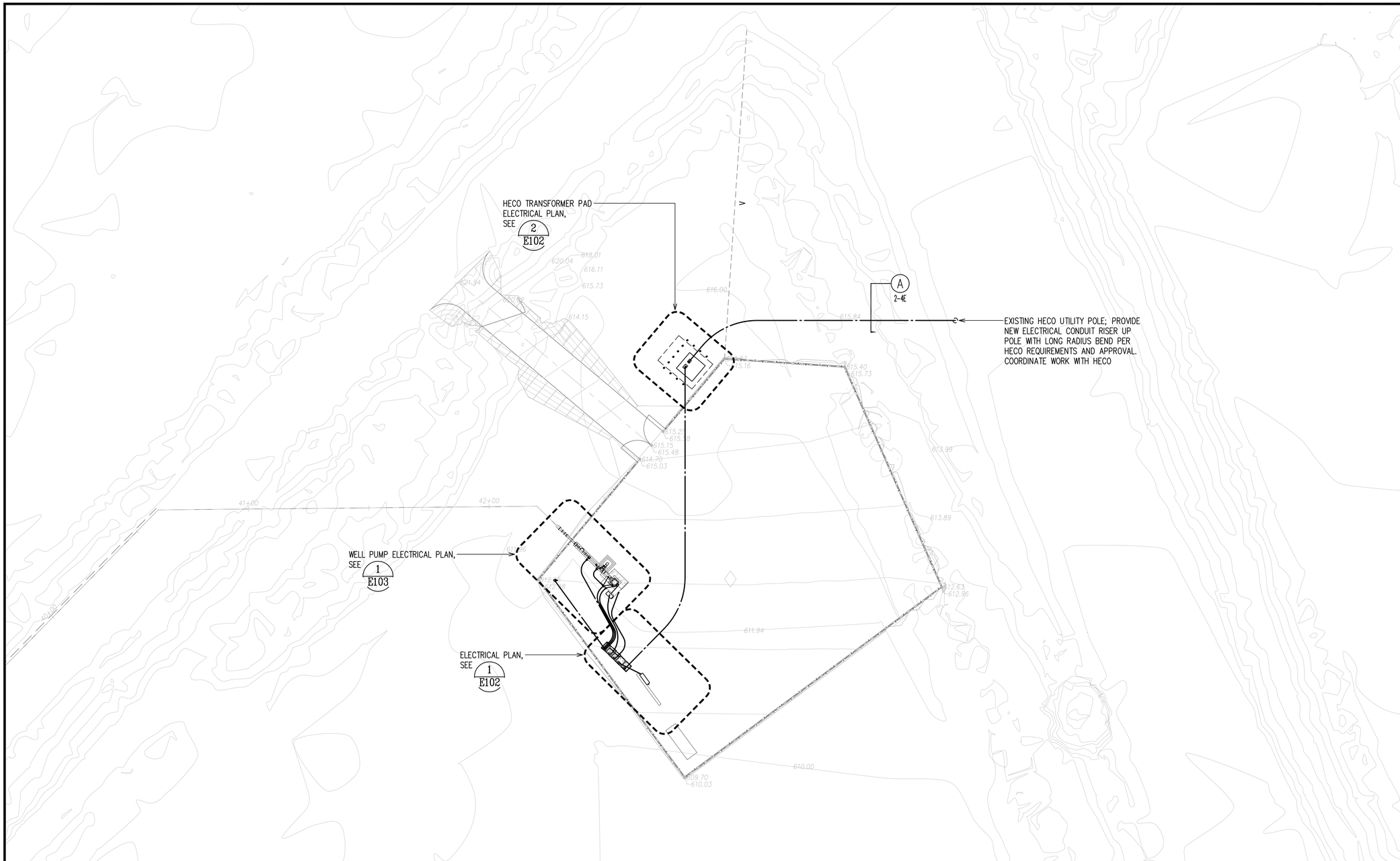

1 E101 WELL ELECTRICAL SITE PLAN

SCALE: 1"=20'

NORTH

20' 10' 0 20' 40' 60'

SCALE: 1"=20'

GRAPHIC SCALE

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WELL ELECTRICAL SITE PLAN

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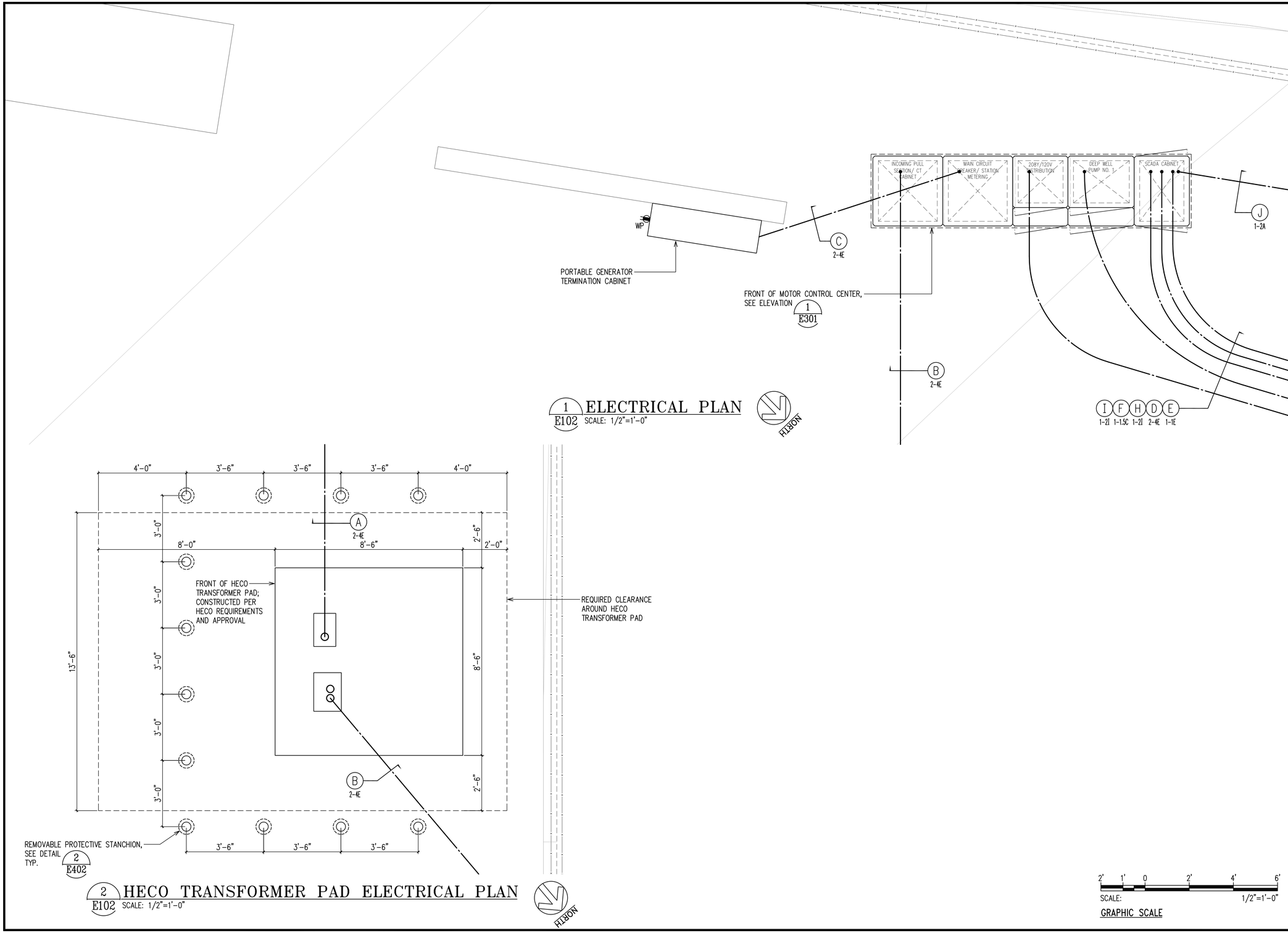

1 E102 ELECTRICAL PLAN
SCALE: 1/2"=1'-0"

2 E102 HECO TRANSFORMER PAD ELECTRICAL PLAN
SCALE: 1/2"=1'-0"

2' 1' 0 2' 4' 6'
SCALE: 1/2"=1'-0"
GRAPHIC SCALE

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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ELECTRICAL PLAN

E102 SHEET OF SHEETS

FILE	POCKET	FOLDER	NO.

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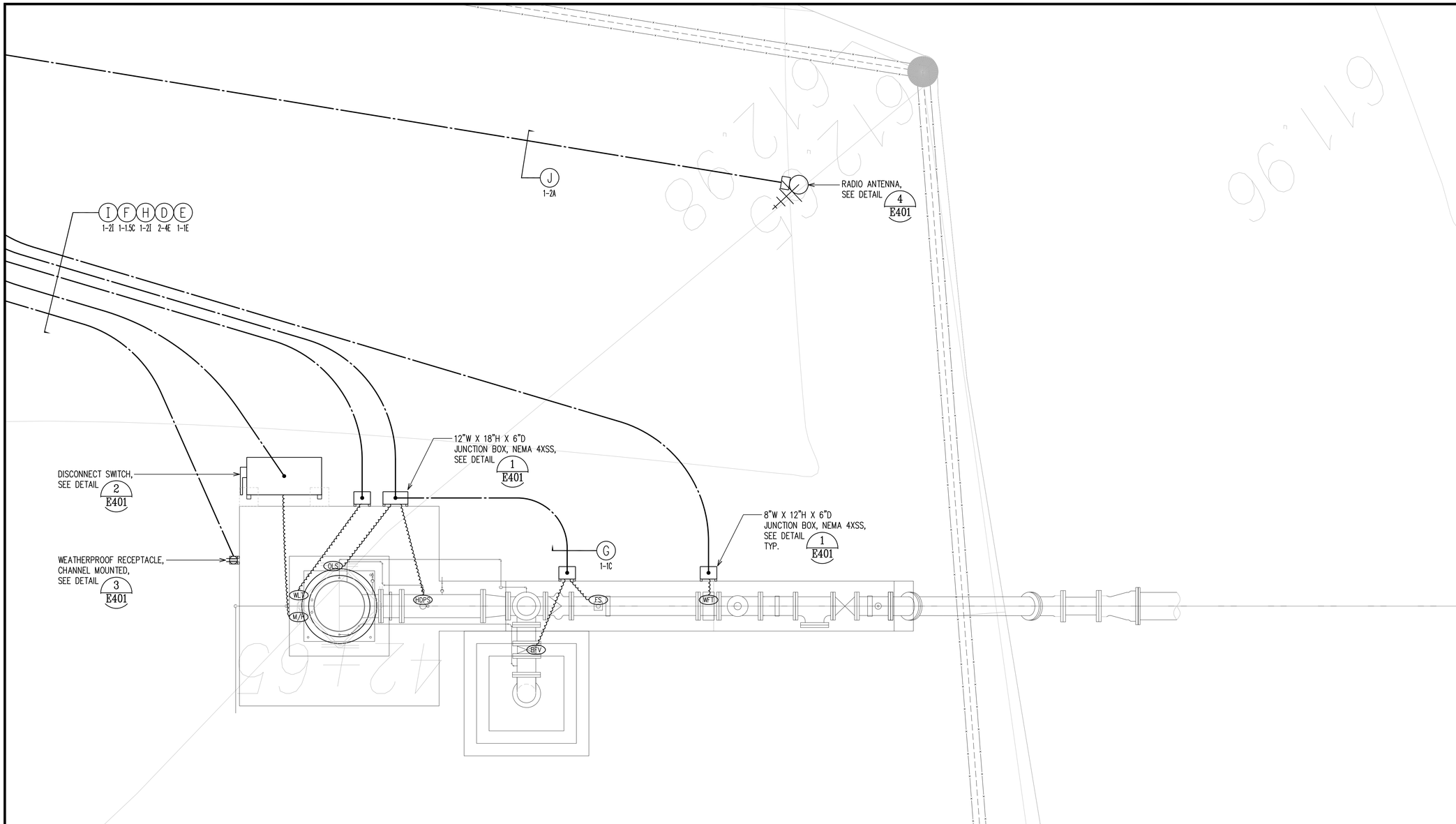

1 E103 WELL PUMP ELECTRICAL PLAN
SCALE: 1/2"=1'-0"

FLIPSON

2' 1' 0 2' 4' 6'
SCALE: 1/2"=1'-0"
GRAPHIC SCALE

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WELL PUMP ELECTRICAL PLAN

FILE	POCKET	FOLDER	NO.

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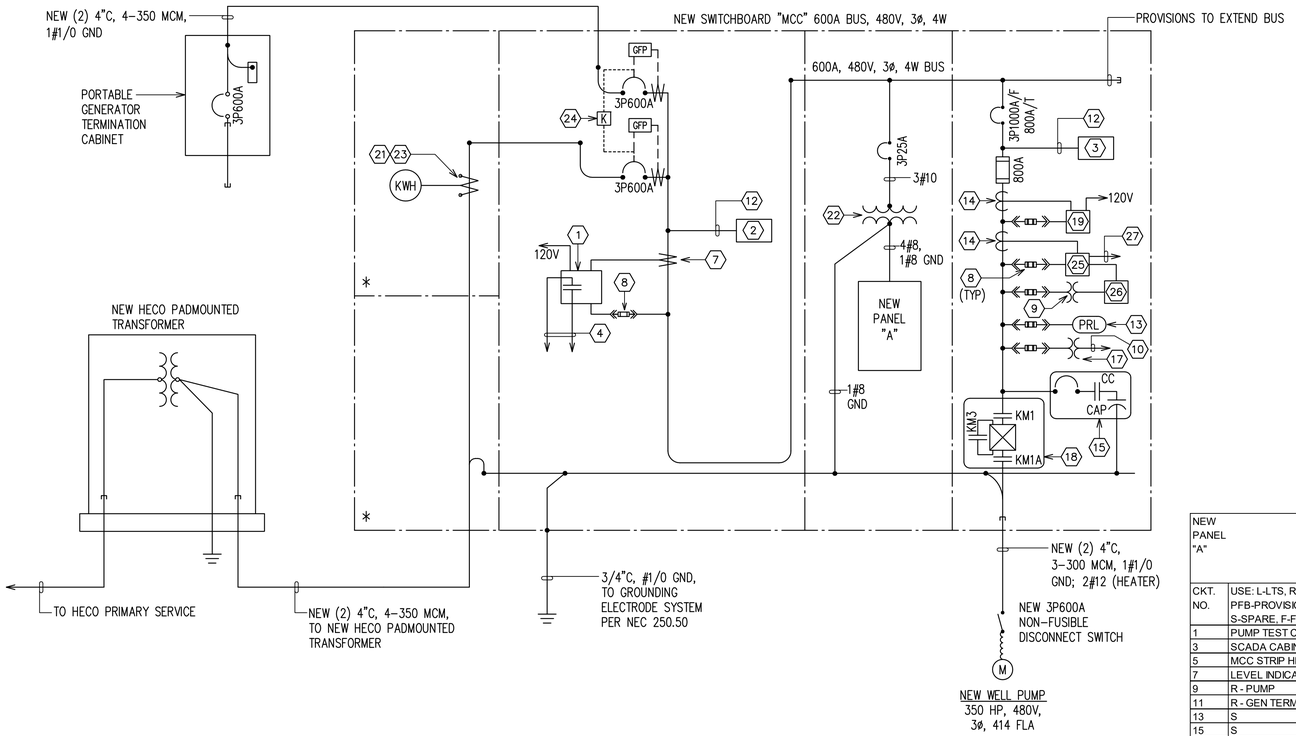

1 E201 ONE-LINE DIAGRAM

NOTES:

1. POWER AND GROUND BUSSES SHALL NOT PROTRUDE INTO ADJACENT SCADA CABINET SECTIONS

NEW PANEL "A" — 50 A MAIN BREAKER; 208Y/120 VOLTS, 3-PHASE, 4-WIRE; 10,000 A.I.C. MINIMUM INDUSTRIAL-BOLTED TYPE, WITH INTEGRAL SURGE PROTECTIVE DEVICE

CKT. NO.	USE: L-LTS, R-RECEP, PFB-PROVISION FUTURE BKR., S-SPARE, F-FAN, W-WARMER	BREAKER POLE	BREAKER AMPS	WIRE SIZE	KVA ON BUSSES PHASE A		PHASE B		PHASE C		WIRE SIZE	BREAKER POLE	BREAKER AMPS	USE: L-LTS, R-RECEP, PFB-PROVISION FUTURE BKR., S-SPARE, F-FAN, W-WARMER	CKT. NO.
1	PUMP TEST CIRCUIT	1	20	12	1.0	1.0					12	1	20	PUMP MOTOR HEATER	2
3	SCADA CABINET	1	20	12			0.5	0.5			12	1	20	SCADA CABINET	4
5	MCC STRIP HEATER	1	20	12					1.0	1.0	12	1	20	MCC STRIP HEATER	6
7	LEVEL INDICATOR	1	20	12	0.5	0.5					12	1	20	FLOW INDICATOR	8
9	R - PUMP	1	20	12			0.5							PFB	10
11	R - GEN TERMINATION CABINET	1	20	12					0.5					PFB	12
13	S	1	20		0.5									PFB	14
15	S	1	20				0.5					2	-	SPD	16
17	S	1	20						0.5			-	-	-	18
	CONNECTED LOAD PER PHASE				3.5		2.0		3.0						
	DEMAND LOAD PER PHASE				2.5		1.4		2.1						

TOTAL CONNECTED LOAD (KVA)	8.5
DEMAND FACTOR	70%
TOTAL DEMAND LOAD (KVA)	6.0
HIGH LEG (AMPS)	20.4

SCHEDULE OF INSTRUMENTS

KEY ON PLAN	DESCRIPTION
1	THREE PHASE DIGITAL MULTI-FUNCTION POWER MONITOR AND RECORDER; PROVIDE CORRECT CONNECTIONS REQUIRED FOR COMPLETE OPERATION OF MONITOR FUNCTIONS, PER MANUFACTURER'S INSTRUCTIONS, ELECTRO INDUSTRIES NEXUS 1500 OR APPROVED EQUAL
2	MAIN ELECTRICAL SERVICE SURGE PROTECTIVE DEVICE 480V, 3ø, 3W
3	BRANCH FEEDER SURGE PROTECTIVE DEVICE 480V, 3ø, 3W
4	TO RTU, PROVIDE SOFTWARE & PROGRAM TO ACTIVATE UPON LOSS OF POWER
5	
6	
7	CURRENT TRANSFORMER, 600V, 600:5
8	FUSE HOLDER WITH FUSE, 600V, SIZE BY MANUFACTURER
9	CONTROL TRANSFORMER, 600V FOR 480-120V, KVA AS REQ'D
10	TO CONTROL CIRCUIT
11	
12	3#12, FURNISHED AS PART OF SURGE PROTECTIVE DEVICE, AS SHORT AS POSSIBLE (MAX. LENGTH 30"); GROUND TO SWITCHBOARD GROUND BUS AS REQUIRED
13	PHASE REVERSAL/LOSS RELAY
14	CURRENT TRANSFORMER, 600V, 800:5
15	CAPACITOR AND CAPACITOR BREAKER PER PUMP MOTOR MANUFACTURER'S RECOMMENDATIONS, INCLUDING ISOLATION CONTACTOR (CC) TO REMOVE CAPACITORS FROM SYSTEM DURING PUMP MOTOR START UP
16	NOT USED
17	CONTROL TRANSFORMER, 600V FOR 480-120V, 2-1 KVA
18	400 HP MOTOR STARTER, SIZE ONE STANDARD HP SIZE LARGER THAN MOTOR HP SIZE FOR COOLER SCR OPERATION, SOLID-STATE TYPE WITH BYPASS CONTACTOR, AND SCR ISOLATION CONTACTORS WITH SOLID STATE OVERLOAD HEATERS SELECTED TO MATCH MOTOR NAMEPLATE RATING AT 460V, 3 PHASE
19	THREE PHASE DIGITAL MULTI-FUNCTION POWER MONITOR AND RECORDER; PROVIDE CORRECT CONNECTIONS REQUIRED FOR COMPLETE OPERATION OF MONITOR FUNCTIONS, PER MANUFACTURER'S INSTRUCTIONS, ELECTRO INDUSTRIES SHARK 200 OR APPROVED EQUAL
21	P.T.'S BY HECO, OBTAIN REQUIREMENTS & APPROVAL FROM HECO
22	DRY-TYPE TRANSFORMER, 15 KVA, 480-208Y/120V, 3 PHASE, 4 WIRE, 80°C RISE.
23	C.T.'S BY HECO, OBTAIN REQUIREMENTS & APPROVAL FROM HECO
24	MAIN CIRCUIT BREAKER / MANUAL TRANSFER SWITCH WITH 2-MOLDED CASE CIRCUIT BREAKERS, SIZE AS INDICATED WITH KIRK-KEY INTERLOCKS FOR NORMAL OR GENERATOR OPERATION; PREVENTS CIRCUIT BREAKERS FROM OPERATING SIMULTANEOUSLY
25	THREE PHASE MOTOR PROTECTOR, SYMCOM, INC. MOTOR SAVER MODEL 777KW SERIES WITH MODBUS INTERFACE
26	THREE PHASE MOTOR PROTECTOR REMOTE MANAGER, SYMCOM, INC. MODEL RM-2000 SERIES, WITH REQUIRED RS485MS-2W SERIAL INTERFACE FOR CONNECTING TO MODEL 777KW MOTOR PROTECTOR
27	TYPE RS485 NETWORK CABLE FOR INPUT INTO SCADA SYSTEM
28	
29	

NOTES:

1. SUBMIT THE SHOP DRAWINGS OF THE SWITCHBOARD DIRECTLY TO HECO FOR THEIR REVIEW AND APPROVAL PRIOR TO FABRICATION. COMPLY WITH HECO REQUIREMENTS REGARDING SHOP DRAWING SUBMITTALS AND ACCOUNT FO HECO REVIEW PROCESS DURATION IN CONSTRUCTION SCHEDULE. ALSO SUBMIT SWITCHBOARD SHOP DRAWING TO BWS FOR APPROVAL. SWITCHBOARD SHALL BE DESIGNED IN ACCORDANCE WITH "EUSERC" DRAWINGS AND REQUIREMENTS.
2. ALL GROUNDING SYSTEMS SHALL BE PROVIDED PER N.E.C. ARTICLE 250.
3. SECONDARY SERVICE: 480Y/277V, 3 PHASE, 4 WIRE. SHORT CIRCUIT RATING: 65,000 A.I.C.
4. PROVIDE SHORT CIRCUIT ANALYSIS AND COORDINATION STUDY ON THE ELECTRICAL SYSTEM. VERIFY EXACT SHORT CIRCUIT CAPACITY WITH HECO AND WITH THE RESULTS OF THE ANALYSIS AND STUDY. PROVIDE EQUIPMENT WITH APPROPRIATE RATINGS.
5. * INDICATES PROVISION FOR HECO SEALS.
6. ALL FEEDER CIRCUIT BREAKERS FOR PUMP MOTORS SHALL BE PROVIDED WITH PROVISIONS FOR LOCKING IN THE "OFF" POSITION.

480Y/277V, 3-PHASE, 4-WIRE SYSTEM SERVICE DATA:

A. SERVICE VOLTAGE: 480Y/277V, 3-PHASE, 4-WIRE
B. LOAD DATA:
CONNECTED: 350 HP
DEMAND: 350 HP
MISC LOAD: 15.0 KVA
C. SERVICE CONDUCTORS: 4-350 MCM
D. METERING: HECO STD. B-19, RATE J
E. TYPE: UNDERGROUND

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SIGNATURE 2020.04.15 — 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	APPROVED

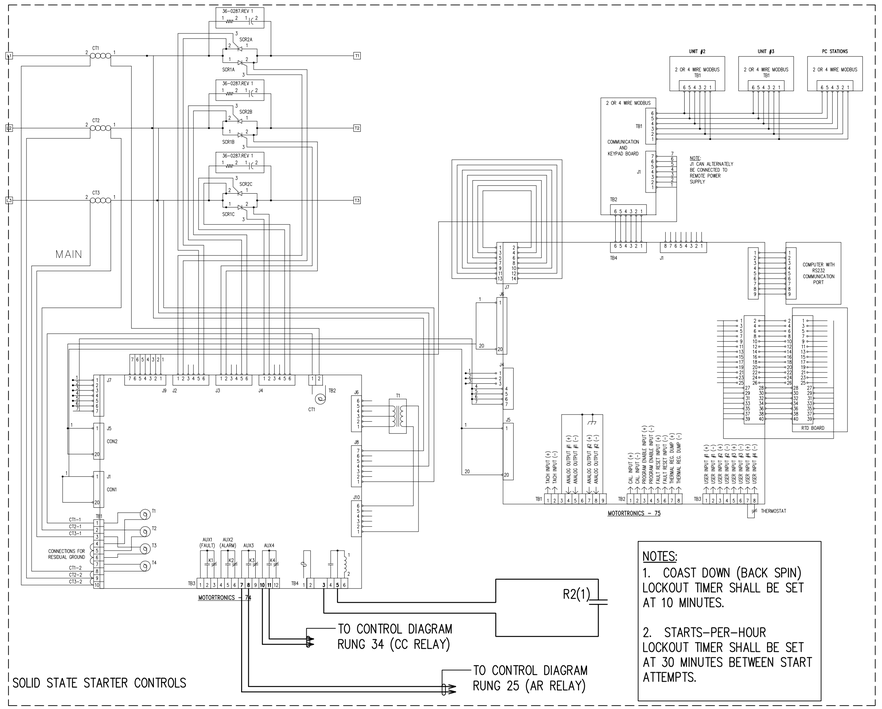
APPROVED BY

ENGINEER	BHK
DRAFTSMAN	BHK
CHECKED BY	BO
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

ONE-LINE DIAGRAM

FILE	POCKET	FOLDER	NO.

2020-04-14 10:31 PM Z:\ACAD\PROJECTS\220052\E201_220052-one line



SOLID STATE STARTER CONTROLS

DEEPWELL PUMP CONTROL SEQUENCE

ON START-UP, REMOTE LEVEL CONTROL CONTACT "DO1" CLOSES AND ENERGIZES RESPECTIVE RELAY "RE"". CONTACT "RE(1)" CLOSES AND ENERGIZES SEQUENCE TIMER "Q" AND LIGHTS A BLUE LIGHT, PROVIDED THE SSS "COAST DOWN LOCKOUT TIMER" HAS TIMED OUT FROM THE LAST PUMP CYCLE OR THE SSS "STARTS-PER-HOUR LOCKOUT TIMER" HAS TIMED OUT.

"Q(1)" CLOSES AND ENERGIZES OIL LUBE SOLENOID "OLS", WHICH STARTS THE LUBRICATION OF THE PUMP SHAFT THROUGHOUT THE PUMP CYCLE.

"Q(2)" CLOSES AND ENERGIZES "OPEN VALVE CIRCUIT" TO ENSURE PUMP CONTROL VALVE IS OPEN PRIOR TO PUMP START. AFTER A TIME DELAY, "Q(3)" CLOSES AND ENERGIZES RELAYS "R1" AND "TD2".

"R1(1)" CLOSES, ENERGIZING RELAY "R2". "R2(1)" CLOSES AND STARTS THE PUMP MOTOR VIA THE SOLID STATE STARTER. "R1(2)" CLOSES AND AFTER A TIME DELAY, "Q(4)" CLOSES AND ENERGIZES "CLOSE VALVE CIRCUIT" TO THE PUMP CONTROL VALVE.

AFTER THE PUMP CONTROL VALVE STARTS TO CLOSE, PUMP CONTROL VALVE LIMIT SWITCH "LS6" CLOSES AND WITH "R2(2)" CLOSES, KEEPS RELAY "R2" ENERGIZED THROUGHOUT THE PUMPING CYCLE.

AFTER THE PUMP MOTOR IS RUNNING AT FULL SPEED, CONTACT "TB4(7-8)" FROM SOLID STATE STARTER CLOSES AND ENERGIZES CAPACITOR ISOLATION CONTACTOR "CC", WHICH ENERGIZES THE POWER FACTOR CORRECTION CAPACITORS.

AFTER THERE IS MAIN LINE FLOW, FLOW SWITCH "FC" CLOSES AND ENERGIZES RELAY "RA". CONTACT "Q(5)" CLOSES AND CHECKS FOR MAIN LINE FLOW. IF THERE IS NO WATER FLOW, RELAY "R3" IS ENERGIZED THROUGH "Q(5)" AND "RA(1)". "R3(1)" CLOSES AND HOLDS IN RELAY "R3"; "R3(2)" CLOSES AND STARTS THE PUMP SHUTDOWN SEQUENCE VIA RELAY "R5". "R3(3)" CLOSES AND ILLUMINATES AN AMBER LIGHT UNTIL MANUALLY RESET.

"HIGH DISCHARGE PRESSURE" ALARM CONDITION:
IF THERE IS A HIGH DISCHARGE PRESSURE IN THE MAIN LINE, "HDPS" CLOSES AND ENERGIZES RELAY "R4". "R4(1)" CLOSES AND HOLDS IN RELAY "R4"; "R4(3)" CLOSES AND ILLUMINATES AN AMBER LIGHT UNTIL MANUALLY RESET. "R4(2)" CLOSES AND START THE PUMP SHUTDOWN SEQUENCE VIA RELAY "R5".

ON SHUTDOWN, REMOTE LEVEL CONTROL CONTACT "DO1" OPENS AND DE-ENERGIZES RESPECTIVE RELAY "RE". CONTACTS "RE(1)" OPENS AND DE-ENERGIZES SEQUENCE TIMER "Q", WHICH CLOSES Q(2) AND STARTS THE BUTTERFLY PUMP CONTROL VALVE OPENING . AFTER BUTTERFLY PUMP CONTROL VALVE FULLY OPEN, LIMIT SWITCH "LS6" OPENS, WHICH DE-ENERGIZES RELAY "R2". CONTACT "R2(1)" OPENS AND DE-ENERGIZES THE SS STARTER CONTROLS, WHICH STOPS THE PUMP. IF LIMIT SWITCH "LS6" DOES NOT OPEN, AFTER 2 MINUTES (ADJUSTABLE), TIME DELAY CONTACT "TD2(1)" OPENS AND STOPS THE PUMP.

1 / E202 WELL PUMP CONTROL SCHEMATIC DIAGRAM I

WAIAHOLE WATER SYSTEM IMPROVEMENTS

R. M. TOWILL CORPORATION
Planning • Engineering • Environmental Services • Photogrammetry • Surveying • Construction Management
2024 North King Street Suite 200
Honolulu Hawaii 96819

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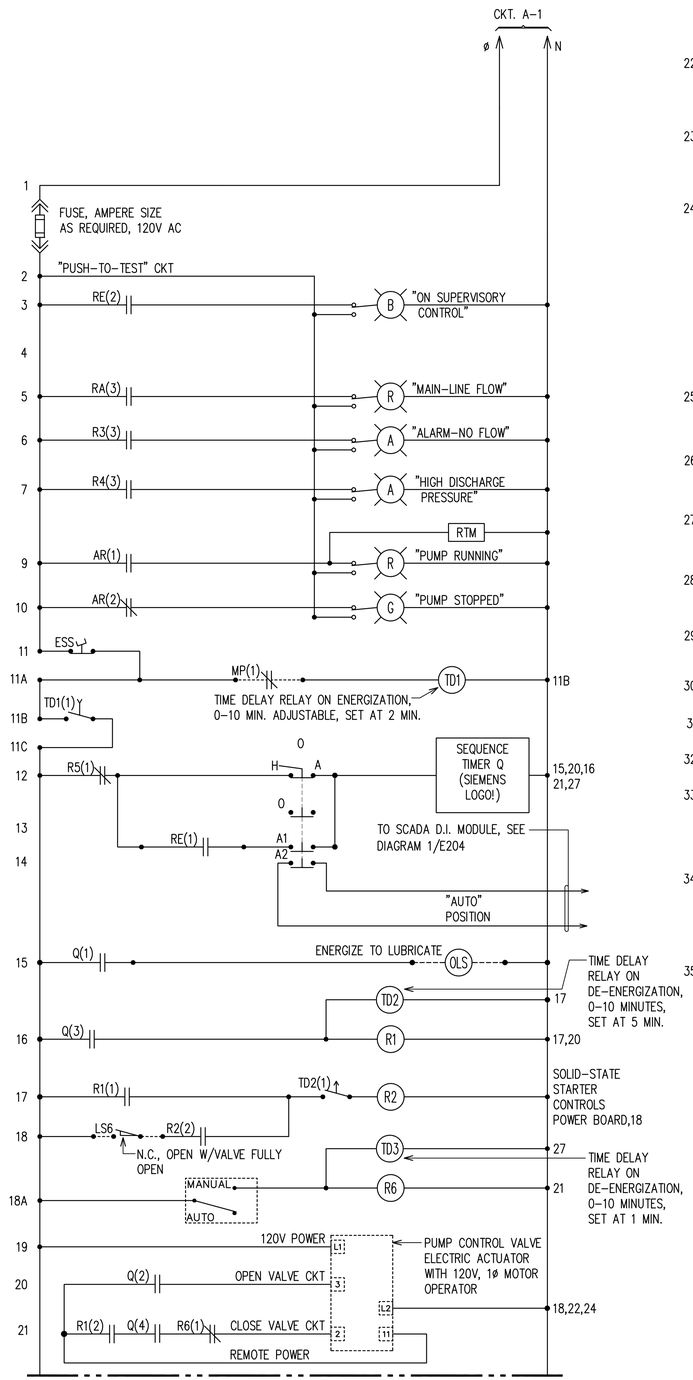
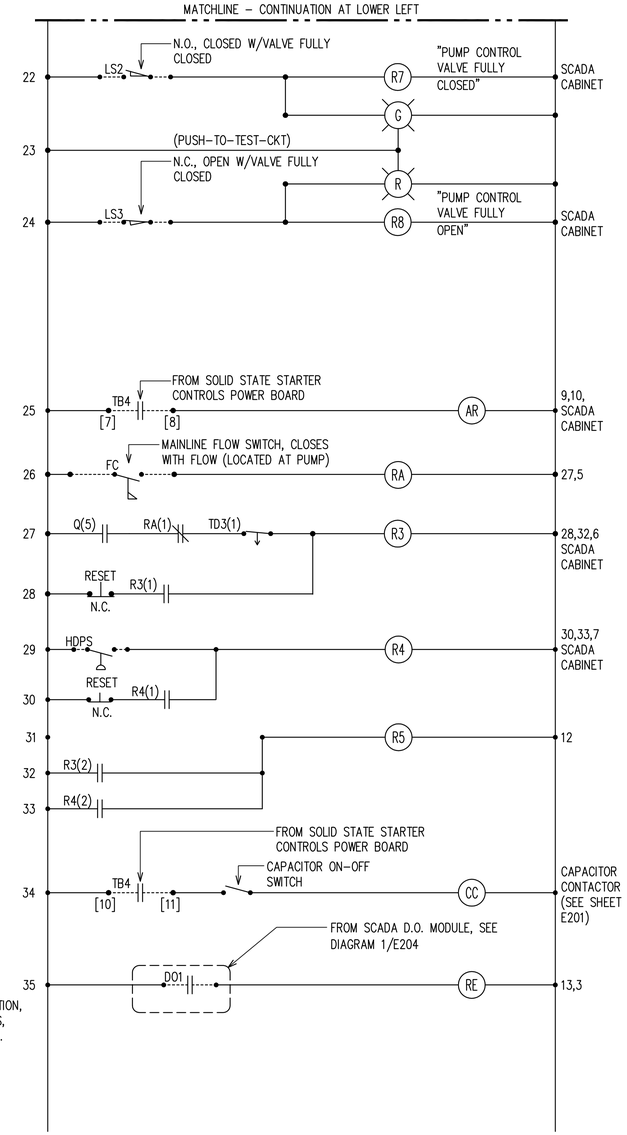
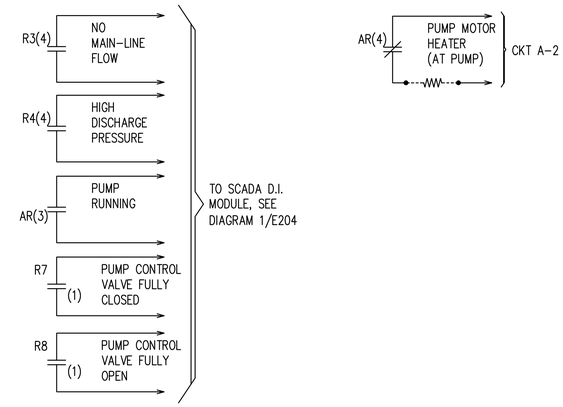
WELL PUMP CONTROL SCHEMATIC DIAGRAM I

2020-04-14 9:47 PM Z:\ACAD\PROJECTS\220052\E202_220052-well pump controls I

FILE	POCKET	FOLDER	NO.

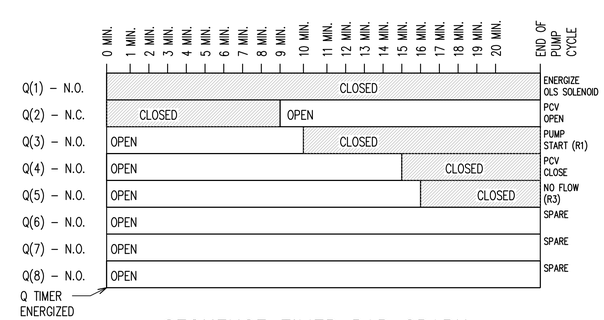






NOTES:

1. WELL PUMP CONTROLS SHOWN ON THIS SHEET SHALL BE PROGRAMMED IN THE PLC. CONFIGURE EQUIPMENT AS REQUIRED. SEE RTU PANEL LAYOUT ON 1/E-15.
2. SCHEMATIC DIAGRAM FOR REFERENCE ONLY.



SEQUENCE TIMER BAR GRAPH

1 / E203 WELL PUMP CONTROL SCHEMATIC DIAGRAM II

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WELL PUMP CONTROL SCHEMATIC DIAGRAM II

FILE	POCKET	FOLDER	NO.

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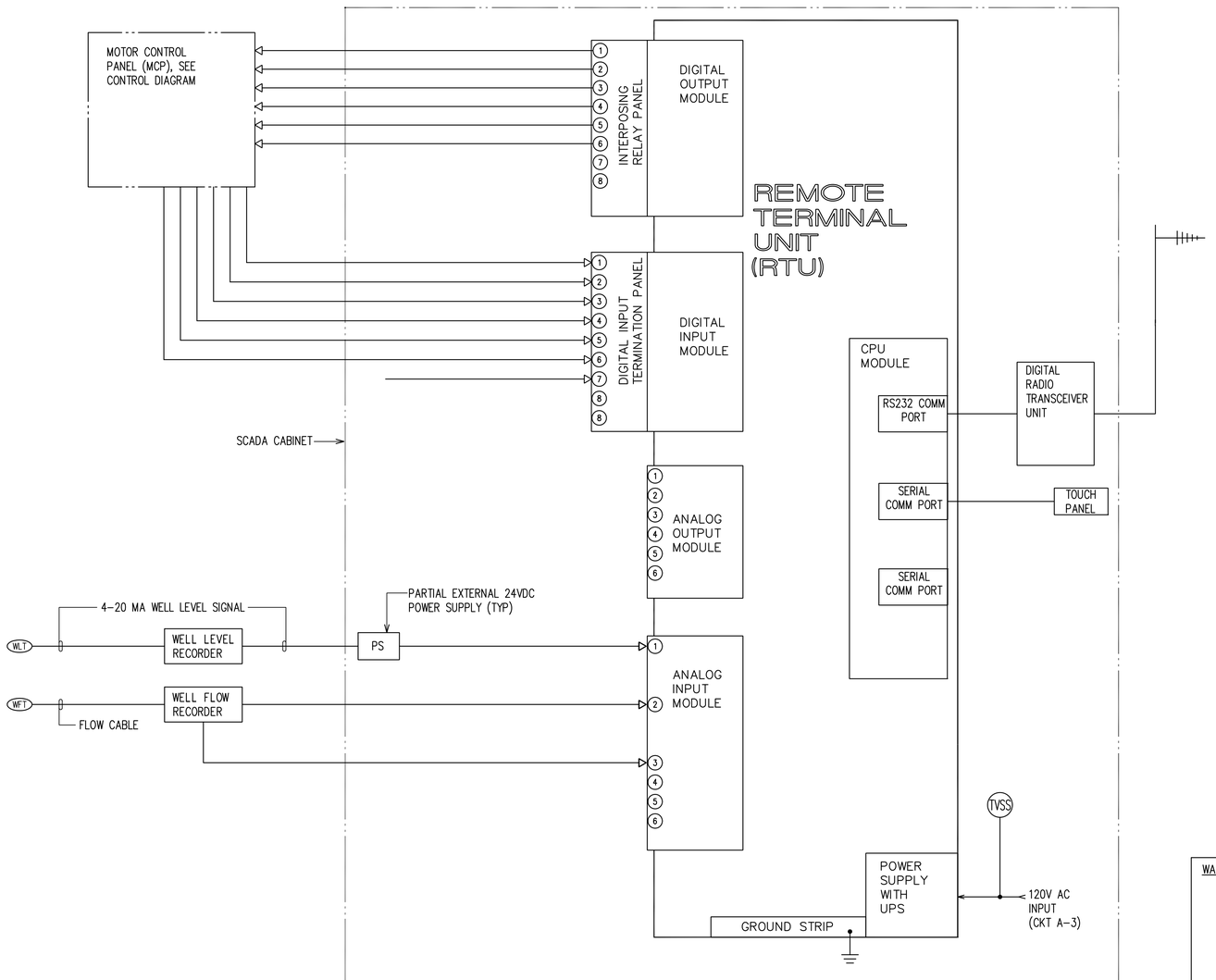


1 E204 SCADA SYSTEM SCHEMATIC DIAGRAM

REQUIRED MINIMUM SCADA INPUT POINTS AND MINIMUM PROVISIONS FOR ITEMS TO BE DISPLAYED / CONTROLLED ON TOUCH PANEL:

1. ENTIRE SITE OVERVIEW SCREEN THAT INCLUDES THE WELL PUMP SITE.
2. WELL PUMP SITE SCREEN TO INCLUDE:
   a. WELL PUMP MOTOR STATUS
   b. WELL LEVEL
   c. WELL FLOW
3. ONE ALARM SCREEN TO INCLUDE A SUMMARY OF ALARMS AND A PAST HISTORY OF ALARMS.

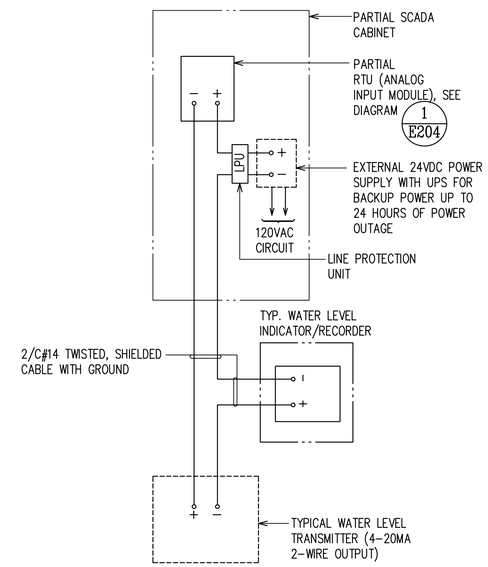
POWER FUNCTION MONITOR NOTES:

1. CONTRACTOR SHALL PROVIDE ALL REQUIRED PARAMETERS, FROM THE POWER FUNCTION MONITOR, TO BE RECORDED AT THE MASTER COMPUTER.

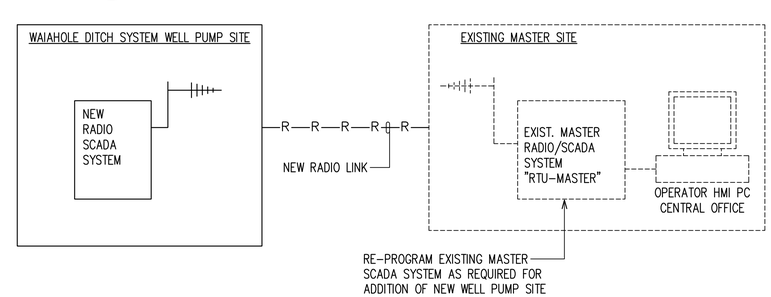
INSTRUMENTATION CIRCUIT WIRING NOTES:

1. ALL 4–20MA INSTRUMENTATION CIRCUITS TO BE TWISTED, SHIELDED CABLES WITH GROUIND; BELDEN CATALOG NUMBER 1266A OR APPROVED EQUAL.

2. THE SHIELD OF THE SHIELDED CABLE SHALL BE TERMINATED TO ELECTRICAL GROUND AT ONE LOCATION ONLY AND SHALL NOT HAVE OTHER PATHS TO GROUND.



2 E204 TYPICAL INSTRUMENTATION DIAGRAMS



SCADA SYSTEM OPERATION NOTES:

1. THE SCADA CONTRACTOR SHALL PROGRAM THE NEW RTU AND RE–PROGRAM THE EXISTING MASTER SCADA SYSTEM AS REQUIRED AND AS INDICATED IN THE SPECIFICATIONS.

3 E204 OVERALL SCADA SYSTEM SCHEMATIC DIAGRAM

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SCADA SYSTEM SCHEMATIC DIAGRAM

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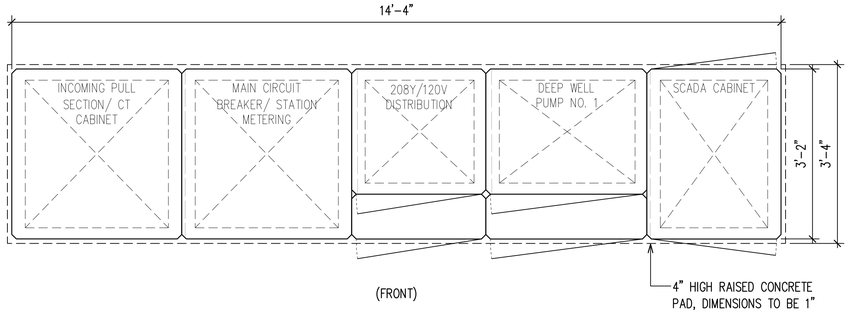
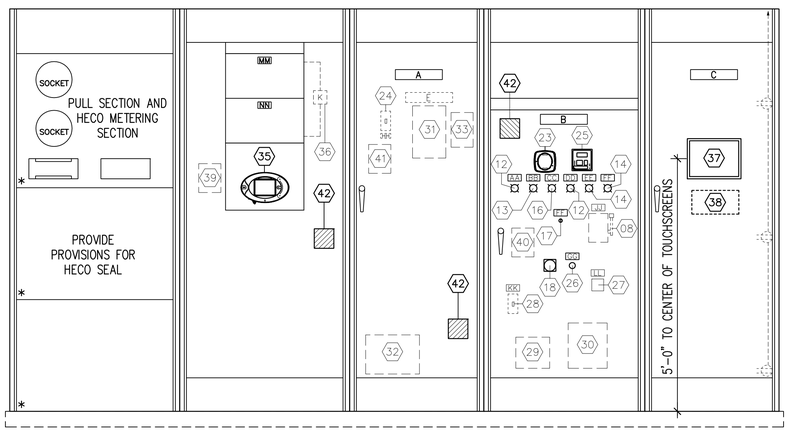


PLAN



ELEVATION

1 / E301 WELL PUMP MOTOR CONTROL CENTER (MCC) ELEVATION

SCALE: 3/4"=1'-0"

MOTOR CONTROLLER SWITCHBOARD NOTES:

1. REAR PANEL SHEATHING TO BE REMOVABLE FOR ALL SECTIONS.
2. VERIFY ALL DIMENSIONS AND LAYOUT WITH APPROVED SHOP DRAWINGS.
3. SWITCHBOARD STARTER COMPARTMENTS SHALL HAVE HINGED DEAD FRONT PANEL BEHIND DOORS.
4. GROUND ALL CONDUITS TO SWITCHGEAR GROUND BUS. EXTEND GROUND BUS THRU ALL SECTIONS OF MCS. GROUND BUS SHALL NOT PROTRUDE INTO SCADA CABINET SECTION.
5. PROVIDE 6" WIRING TROUGH AT BOTTOM OF SWITCHBOARD.
6. MOTOR CONTROLLERS SHALL HAVE PROVISIONS FOR LOCKING IN THE "OFF" POSITION.
7. ALL DOORS SHALL HAVE LEVER TYPE HANDLES.
8. DIMENSIONS OF ALL COMPARTMENTS SHALL BE AS SHOWN.

MOTOR CONTROLLER SWITCHBOARD NOTES (CONT'D):

9. ALL SWITCHES MOUNTED ON FRONT PANEL OF MCC SHALL BE MOUNTED NO HIGHER THAN 70" ABOVE FINISH FLOOR. THE EMERGENCY STOP PUSHBUTTON SWITCH SHALL BE MOUNTED NO HIGHER THAN 60" ABOVE FINISH FLOOR.
10. ENTIRE MOTOR CONTROL CENTER SHALL BE CONSTRUCTED PER UL 891 AND NEMA PB-2 STANDARDS. METERING SECTION OF SWITCHBOARD SHALL COMPLY WITH EUSERC STANDARDS.
11. SWITCHBOARD SHOP DRAWINGS SHALL BE SUBMITTED TO HECO FOR REVIEW AND APPROVAL PRIOR TO FABRICATION.
12. SWITCHBOARD SHALL BE FURNISHED WITH STRIP HEATERS AND THERMOSTAT.
13. * INDICATES PROVISIONS FOR HECO SEAL.
14. PROVIDE WITH NEMA 3R TYPE 316 STAINLESS STEEL WEATHERPROOF ENCLOSURE.

NAMEPLATES

ITEM	DESCRIPTION
A	208Y/120V, 3ø, DISTRIBUTION SECTION
B	WELL PUMP
C	TELEMETERING CABINET
D	
E	PANEL "A", 208Y/120V, 3ø, 4W
F	
G	
H	
I	
J	
K	
L	
M	
N	
O	
P	
Q	
R	
S	
T	
U	
V	

ABOVE NAMEPLATES TO BE 9" X 2 1/4" X 1/8" DILECTO WITH 5/8" WHITE LETTERING & BEVELED EDGES

* COORDINATE WITH MECHANICAL AND PROVIDE ACTUAL NAMEPLATE AS REQUIRED.

NAMEPLATES

ITEM	DESCRIPTION
AA	MOTOR RUNNING
BB	MOTOR STOPPED
CC	ON SUPERVISORY
DD	MAIN LINE FLOW
EE	NO FLOW
FF	EMERGENCY STOP AND RESET
GG	TROUBLE RESET
HH	TRANSFORMER MAIN
II	
JJ	DEEP WELL PUMP CIRCUIT BREAKER
KK	CAPACITOR CIRCUIT BREAKER
LL	TEST-NORMAL
MM	MAIN CIRCUIT BREAKER
NN	GENERATOR MAIN BREAKER (EMERGENCY)
OO	
PP	
QQ	
RR	
SS	
TT	
UU	
VV	
WW	

ABOVE NAMEPLATES TO BE 4" X 2" X 1/8" DILECTO WITH 1/4" WHITE LETTERING & BEVELED EDGES

COMPONENTS (#)

ITEM	DESCRIPTION
01	
02	
03	
04	
05	
06	
07	
08	PADLOCKABLE EXTERNAL CIRCUIT BREAKER OPERATING HANDLE, PER OSHA LOCK-OFF PROCEDURES
09	
10	
11	
12	RED LIGHT
13	GREEN LIGHT
14	AMBER LIGHT
15	WHITE LIGHT
16	BLUE LIGHT
17	EMERGENCY STOP RESET PUSHBUTTON
18	RUNNING TIME METER
19	
20	
21	
22	
23	DIGITAL MULTI-FUNCTION POWER METER (ELECTRO INDUSTRIES SHARK 200 OR APPROVED EQUAL)
24	CIRCUIT BREAKER
25	MOTOR PROTECTOR REMOTE MANAGER
26	TROUBLE RESET PUSHBUTTON
27	TEST/NORMAL SWITCH
28	CAPACITOR CIRCUIT BREAKER
29	POWER FACTOR CORRECTION CAPACITOR
30	SOLID-STATE STARTER WITH ISOLATION AND BY-PASS CONTACTORS
31	PANEL "A"
32	DRY TYPE TRANSFORMER
33	TIME CLOCK W/ ASTRONOMICAL DIAL
34	
35	DIGITAL MULTI-FUNCTION POWER METER (ELECTRO INDUSTRIES NEXUS 1500 OR APPROVED EQUAL)
36	KEYED SAFETY INTERLOCK SYSTEM
37	TOUCHSCREEN
38	PROGRAMMABLE LOGIC CONTROLLER (PLC)
39	MAIN SERVICE SPD (480V)
40	BRANCH FEEDER SPD (480V)
41	BRANCH FEEDER SPD (208V)
42	ARC FLASH WARNING SIGN; PROVIDE PER NEC 110.16, LOCATIONS AS REQUIRED
43	

WAIAHOLE WATER SYSTEM IMPROVEMENTS

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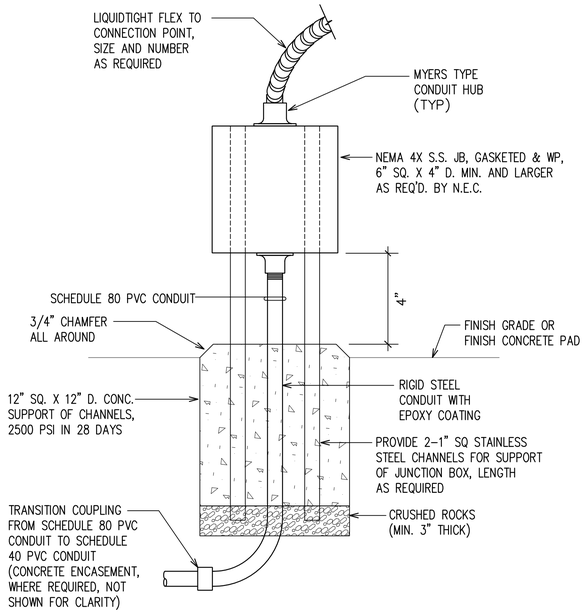
WELL PUMP MCC ELEVATION

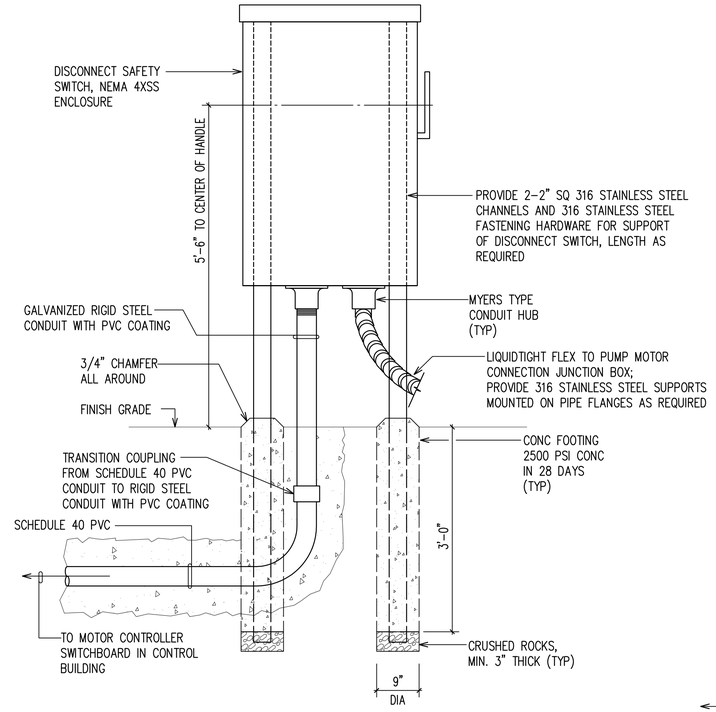
2020-04-14 11:48 PM Z:\ACAD\PROJECTS\220052\E301_220052-mcc elevation

FILE	POCKET	FOLDER	NO.

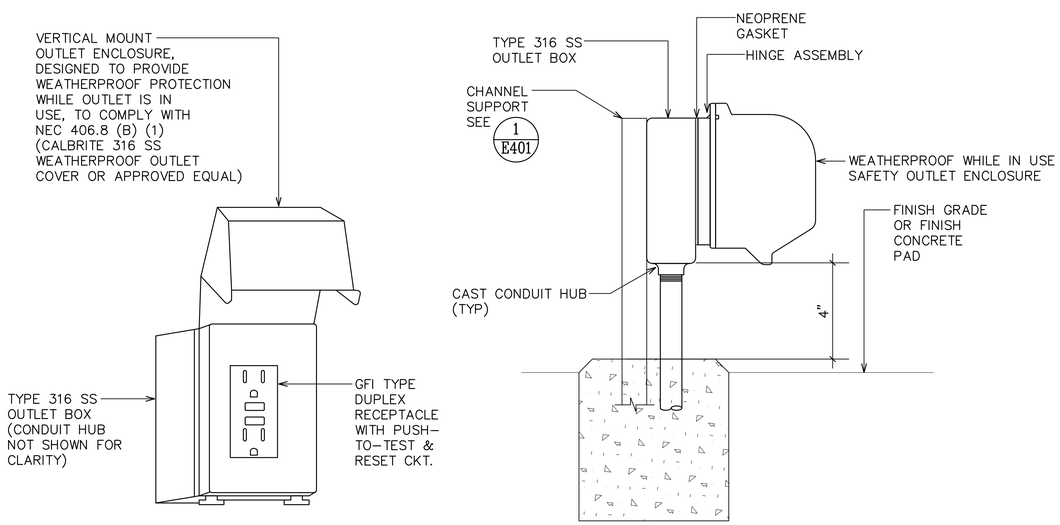


NOTE:
1. ALL MOUNTING HARDWARE SHALL BE TYPE 316 STAINLESS STEEL.

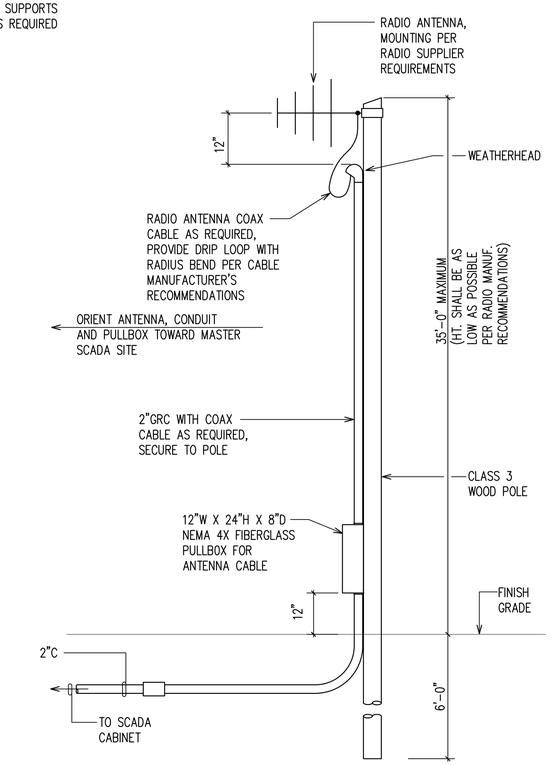
1 / E401 CHANNEL SUPPORTED JUNCTION BOX DETAIL
NOT TO SCALE



2 / E401 PUMP MOTOR DISCONNECT SWITCH DETAIL
NOT TO SCALE



3 / E401 WEATHERPROOF RECEPTACLE DETAIL
NOT TO SCALE



NOTES:

1. PROVIDE GROUNDING OF ANTENNA MAST AND COAXIAL ANTENNA CABLE PER RADIO MANUFACTURER'S RECOMMENDATIONS.
2. ANTENNA MOUNTING HEIGHT SHALL NOT BE LESS THAN 16 FEET FROM EXISTING GROUND SURFACE, OR MANUFACTURER'S RECOMMENDATION, WHICHEVER IS HIGHER.
3. ALL MOUNTING HARDWARE SHALL BE TYPE 316 STAINLESS STEEL.

4 / E401 RADIO ANTENNA-POLE TOP MOUNTING DETAIL
NOT TO SCALE

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MISCELLANEOUS ELECTRICAL DETAILS I

FILE	POCKET	FOLDER	NO.

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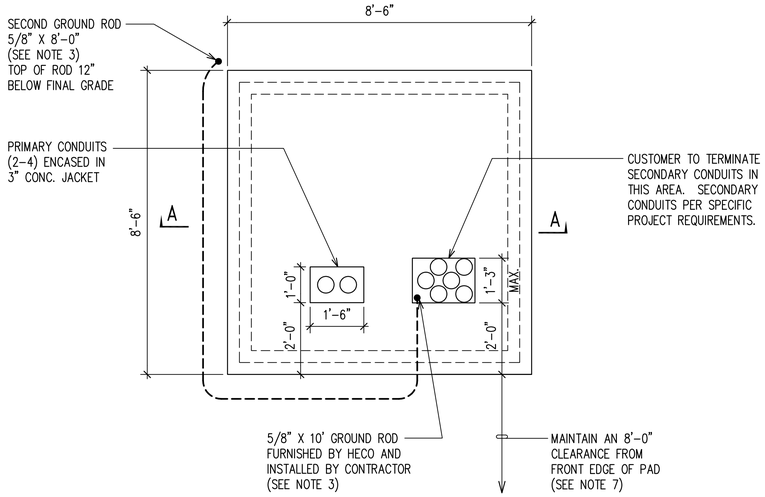
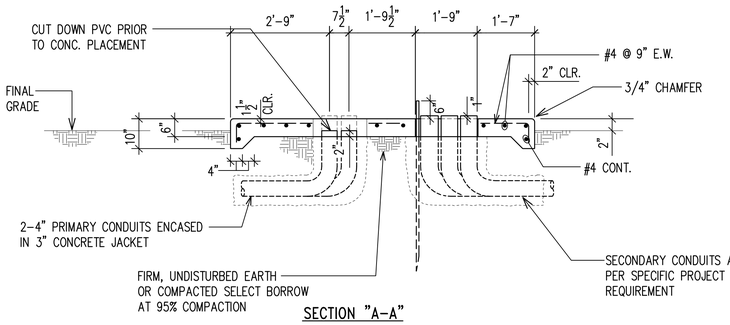


PLAN



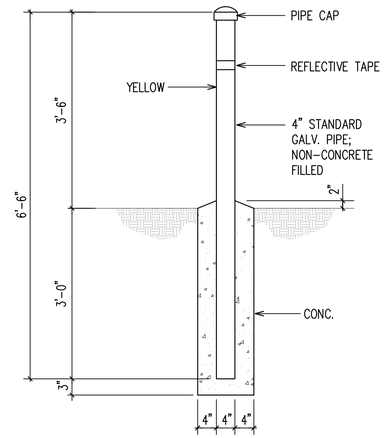
SECTION "A-A"

NOTES:

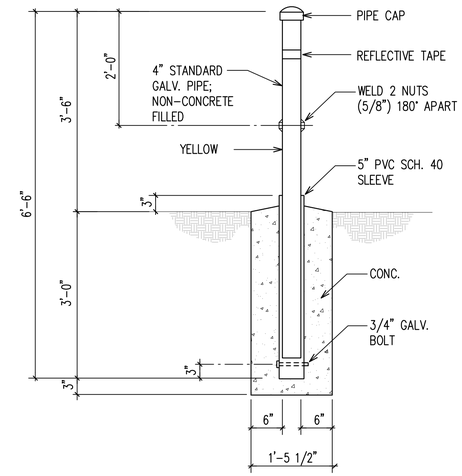
1. REFER TO STD. 30-5000 FOR LOCATIONS AND CLEARANCES.
2. REFER TO STD. 22-2005 FOR 3 PHASE PADMOUNTED TRANSFORMER REQUIREMENTS.
3. 5/8" DIAMETER x 10'-0" GROUND ROD (STOCK CODE 193457) FURNISHED BY HECO AND INSTALLED BY CUSTOMER. IF GROUND RESISTANCE IS MORE THAN 25 OHMS, INSTALL ADDITIONAL 5/8" DIAMETER x 8'-0" GROUND ROD (STOCK CODE 101527) AND CONNECT 4/0 BARE COPPER GROUND WIRE BETWEEN GROUND RODS. A MINIMUM OF 6'-0" SHALL BE MAINTAINED BETWEEN THE DRIVEN GROUND RODS. A SECOND GROUND ROD WILL PROBABLY BE REQUIRED WHEN SOIL RESISTIVITY IS GREATER THAN 67 OHM-METERS.
4. CONCRETE: 3000 PSI COMPRESSIVE STRENGTH IN 28 DAYS. MOISTURE CURE CONCRETE PAD A MINIMUM OF 7 DAYS. DO NOT INSTALL TRANSFORMER UNTIL CONCRETE COMPRESSIVE STRENGTH REACHES 1,500 PSI MINIMUM OR AFTER 14 DAYS.
5. REINFORCING: ASTM A615, GRADE 40 MINIMUM.
6. LOCATE, SECURE, AND CAP ALL CONDUITS BEFORE POURING PAD. TOP OF CONCRETE TO BE SMOOTH AND TRUE, WOOD-FLOAT FINISH, FREE OF DEFECTS, AS PER APPLICATION CITY AND COUNTY SPECIFICATIONS. ROUND ALL EXPOSED EDGES TO 3/4" CHAMFER.
7. MAINTAIN A RELATIVELY LEVEL, MINIMUM CLEARANCE OF 2'-6" FROM THE SIDES OF THE PAD, 2'-0" FROM THE BACK OF PAD, AND 8'-0" IN FRONT OF PAD. EXTEND CONCRETE AN ADDITIONAL 8'-0" IN FRONT IF LOCATED IN PLANTING AREA.

1 / E402 500 - 750 KVA CONCRETE TRANSFORMER PAD DETAIL

NOT TO SCALE



STATIONARY STANCHION



REMOVABLE STANCHION

STANCHION NOTES:

1. STANCHIONS SHALL CONFORM TO ASTM A43.
2. STANCHIONS SHALL BE PAINTED YELLOW PER ANSI SPEC Z535.1 TO COMPLY WITH OSHA 1910.144 FOR COLOR CODING.
3. A 2" WIDE STRIP OF REFLECTIVE TAPE SHALL BE PLACED 6" BELOW THE TOP OF STANCHION.

2 / E402 TYPICAL STANCHION DETAILS

NOT TO SCALE

WAIAHOLE WATER SYSTEM IMPROVEMENTS

R. M. TOWILL CORPORATION
Planning • Engineering • Environmental Services • Photogrammetry • Surveying • Construction Management
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BRYCE H. KANEMURA
LICENSED PROFESSIONAL ENGINEER
No. 16360-E
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

SIGNATURE 2020.04.15 — 4/30/22 EXP. DATE

REVISION	DATE	BRIEF	BY	APPROVED

APPROVED BY

ENGINEER	BHK
DRAFTSMAN	BHK
CHECKED BY	BO
SCALE	AS SHOWN
DATE	APRIL 2020
DPP FILE NO.	2020/CP-XX

MISCELLANEOUS ELECTRICAL DETAILS II

FILE	POCKET	FOLDER	NO.

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