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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF: OCCL: AJR

CDUA: OA-3818

MAY - 3 2018

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

SUBJECT: **PUBLICATION OF THE DRAFT ENVIRONMENTAL ASSESSMENT (DEA) FOR THE PROPOSED MDHE, LLC SINGLE FAMILY RESIDENCE PROJECT**
Kailua, Ko'olaupoko District, Island of Oahu
TMK: (1) 4-3-005:094

Dear Mr. Glenn,

With this letter, the Department of Land and Natural Resources (DLNR) Office of Conservation and Coastal Lands (OCCL) hereby transmits the draft environmental assessment and anticipated finding of no significant impact (DEA-AFONSI) for the proposed *MDHE, LLC Single Family Residence Project* located on TMK: (1) 4-3-005:094 in Kailua, Ko'olaupoko District, Island of Oahu for publication in the **May 23, 2018** edition of the *Environmental Notice*.

Enclosed is a completed OEQC Publication Form, one (1) copy of the DEA-AFONSI, an Adobe Acrobat PDF file of the same, and an electronic copy of the publication form in MS Word. Simultaneous with this letter, we have submitted the summary of the action in a text file by electronic mail to your office.

If there are any questions regarding this letter, please contact Alex J. Roy, M.Sc., DLNR-OCCL, at 587-0316.

Sincerely,

for Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

Attachments: *OEQC Publication Form*
DEA-AFONSI (1 copy)
CD-RW w/ Pub Form (word), DEA-AFONSI (pdf)

18-557

APPLICANT
PUBLICATION FORM

Project Name:	1711 Kanapu'u Drive Residence and Stewardship
Project Short Name:	1711 Kanapu'u Drive Residence and Stewardship
HRS §343-5 Trigger(s):	Use of Conservation District Land
Island(s):	O'ahu
Judicial District(s):	Ko'olau Poko
TMK(s):	(1) 4-2-004:001
Permit(s)/Approval(s):	Conservation District Use Pemit; Building Permit; Grading Permit;
Approving Agency:	Office of Conservation and Coastal Lands, Department of Land and Natural Resources
Contact Name, Email, Telephone, Address	Alex J. Roy; alex.j.roy@hawaii.gov; (808) 587-0316 1151 Punchbowl St., Kalanimoku Bldg. Room 131 Honolulu, HI 96813
Applicant:	MDHE LLC.
Contact Name, Email, Telephone, Address	Dawn Horn; manager@1711kanapuu.com; (808) 225-7873 129 South Kalaheo Ave., Kailua, HI 96734
Consultant:	G70
Contact Name, Email, Telephone, Address	Jeffrey H. Overton; kanapuu_drive@g70.design; (808) 523-5866 111 S. King Street; Suite 170 Honolulu, HI 96813

Status (select one)	**Submittal Requirements**
_X_ DEA-AFNSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.
____ FEA-FONSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.
____ FEA-EISPN	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.
____ Act 172-12 EISPN ("Direct to EIS")	Submit 1) the approving agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.
____ DEIS	Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.
____ FEIS	Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.
___ FEIS Acceptance Determination	The approving agency simultaneously transmits to both the OEQC and the applicant a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
____ FEIS Statutory Acceptance	The approving agency simultaneously transmits to both the OEQC and the applicant a notice that it did not make a timely determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and therefore the applicant's FEIS is deemed accepted as a matter of law.
____ Supplemental EIS Determination	The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that

	a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice.
____ Withdrawal	Identify the specific document(s) to withdraw and explain in the project summary section.
____ Other	Contact the OEQC if your action is not one of the above items.

Project Summary
Provide a description of the proposed action and purpose and need in 200 words or less.

The applicant proposes full time occupancy of its undeveloped privately-owned land with construction of a single-family residence and intends to improve vegetation diversity and soil conditions through forest stewardship and land conservation activities. The home will be accessed through the 81-home subdivision of Kailua Bluffs, and will tie into City sewer and drinking water infrastructure. A roof-top mounted photovoltaic system will provide for the home's energy needs. The two-story single-family home will be constructed within the maximum developable area as defined by the Conservation District Rules Single Family Residential standards, leaving 99.7 percent of the 36.9-acre parcel as open space. The home has been purposefully sited below a primary ridgeline to prevent silhouette and behind an existing grove of mature Formosa koa trees. Roof color and finishes will be selected to blend with the surrounding environment.

A subsistence garden approximately .6 acres in size will be established near the home site to provide fruits and vegetables for the family's use. Under a State-approved Forest Stewardship Management Plan, 6 acres of low-benefit, non-native dominated forest will be transformed to a native and Hawaiian-canoe plant dominated lowland mesic forest. Additional soil conservation measures will be implemented to improve soil conditions.

1711 KANAPU'U DRIVE
Residence and Stewardship

TMK (1) 4-2-004:001
Kailua, O'ahu, Hawai'i

Draft Environmental Assessment

Applicant:
MDHE LLC
129 South Kalaheo Avenue
Kailua, HI 96813

Prepared by:

G70

Architecture • Planning & Environmental Services • Interior Design • Civil Engineering
Honolulu, Hawai'i

April 2018

1711 KANAPU'U DRIVE
Residence and Stewardship

TMK (1) 4-2-004:001
Kailua, O'ahu, Hawai'i

Draft Environmental Assessment

This environmental document is prepared in
accordance with the requirements of Chapter 343, HRS and
Hawai'i Administrative Rules, Title 11, Department of Health.

Applicant:
MDHE LLC
129 South Kalaheo Avenue
Kailua, HI 96813

Prepared by:

G70

Architecture • Planning & Environmental Services • Interior Design • Civil Engineering
Honolulu, Hawai'i

April 2018

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Section 1.0

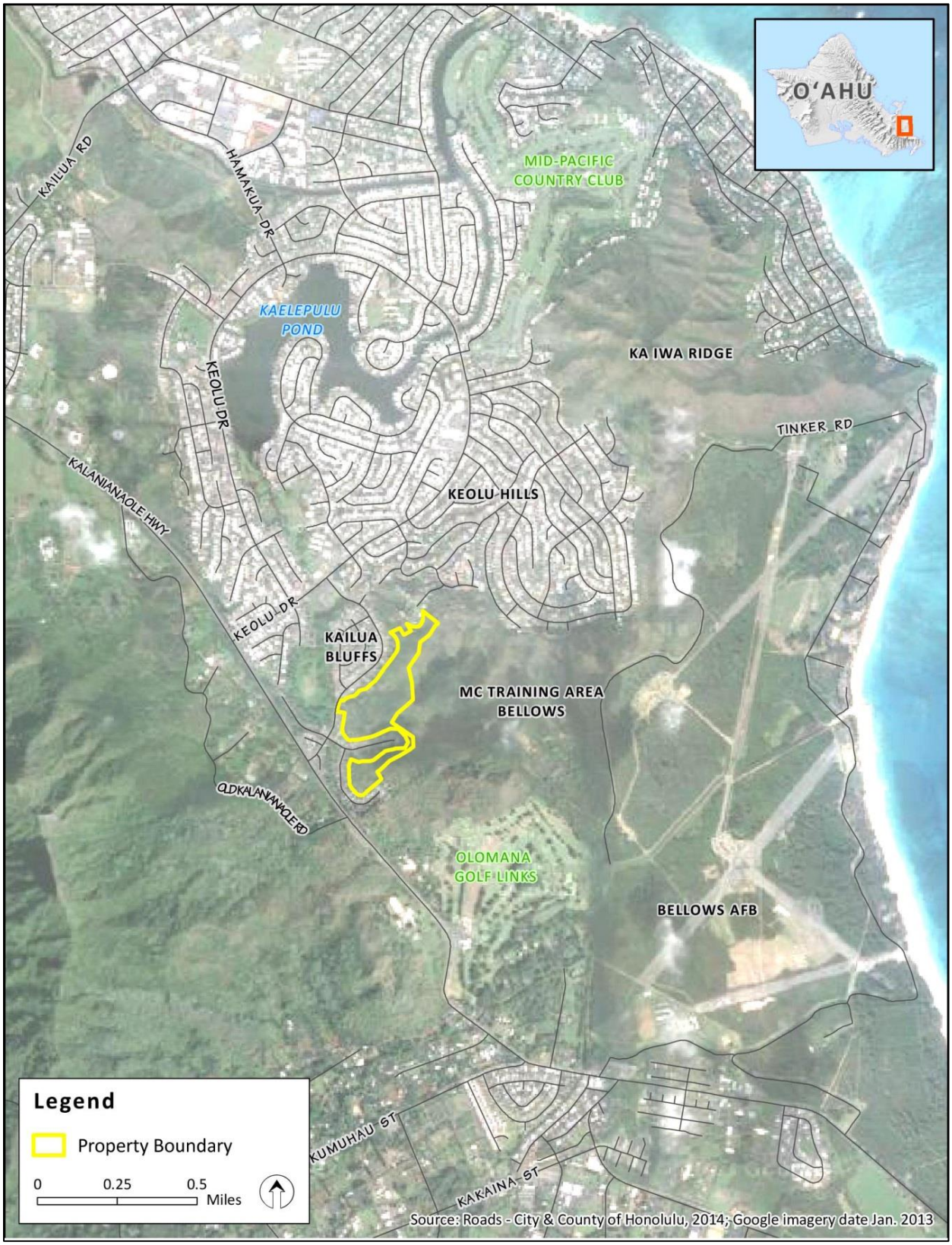
Introduction

1.0 INTRODUCTION

This Environmental Assessment (EA) was prepared in accordance with Hawaiʻi Revised Statutes (HRS) Chapter 343, and HRS Chapter 183C, Conservation District, and Hawaiʻi Administrative Rules (HAR) Title 13 Chapter 5, Conservation District Rules.

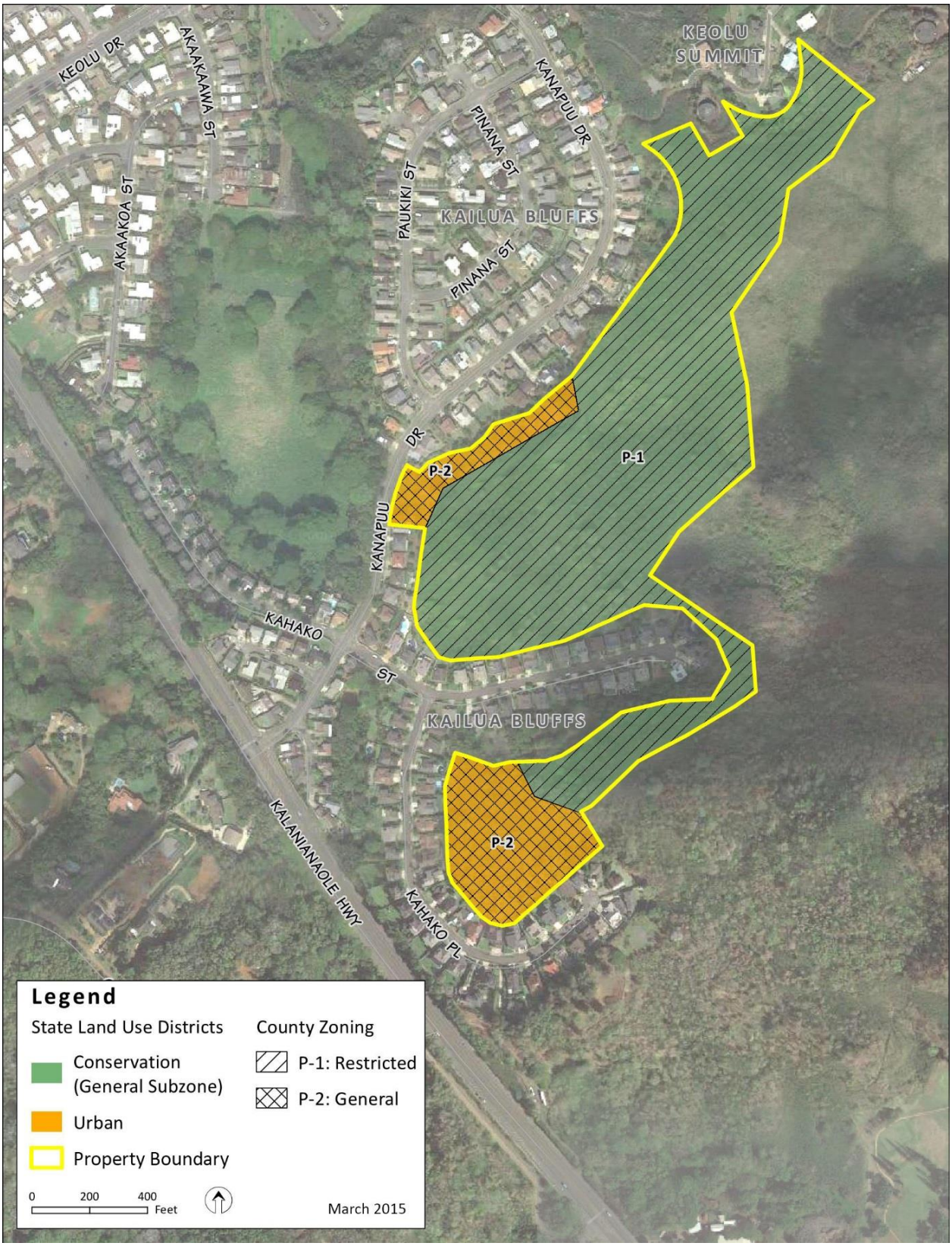
1.1 PROJECT INFORMATION SUMMARY

Type of Document:	Draft Environmental Assessment (EA)
Project Name:	1711 Kanapuʻu Drive Residence and Stewardship
Applicant:	MDHE LLC 129 South Kalaheo Ave. Kailua, HI 96734 Contact: Dawn R. Horn, Managing Member Phone: 808 225-7873
Applicant's Agent:	G70 925 Bethel Street, 5th Floor Honolulu, HI 96813 Contact: Jeff Overton, AICP; Principal Planner Phone: 808 523-5866
Approving Agency:	Office of Conservation and Coastal Lands Department of Land and Natural Resources 1151 Punchbowl St., Room 131, Honolulu, HI 96813
EA Trigger:	HRS 343-5(2) Use within State Conservation District
Project Location:	1711 Kanapuʻu Drive, Kailua, Oʻahu, HI *(Figure 1-1)*
Tax Map Key:	(1) 4-2-004:001 *(Figure 1-2)*
Project Area:	7.6 acres (Parcel size: 36.89 acres)
Landowner:	MDHE LLC
State Land Use District:	Urban & Conservation District (General Subzone) *(Figure 1-3)*
City & County Zoning:	P-1 Restricted Preservation, P-2 General Preservation *(Figure 1-3)*
City & County Development Plan:	Koʻolau Poko Sustainable Communities Plan
Special Design District:	None
Special Management Area:	Not in SMA
Flood Zone:	Zone X (Outside the 0.2 percent annual chance floodplain)
Anticipated Determination:	Finding of No Significant Impact (FONSI)



Project Location **Figure 1-1**

Parcel Boundary: Tax Map Key **Figure 1-2**



State Land Use Districts and County Zoning **Figure 1-3**

1.2 SITE LOCATION AND CHARACTERISTICS

The 36.89-acre parcel lies within the traditional moku of Koʻolaupoko and the ahupuaʻa of Kailua (*Figure 1-2*). The parcel is owned by MDHE LLC, a Veteran-owned, Limited Liability Company formed for the care and management of the property. Two State Land Use designations fall within the parcel: 30 acres of Conservation District (General subzone), and nearly 7 acres – in separate pieces – of Urban District (*Figure 1-3*). The property is a remnant of rezoning for the purposes of subdivisions granted in 1981 and 1987 to the developer of Kailua Bluffs. Approximately 81 single-family homes border the parcel's west and southern boundaries.

The property has been assigned the address of 1711 Kanapuʻu Drive. The topography is varied, rising from approximately 80 feet above mean sea level (msl) at the Kanapuʻu Drive access point, to approximately 360 feet msl at the highest point along the north/northeast boundary. Slopes range from 5 to 70 percent with aspects in all cardinal directions, culminating in a ridge that comprises the parcel's eastern boundary. A rudimentary road rises from the vicinity of Kanapuʻu Drive to the ridge line, following fragments of a previously graded dirt road network. The landowner maintains portions of the road from encroaching brush to retain access by foot or 4-wheel drive vehicle.

From the eastern boundary, slopes drop into the adjacent Marine Corps Training Area Bellows. The south-eastern boundary is adjacent to the DK Ranch and Boarding Stables. Previous use of the parcel includes cattle ranching, and old barbed-wire fencing can be found on site. Vegetation on site is typical of former pasture and low-elevation environments on Oʻahu, dominated by introduced plants and animals. A biological inventory of the parcel confirmed the parcel does not include any wetlands or other sensitive ecosystems; no rare or endangered plants, animals, or native-dominated habitat exist on site.

Development History

The two Urban District areas within the parcel are a remnant of site development. In 1980 and 1987, the State of Hawaiʻi Land Use Commission approved two petitions by developer Lone Star Hawaiʻi, Inc. Reclassification of 34.1 acres from Conservation District to Urban District was granted for Increment I in 1981. Proposed in four phases, a total of 250 units were proposed in Increment I as a mix of single family residences and attached residences in cluster development (LUC 1981). Increment II was proposed at another 159 units on an additional 37.8 acres of land reclassified from Conservation District to Urban District. In 1987, the developer provided evidence of substantial progress on on-site and off-site improvements under Increment I, and the Land Use Commission reclassified the additional 37.8 acres. The total lots to be available for residences were reduced to approximately 104 units. Lot 88 – now defined as 1711 Kanapuʻu Drive – incorporates areas of the Urban district not developed by Lone Star Hawaiʻi, Inc.

In 2014, the landowner consigned a survey to determine the location of the Urban District boundary portions within the parcel. With the survey findings, the Land Use Commission provided a boundary determination: the two Urban District pieces within the MDHE, LLC parcel are approximately 4.691 and 1.985 acres, for an approximate total of 6.676 acres. The remainder of the MDHE-owned parcel, or approximately 30.217 acres, was determined to be in the Conservation District. The survey map was filed March 2015 by the State Land Use Commission as Boundary Interpretation No. 14-01.

Encroachments

Twelve encroachments violating Conservation District rules and affecting 3.5 acres of the property within the Conservation District were resolved by the landowner through cooperation with the encroaching neighbors. Another twelve encroachments affecting only the portions of the property within the Urban District were similarly resolved.

Two encroachments into both the Urban and Conservation Districts resulted in agreement that the encroaching neighbor discontinue all activities and remove the structures within the Conservation District. MDHE allowed temporary continued use of limited activities within the Urban District under revocable licenses terminating in July 2019 or upon the earlier sale or transfer of the encroaching neighbor's property. One encroachment of a retaining wall solely within the Urban District resulted in standard residential wall encroachment agreement terminating upon the encroaching owner's transfer or sale of the property. One significant encroachment including a concrete rock masonry wall (CRM) and drainage swale installed by a Keolu Summit landowner crossing into the parcel's northern boundary was resolved with an after-the-fact approval for a drainage swale (File No. CDUP OA-3721).

Current Land Uses

The landowner has removed items dumped on the property and initiated removal of dying trees and potential fire hazards. Authorization was granted by the State Department of Land and Natural Resources (DLNR) Office of Coastal and Conservation Lands (OCCL) for several management activities including routine weed control to maintain drainage ways and site access, and for periodic humane trapping and relocation of feral pigs. The latter is conducted by the Pig Hunters Association of Oʻahu in cooperation with the land owner.

1.3 OVERVIEW OF PLANNED USE

The project proposes an owner-occupied single-family residence, with conservation and stewardship on a portion of the parcel in accordance with the Hawaiʻi State Division of Forestry and Wildlife (DOFAW) approved Forest Stewardship Management Plan, and the Windward Oahu Soil and Water Conservation District-approved Conservation Plan. The house site will be supported by an access road and utilities (electrical, water, and sewer) from the neighboring Kailua Bluffs subdivision at 1711 Kanapuʻu Drive. With a vision of low-impact and sustainable systems, the home will include a rooftop photovoltaic (PV) system with battery storage backup, and a family subsistence garden on approximately 0.6 acre near the home. Conservation and stewardship activities on approximately 6 acres in the central portion of the site will be undertaken to reduce erosion, improve soil conditions, and transform the low-benefit, non-native dominated landscape into a native plant-dominated lowland forest and shrub land. The majority of the 37-acre parcel will remain open space.

This project reflects a refinement of a similar project proposed in 2014 by the same landowner.

1.4 PURPOSE OF THE ENVIRONMENTAL ASSESSMENT

This Environmental Assessment (EA) was prepared in accordance with Hawaiʻi Revised Statutes (HRS) 343, as use of land in the State Conservation District is a trigger under §343-5(a)(2). The content of this EA is guided by Hawaiʻi Administrative Rules (HAR) §11-200 Environmental Impact Statement Rules. DLNR's OCCL is the Approving Agency for the EA.

Under HAR §11-200, the approving agency facilitates publication of the Draft EA through *The Environmental Notice* of the Office of Environmental Quality Control. Publication initiates a 30-day public comment period. Responses to comments will be prepared and sent directly to commenters, as well as published in the Final EA alongside the original comments. OCCL as the Approving Agency will review the Draft EA and public and agency comments and will consider potential impacts against the significance criteria in HAR §11-200-12 to determine whether the proposed action may have a significant effect. Section 6 of this EA evaluates project impacts against the significance criteria and anticipates that OCCL will issue a Finding of No Significant Impact (FONSI).

This EA is largely based on a Final EA published April 8, 2015 in *The Environmental Notice* for which the OCCL issued a Finding of No Significant Impact (FONSI). Under the Conservation District Rules (HAR §13-5), an EA (or proof of an exemption) is required as part of a Conservation District Use Permit (see *Section 1.5 Permits and Approvals Required*). HRS §343-5(g) allows the use of a prior determination or FONSI ". . . an agency may consider and, where applicable and appropriate, incorporate by reference, in whole or in part, previous determinations of whether a statement is required and previously accepted statements. . . ." Thus per §343-5, the FONSI issued in 2014 could be relied upon for future proposed action used in an EA for that subsequent particular action. However, a new EA and CDUA is required for the currently refined proposed project.

1.5 PERMITS AND APPROVALS REQUIRED

Land uses identified as allowable in the Conservation District are specified in HAR §13-5. The property is within the Conservation District General subzone, where the project components described in this EA are allowed with varying review, permits and conditions (*Table 1-1*).

A Conservation District Use Application will be submitted to the Office of Conservation and Coastal Lands. OCCL and the Board of Land and Natural Resources will review uses proposed and consider issuance of a Conservation District Use Permit (CDUP) with standard conditions.

Additional County and State permits will be needed to implement the proposed action:

- Building Permit (Buildings, Electrical, Plumbing), and Sidewalk/Driveway Work (Department of Planning and Permitting - DPP)
- Grading and Trenching Permits (DPP)
- Sewer Connection Permits (DPP)
- Historic Preservation Review (State Historic Preservation Division)

Two technical plans have been approved for the parcel for vegetation and soils management. A Conservation Plan was developed in coordination with the Oʻahu Resources and Conservation Service and approved by the Windward Oʻahu Soil and Water Conservation District (July 2016). A Forest Stewardship Management Plan was approved by the Forest Stewardship Advisory Committee in January 2017. Participation in the Forest Stewardship program provides State cost-matching funds for the eligible practices approved under the plan.

Table 1-1: Compliance with HAR §13-5 Identified Land Uses and Required Permits			
Proposed use	**Regulatory Reference HAR §13-5** (Unless otherwise noted)	**Review or Permit Required †**	**General Conditions**
Single Family Residence and Accessory Use	§13-5 Section 24 *Identified Land Use in the Resource Subzone* (R-7)* Single Family Residence	D-1: Board of Land and Natural Resources Permit (Conservation District Use Permit – CDUP - with EA)	In compliance with HAR §13-5 Exhibit 4: Single Family Residential Standards
Access Road	Conservation Practice Code 560 (Natural Resources Conservation Services) City and County of Honolulu Uniform Fire Code 2006	Review by: Windward Oahu Soil and Water Conservation District; and Honolulu Fire Department	16' width With 20' clearance
Removal of invasive plants and diseased or dead trees Native plant introduction	§13-5 Section 22 *Identified Land Use in the Protective Subzone* (P-4, P-11, and P- 13)* Remove Invasive Species (>1 ac) Tree Removal Land /Resource Mgmt. (> 1 ac)	B-1: Site Plan approval A-2: No permit required B-2: Site Plan approval	Issuance of CDUP OCCL requires documentation of the need to remove trees
Subsistence Agriculture	§13-5 Section 23 *Identified Land Use in the Limited Subzone* (L-1*) Agriculture (< 1 ac)	C-1: Departmental permit	Issuance of CDUP
† Required permits are identified by alpha-numeric code summarized in HAR §13-5-22 * Allowable land uses in Protective, Limited and Resource Subzones also apply to the General Subzone			

1.6 AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONTACTED DURING THE EARLY CONSULTATION PROCESS

Numerous resource management agencies and entities were contacted to formulate specific goals and objectives for two key uses: Land and Resource Management (referred to as "stewardship" in this document) and Subsistence Agriculture. Soil conservation entities, forest management, native plant specialists and agricultural groups were consulted. OCCL provided feedback on the project as proposed in 2014; this EA includes the refinements requested by OCCL.

The full list of agencies and entities contacted during the EA pre-consultation period is provided in *Section 7.0* of this document, and the additional agencies to be sent the Draft EA for comment are also noted.

Section 2.0

Description of the Proposed Action

2.0 DESCRIPTION OF THE PROPOSED ACTION

2.1 PROJECT PURPOSE

The project purpose is to utilize currently undeveloped private land and bring full-time presence to the site, and to enhance vegetation diversity through forest stewardship and land conservation. Land uses will include an owner-occupied single-family residence, and conservation and stewardship in a portion of the parcel in accord with the Hawaiʻi State Division of Forestry and Wildlife (DOFAW) approved Forest Stewardship Management Plan, and the Windward Oʻahu Soil and Water Conservation District-approved Conservation Plan for the property. A subsistence garden on approximately 0.6 acre near the home will provide fruits and vegetables for family consumption.

2.2 DESCRIPTION OF THE PROPOSED ACTION

Full-time landowner presence will be enabled through construction of a single-family home built in conformance with all applicable building and grading codes including those of the State Conservation District Use rules (see *Section 2.2.1 Conservation District Use Requirements*). Municipal utility tie-in for wastewater, water and electrical lines will follow the route of the on-site access road to support the two-story, three-bedroom home. Landscaping around the house and a small therapeutic pool will complete the developed home site.

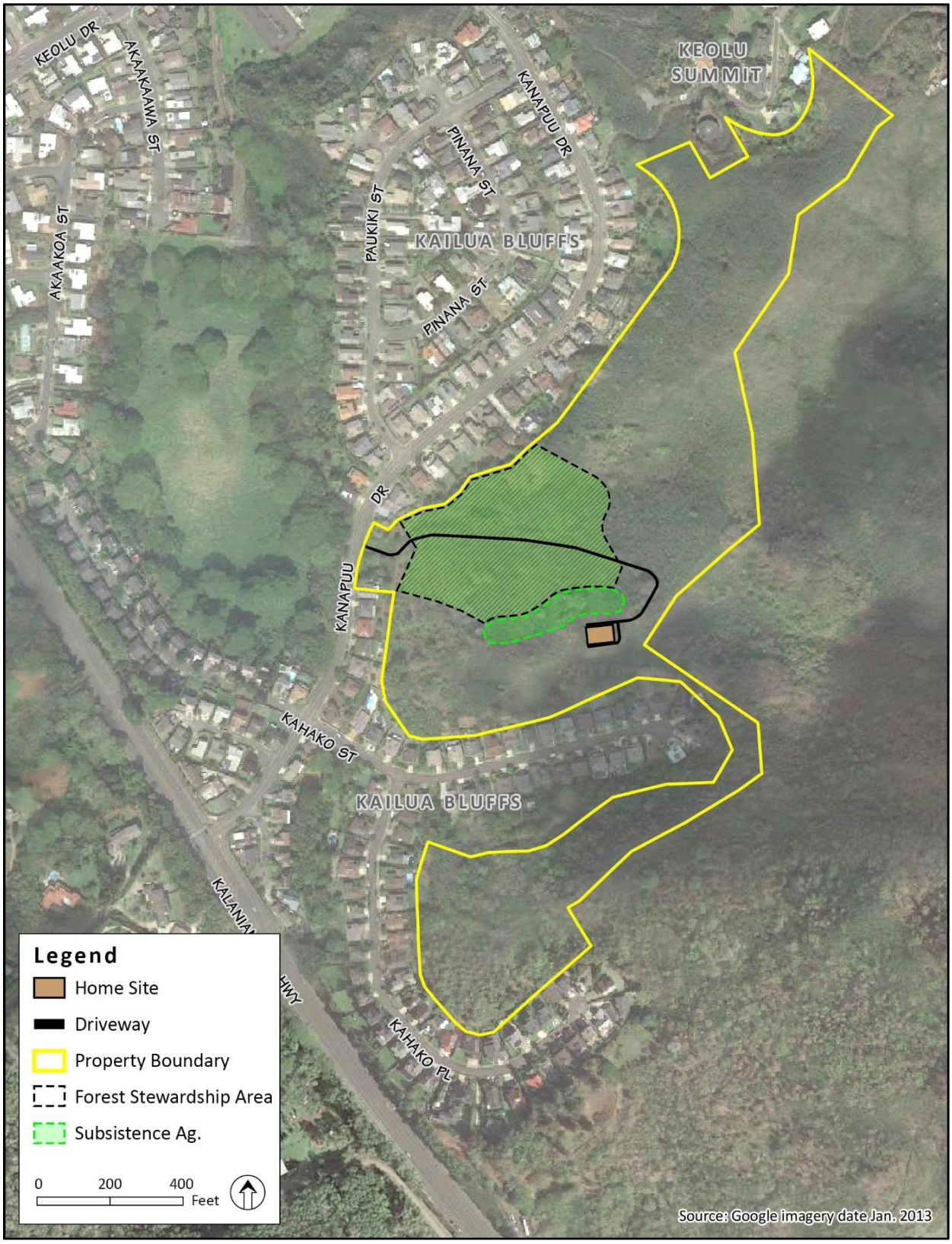
A subsistence garden of 0.6 acre is proposed near the home to grow fresh vegetables and fruit for the family. Stewardship (management of the land) to enhance vegetation diversity and to reduce erosion across approximately 6 acres of the parcel's central portion will be undertaken over a period of 10 years. Further details are provided in *Sections 2.2.4* and *2.2.5*.

OCCL requested that alternative home sites on the parcel be analyzed to ensure impacts to Conservation lands are sufficiently mitigated. This Chapter describes the proposed action using Alternate Site A ("Alt A"), which was determined through this EA analysis to meet the selection criteria. The complete analysis is contained in Chapter 4; *Figure 2-1* displays the proposed uses.

2.2.1 CONSERVATION DISTRICT USE REQUIREMENTS

The project components are identified uses within the Conservation District under HAR §13-5 with review and permits as outlined in *Table 1-1*. Single-family residences are guided by Exhibit 4 of HAR §13-5, with compatibility of the surrounding environs a guiding tenet. By definition, a single-family residence is limited to one kitchen, and is not to be used for rental or commercial purposes. Structures are to be painted in earth tones compatible with the surrounding areas, and landscaping should screen structures. Grading and contouring are to be kept to a minimum with consideration of slope. For lots larger than one acre, the maximum developable area is 5,000 square feet. This use requires a Board permit.

The subsistence garden approximately 0.6 acre is allowable under the Agricultural use identified in HAR §13-5. For planting, cultivation and harvesting of horticulture crops or forest products in an area of less than one acre, a departmental permit is required.



Overview of Project **Figure 2-1**

The stewardship activities described in *Section 2.2.4* are characterized by three uses identified in HAR §13-5: remove invasive species (P-4); tree removal (P-11); and land and resource management (P-14). Removal of invasive species in an area of greater than 1 acre requires Site Plan Approval from OCCL (the "Department"). Removal of dead, diseased or hazardous trees does not require a permit from OCCL. Selective removal of individual trees for non-commercial purposes is allowable with Site Plan Approval from OCCL, provided the tree is replaced on a one-to-one basis, preferably with endemic or indigenous trees. A Conservation District Use Permit (CDUP) for all uses presented in this EA will be requested and will cover review by both the Department and the Board (Board of Land and Natural Resources; BLNR.

Additionally, two approved management plans providing technical guidance for proposed activities on the site have been approved by resource agencies. A Conservation Plan was developed in coordination with the O'ahu Resources and Conservation Service and approved by the Windward O'ahu Soil and Water Conservation District (July 2016), which provides conservation practices to minimize soil erosion, improve plant conditions, and address water runoff. A Forest Stewardship Management Plan was approved by the Forest Stewardship Advisory Committee in January 2017; implementation can begin when the CDUP is secured. The plan describes the forest stewardship practices to achieve objectives of transforming a 6-acre non-native dominated area to native and Hawaiian canoe plant lowland mesic forest and shrubland and to improve watershed function through increased biodiversity and improved rainwater infiltration. *Section 2.2.4 Forest Stewardship* provides further detail on the conservation and forest stewardship practices to be applied.

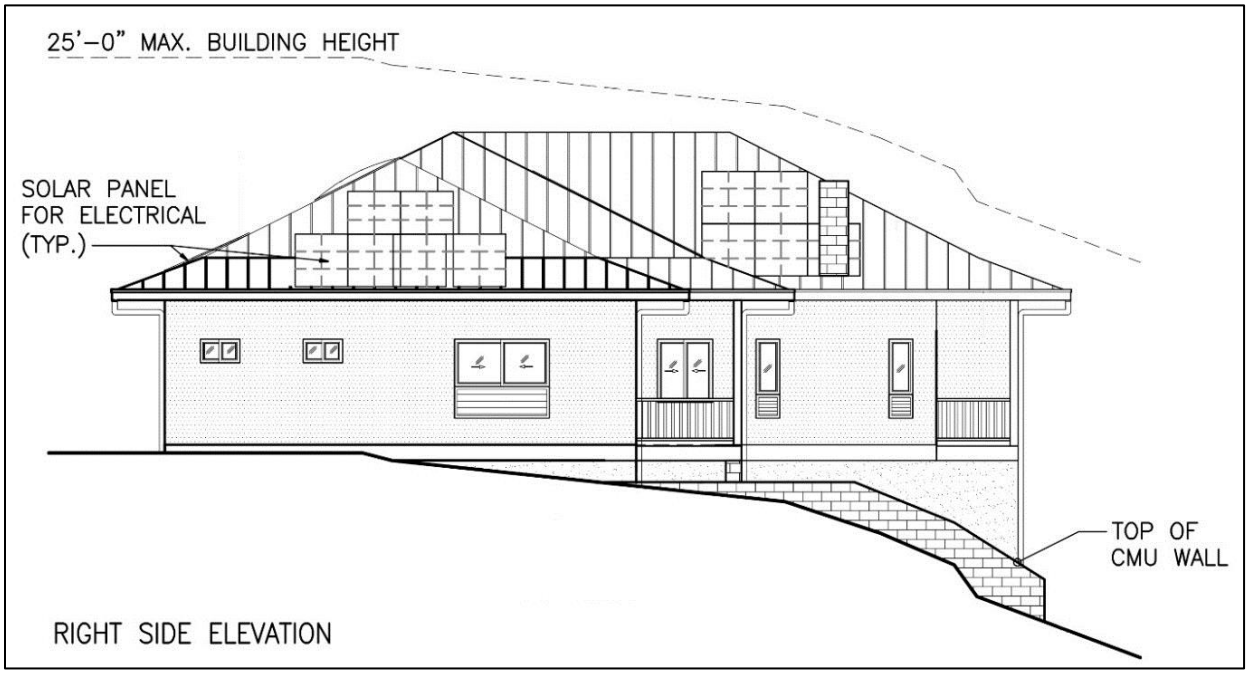
The majority of the 36.89-acre parcel (99.7 percent) will remain open space (see *Section 3.16, Visual Resources*).

2.2.2 SINGLE FAMILY HOME

The two-story, three-bedroom home will evoke an open Plantation-style home (*Figure 2-2*). The upper level includes covered lanai and entry areas and will provide the primary 2,614 square feet of living space. The lower level will consist of a garage and storage space of approximately 1,700 square feet, to be constructed from a concrete slab at 244-feet mean sea level. A small lap pool and associated impermeable areas complete the homesite within the maximum developable area of 5,000 square feet (*Figure 2-3*).

In accordance with the single-family home development standards under HAR §13-5, the structure's paint and roof color will be compatible with the surroundings, and landscaping will be used to screen the structures. Mature Formosa koa trees will screen the home from the west/northwest. The wastewater and water collection systems will be permitted by the Department of Planning and Permitting, and grading of the property will be kept to a minimum with consideration of slope. The structures will conform to all applicable building and grading codes.

The access road will contour up from Kanapu'u Drive following fragments of a previously graded dirt road network and will be excavated with embankments where needed for stabilization. Use of permeable surfacing materials such as Grasscrete® or gravel paving will be considered and determined during the City and County construction permit phase.



Single-Family Home Elevation View **Figure 2-2**

2.2.3 UTILITIES AND INFRASTRUCTURE

Water Supply

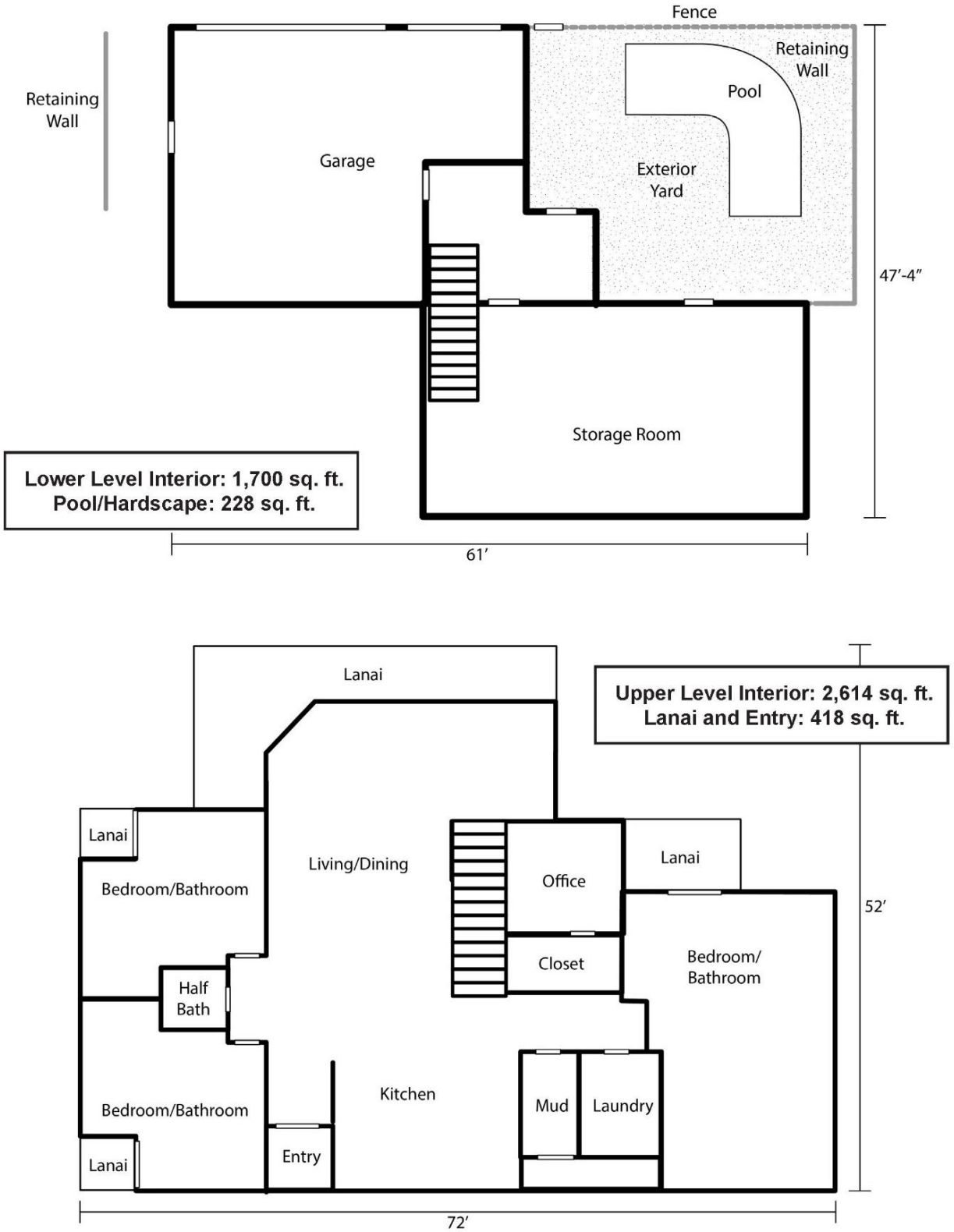
The City and County of Honolulu Board of Water Supply responded to an inquiry from the landowner prior to finalization of purchase, confirming the existing water system is adequate to accommodate the proposed development. A water meter will be installed at the property entrance on Kanapu'u Drive; a two-inch diameter pipe will convey water to the home. Fire suppression infrastructure will also be installed to include appropriately sized water supply lines and an on-site fire hydrant to ensure adequate pressure at the home site.

Wastewater

Wastewater flows generated at the home site will be transmitted to the existing City and County 8-inch main through a 6-inch gravity sewer lateral along the access road connection at 1711 Kanapu'u Drive.

Storm Drainage

The current surface flow pattern and vegetation on site will be retained. Existing on-site drainage for the west-facing 23-acre portion of the parcel will continue to flow to a culvert installed by the Kailua Bluffs subdivision developer. Overland runoff flows over the vegetated site. *Section 3.8.3 Storm Drainage* and *Appendix C* calculate changes in runoff from the single-family home construction and conclude that the existing culvert has sufficient capacity for the calculated increase of 2.8 percent in storm water runoff.



Single-Family Home Plan View **Figure 2-3**

Recently revised City and County of Honolulu "Rules Relating to Water Quality" establish minimum requirements for the selection, design, implementation and maintenance of best management practices (BMPs) to protect receiving waters from pollutants associated with land disturbance and land use. Storm water runoff collected from the home's roof will be routed by downspouts to rain garden areas or planter boxes to prompt infiltration to soil. The approved Conservation Plan describes practices to be employed in the primary drainage area above the culvert to manage water flow and trap sediment (see *Section 2.2.4 and 3.8.3*).

Utilities

Electrical power and communication infrastructure will be routed to the home site through an underground conduit along the access road alignment (*Figure 2-4*). Electricity for the home will be ultimately supplied by roof-top photovoltaic (PV) panels.

Access, Roadways and Parking

The proposed access road to the selected home site will contour along the hillside, gaining 150 feet in elevation to the home site along its 1,220-foot length (*Figure 2-4*). The proposed access road apron along Kanapu'u Drive is in the Urban District, and will be 24-feet wide, narrowing to a 16-foot wide road with 2-foot shoulder clearances on both sides. The access road will meet emergency access standards and be reviewed by the Honolulu Fire Department to ensure compliance with fire code. Selection of acceptable permeable surfacing materials will be finalized in the City and County construction permit phase in consultation with the Honolulu Fire Department Plans Review division.

2.2.4 FOREST STEWARDSHIP AND CONSERVATION PLANNING

Under a Forest Stewardship Management Plan approved by the State Forest Stewardship Committee, the landowner has set goals to transform a 6-acre area of low-benefit, non-native dominated vegetation to a native and Hawaiian canoe-plant dominated lowland mesic forest over a 10-year period. In addition to improving plant diversity on the site, soil erosion will be reduced and rainwater infiltration will be increased with improved soil conditions.

The parcel has a history of agricultural use and was historically used for cattle grazing. The surrounding subdivision was developed in 1980 on portions of the former ranch; *Section 1.2* briefly describes the adjacent, existing livestock ranch and stable. On the 1711 Kanapuu Drive site, 6 acres have been selected for native plant restoration in the central portion of the parcel. This area encompasses the best planting habitat as evidenced by a higher diversity of non-native plant types when compared to the monotypic stands of haole koa and Guinea grass on other parts of the parcel.

Nine management practices are described in the approved *Forest Stewardship Management Plan*: fencing; tree/shrub site preparation; irrigation; tree/shrub establishment; groundcover establishment; mulching; weed control; forest health and protection; and monitoring. Described briefly here, the stewardship use may be modified through guidance of the plan-approving body, the Forest Stewardship Committee, as well as personnel from the State Division of Forestry and Wildlife within the Department of Land and Natural Resources, and technical advisors.

Fencing will be to exclude feral pigs from the 6-acre planting site and will consist of a four-foot tall "hogwire" (woven galvanized steel 12- to 14-gauge wire) fence stretched between steel "T-posts." Posts are pounded into the ground; corners and gates are braced with treated wood or galvanized steel pipe posts installed in concrete footings. Brush along the fence line route must be removed.

Continued trapping and removal of feral pigs by the O'ahu Pig Hunters Association will continue, to minimize pig rooting and damage.

Site preparation consists of removing invasive species and digging individual holes for seedlings. Holes will be dug with a pick axe or gas-powered auger approximately 1½ foot deep and 1 foot in diameter, immediately before planting. Small non-adjacent areas will be planted to create a patchwork of undisturbed and revegetated areas, until all areas within the 6-acres are restored.

Invasive and non-native plants targeted for removal are shown in *Table 2-1*.

Table 2-1
Invasive and Non-Native Species for Removal

Species	Common Name
ANACARDIACEAE *Schinus terebinthifolius Raddi*	Christmas Berry
CUCURBITACEAE *Coccinia grandis*	Scarlet-fruited gourd, Ivy gourd
FABACEAE *Leucaena leucocephala*	Koa Haole
FABACEAE *Falcataria moluccana*	Albizia
POACEAE *Urochloa maxima*	Guinea grass
POACEAE *Urochloa mutica*	California grass

Micro-irrigation or drip irrigation is recommended in the Forest Stewardship Plan to help seedling establishment and survival. An irrigation specialist will be consulted to determine the best system and provide appropriate water pressure nozzle output, etc. Components will be reusable and able to be moved among the small non-adjacent areas as planting progresses through the restoration area.

Tree and shrub establishment refers to planting, which will be done by hand with either a pick-axe or other hand tool appropriate for the type of plant. Indigenous tree species, shrubs and ground cover plants will be intermixed using spacing as provided in the Forest Stewardship Plan or as advised by technical advisors. Natural fertilizers, such as chicken manure, can be used to establish seedlings. Weed control will utilize mulch, shading, and removal of undesirable non-native plants that may compete with the stewardship plantings.

Indigenous and native plants to be used for restoration include those shown in *Table 2-2*.

Ecological monitoring will be conducted to gauge seedling survival and provide a record of success. Monitoring and maintenance of the fence perimeter will be on-going to ensure feral pigs are kept out of the forest stewardship area.

The Conservation Plan includes seven practices, some of which are similarly described in the Forest Stewardship plan. Conservation practice specifications are provided to guide removal of invasive plants, maintaining permanent vegetation cover, and establishing an access road in a manner consistent with a conservation area. The Natural Resources Conservation Service through the local O'ahu Resources and Conservation Service provides on-going technical guidance to landowners such as MDHE.

Table 2-2
Indigenous and Native Plants for Reforestation

Species	Common Name
Tree Species	
Acacia Koaia	Koaiʻe
Aleurites moluccana	Kukui
Alphitonia ponderosa	kauila
Artocarpus altilis	ʻUlu, breadfruit
Cocos nucifera	Niu, coconut
Cordia subcordata	Kou
Diospyros sandwicensis	Lama
Erythrina sandwicensis	wiliwili
Metrosideros polymorpha	ʻōhiʻa
Musa sp. hybrid	Maiʻa, banana
Nestegis sandwicensis	olopua
Pandanus tectorius	hala
Plomele spp.	hala pepe
Thespesia populnea	Milo
Shrub Species	
Broussonetia papyrifera	wauke
Ceasalpinia pulcherrima	ʻohai aliʻi
Chenopodium oahuense	ʻāweoweo
Cordyline fruicosa	Kī, ti
Dodonaea viscosa	ʻaʻaliʻi
Lageneria spp.	pū
Morinda citifolia	noni
Osteomeles anthyllidifolia	ʻūlei
Sida fallax	ʻIlima
Touchardia latifolia	olona
Vitex rotundifolia	Pohinahina
Wikstroemia spp.	akia

Species	Common Name
Groundcover Species	
Asplenium spp.	fern
Colocasia esculenta	Kalo, taro
Curumo domestica	ʻōlena
Dioscorea alata	uhi
Heteropogon contortus	pili
Ipomoea batatas	ʻuala, sweet potato
Nephrolepis cordifolia	Kupukupu
Oxalis corniculata	ʻihi ʻai
Pteris spp.	fern
Tacca leontopetlaoid	Pia
Waltheria indica	ʻuhaloa

2.2.5 GARDEN/AGRICULTURAL AREA

Approximately 11 species of fruit trees will be planted in the area below the home. In addition to providing fruit for the family's use, the trees will provide a visual buffer from Kanapu'u Drive and other areas of Kailua. Drip irrigation will be placed to deliver water to each tree until establishment. Rainwater from roof run-off will be utilized to the extent feasible. Organic gardening techniques will be employed, using natural composts as soil amendment. Vegetables and herbs will be planted in containers of organic soil procured from off-site sources. Use of containers minimizes the exposure to soil pests, slugs and snails. Plants to be raised for non-commercial use by the family are listed in *Table 2-3*.

Table 2-3
Subsistence Agriculture Area

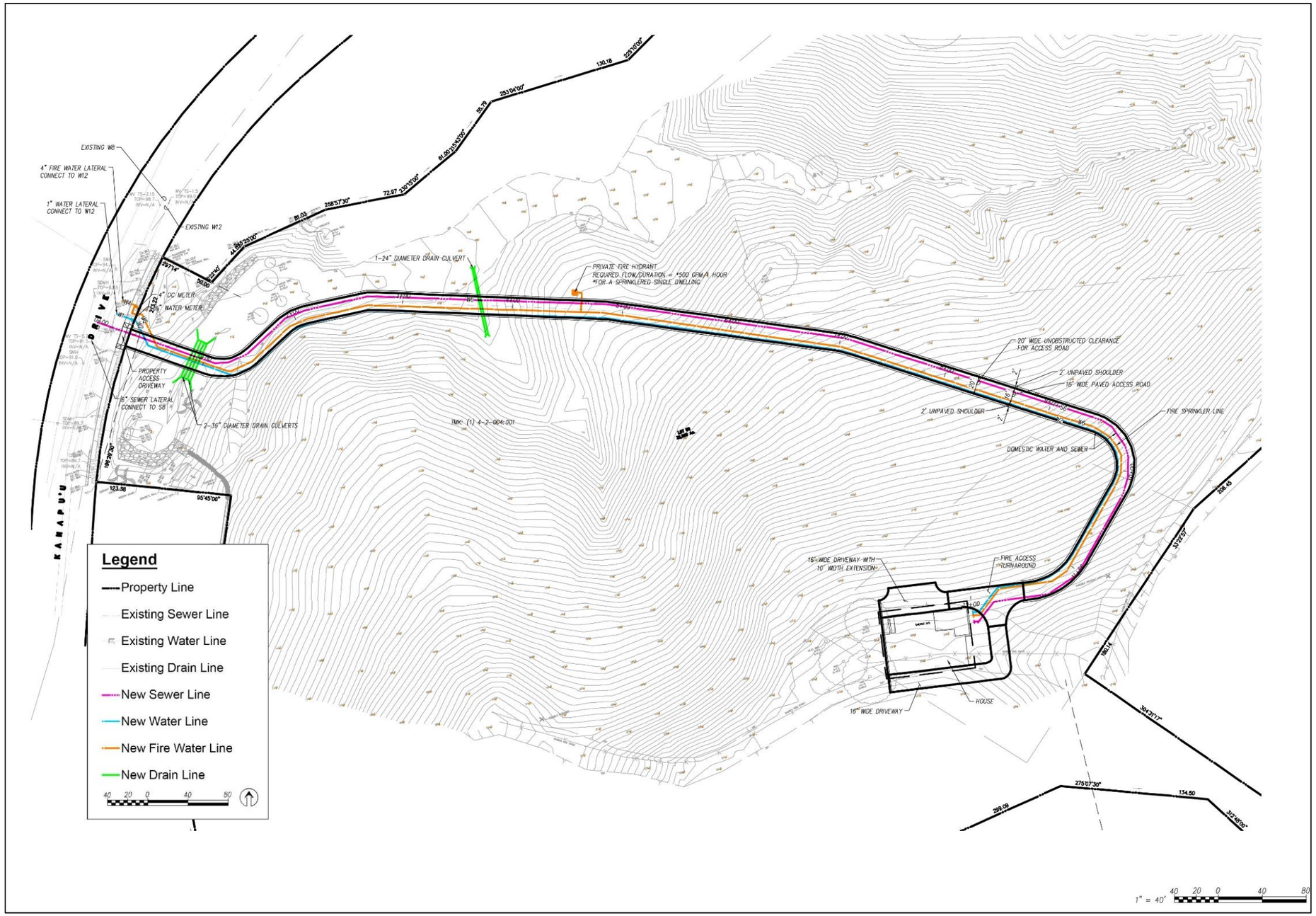
Species	Common Name
AMARYLLIDACEAE *Allium cepa*	Onion
AMARYLLIDACEAE *Allium sativum*	Garlic
AMARYLLIDACEAE *Allium schoenoprasum*	Chive
ANNONACEAE *A.Atemoya*	Atemoya
APIACEAE *Anathum graveolens*	Dill
APIACEAE *Daucus carota*	Carrots
ARACEAE *Colocasia esculenta*	*Kalo*, Taro
ARECEAE *Covos nucifera*	*Niu*, Coconut
ASTERACEAE *Lactuca sativa*	Lettuce
BRASSICACEAE *Brassica oleracea*	Kale, Collard Greens
BRASSICACEAE *Brassica rapa*	Chinese cabbage, Pak Choy
BROMELIACEAE *Ananas comosus*	Pineapple
CACTACEAE *Hylocereas*	Pitahaya, Dragonfruit
CARICACEAE *Carica papaya*	Papaya
CONVOLVULACEAE *Ipomoea batatus*	Sweet Potato
CUCURIBITACEAE *Cucumbus sativis*	Cucumber
FABACEAE *Phaseolus vulgaris*	Beans
FABACEAE *Pisum sativum*	Peas
LAMIACEAE *Ocimum Basilicum*	Basil

- continued -

Table 3 Continued	
Species	**Common Name**
LAMIACEAE *Mentha spicata*	Mint
LAMIACEAE *Origanum vulgare*	Oregano
LAMINACEAE *Rosemarinus officinalis*	Rosemary
LAURACEAE *Persea americana*	Avocado
LYTHRACEAE *Punica granatum*	Pomegranate
MORACEAE *Artocarpus atilis*	*Ulu*, Breadfruit
MORACEAE *Ficus carica*	Common fig
MUSACEAE *Musa sp.hybrid*	*Mai'a*, Banana
MYRTACEAE *Syzygium malaccense*	Mountain Apple
PASSIFLORACEAE *Passiflora flavicarpa*	*Lilikoi,* Passionfruit
POACEAE *Cymbopogon citratus*	Lemongrass
PROTEACEAE *Macadamia tetraphylla*	Macadamia
RUTACEAE *Citrus paradisi*	Grapefruit
RUTACEAE *Citrus limon*	Lemon
RUTACEAE *Citrus latifolia, C.hystrix*	Lime
RUTACEAE *Citrus tangerina*	Tangerine
RUTACEAE *Citrus maxima*	Pomelo
SOLANACEAE *Solanum melongena*	Eggplant
SOLANACEAE *Capsicum*	Peppers
SOLANACEAE *Solanum lycopersicum*	Tomato
ZINGIBERACEAE *Zingiber officinale*	Ginger

The landowner proposes to implement the stewardship activities beginning in the second year following issuance of the Conservation District Use Permit. Priority stewardship activities will focus on erosion control and opportunities to prevent further degradation by invasive introduced species. Stewardship activities will be ongoing in areas of greatest need and highest opportunity for successful transformation to indigenous and endemic species.

Subsistence agriculture will be implemented in conjunction with construction of the single-family residence. Establishment of the fruit trees is anticipated to take up to 5 years.



Conceptual Site and Utility Plan **Figure 2-4**

Section 3.0

The Environmental Setting, Potential Impacts and Mitigation Measures

3.0 THE ENVIRONMENTAL SETTING, POTENTIAL IMPACTS AND MITIGATION MEASURES

This section describes the existing environmental setting and identifies possible impacts of the proposed project. Strategies to minimize and mitigate any potential impacts are also identified.

3.1 TOPOGRAPHY

Existing Conditions

The topography is varied, rising from approximately 80 feet above mean sea level (msl) at the Kanapuʻu Drive access point, to approximately 360 feet msl at the highest point along the north/northeast boundary. Slopes range from 5 to 70 percent with aspects in all cardinal directions. Homes along Kanapuʻu Drive adjacent to the parcel were constructed at elevations ranging from 80 feet msl to 180 feet msl. Homes at the ends of the cul-de-sacs at Kahako Street and Kahako Place are built at 200 and 220 feet msl. The northernmost point of the parcel abuts a small residential development (Keolu Summit) with homes at 260 and 280 feet msl (*Figure 3-1*).

Anticipated Impacts and Mitigation Measures

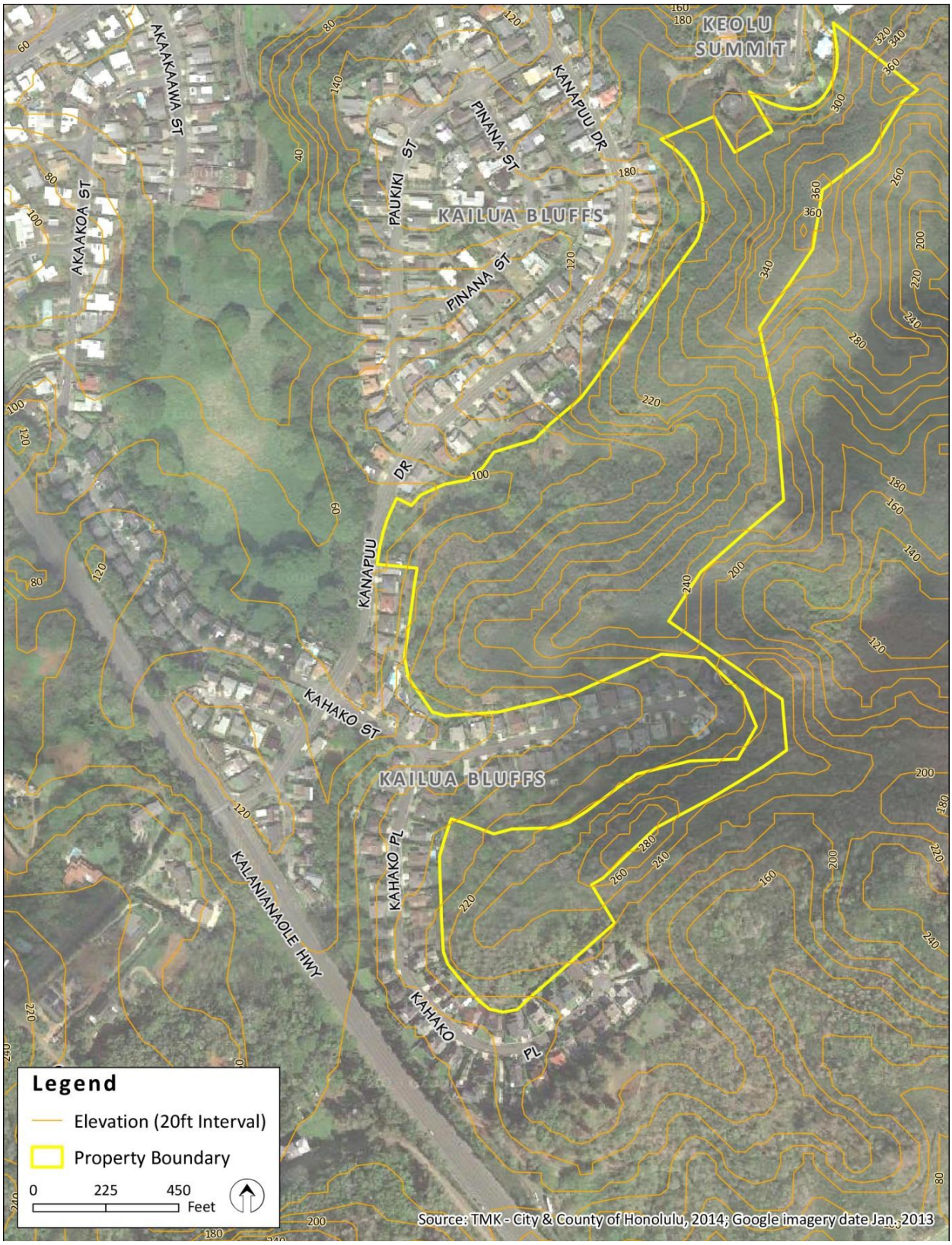
The majority of the 37-acre parcel will remain as it is currently. Forest stewardship activities in the central 6-acre area of the parcel will be conducted on existing grade. Excavation and grading will be required to provide the home site and access road. Utilizing a relatively level area on a spur ridge below the primary ridge, grading will remove approximately four feet of upper clay soil to reach the volcanic tuff bedrock for the home's foundation. The road will follow fragments of a previously graded dirt road network and will be excavated with embankments where needed for stabilization. Low retaining walls may be used where practicable to minimize disturbed areas and visual impacts.

The earth work is nearly balanced in the Conservation District with an estimated net fill of 930 cubic yards. The total (combined Urban and Conservation District) cut would be 4,700 cubic yards, with total (combined Urban and Conservation Districts) fill at 7,300 cubic yards (*Table 4-1*). The need for earth work can be further minimized through use of retaining features along the access road, which can be designed and installed with a goal of minimizing visual impacts from off-site. (Refer to *Table 4-1.*) Erosion control Best Management Practices will be implemented as required by the Grading Permit to minimize potential impacts of soil erosion and fugitive dust during grading and excavation (see *Section 3.2*). Overall topography of the parcel will remain unchanged.

3.2 GEOLOGY AND SOILS

Existing Conditions

The geology of Windward Oʻahu is dominated by the Koʻolau Range, formed by eroded remnants of a volcanic dome. The Koʻolau Range extends approximately 20 miles northwest to southeast, with precipitous fluted cliffs (pali) on the weathered windward side. The basalts of Keolu Hills are thought to have formed from lava that accumulated in the caldera of the ancient Koʻolau volcano as part of the Kailua Volcanic Series (Fujishima and Fan 1977).



Topography **Figure 3-1**

The USDA Soils Survey identifies the primary soil type of the parcel as Pāpaʻa Series (PYF). The soils developed in colluvium and residuum derived from basalt. Permeability is slow and runoff is rapid depending on terrain. This series consists of well-drained soils on uplands of Oʻahu with slow to rapid runoff, depending on slope. The clays in this series are sticky and plastic, and crack widely when dry. ʻAlaeloa silty clay soils (AeE) occur on one edge of the property and are not within an area of the parcel to be management or used by the landowner *(Figure 3-2)*.

The parcel's subsurface conditions were documented through soil borings in a 2016 geotechnical evaluation. Six test borings were drilled to depths of 10 to 14.5 feet below the existing grade along the access road and through Alternate Site S and Alternate Site A. In the four borings along the upper reach of the access road and at the home site (Alternate Site A), volcanic tuff (bedrock) was encountered below the clay soils at a depth ranging from 3 to 6 feet. In two borings made along the lower access road area and at Alternate Site S, the volcanic tuff layer was encountered at a depth of approximately 10 feet below grade.

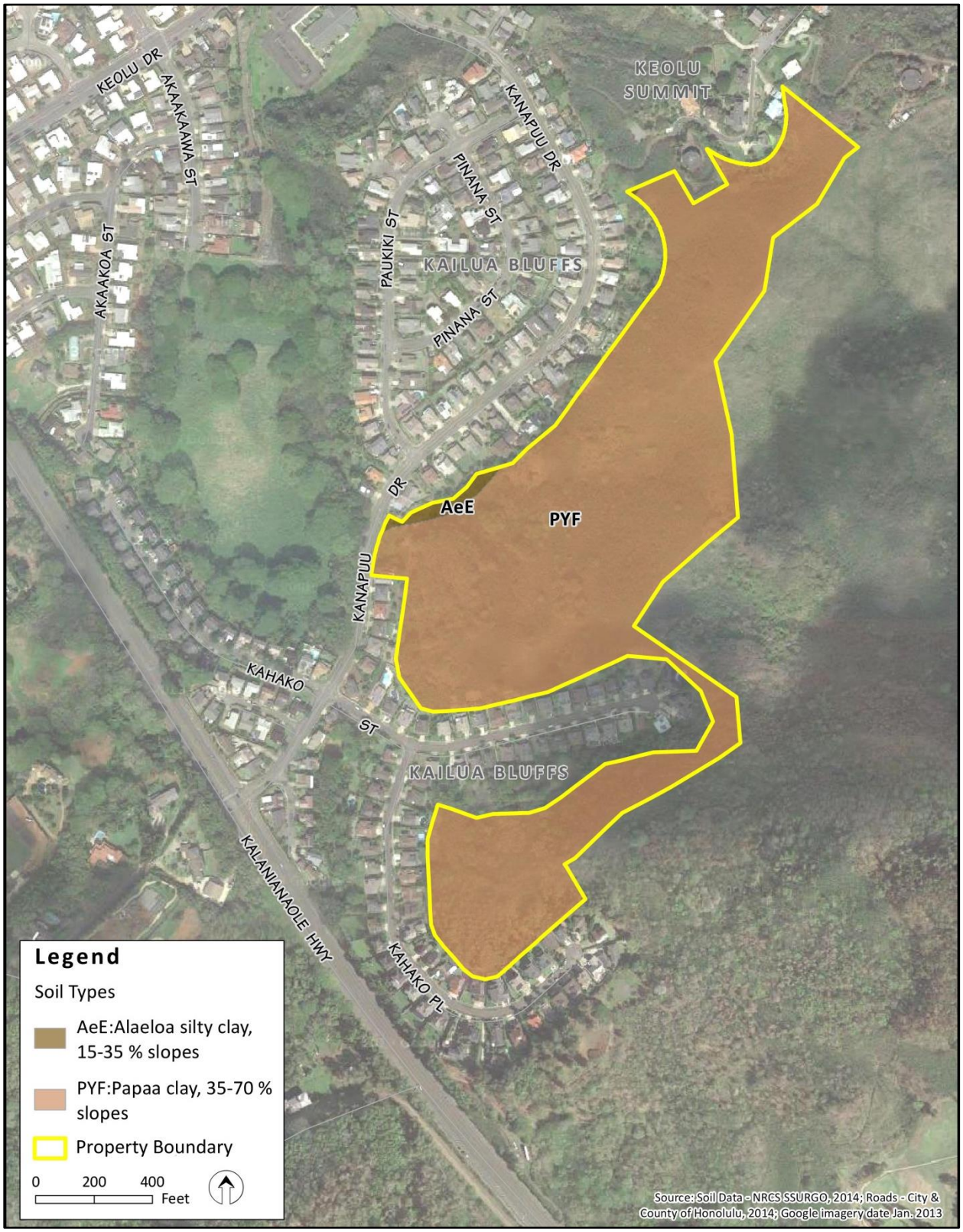
Anticipated Impacts and Mitigation Measures

Most of the parcel's will remain unaffected by the proposed action, with the avoidance of steep slopes. Soil will be disturbed within the limits of the proposed access road and home site construction. The geotechnical evaluation determined the soils are suitable for the proposed construction. Where column and perimeter edge footings for concrete slab-on-grade will be installed on volcanic tuff (bedrock), embedment is recommended to be 12 inches below the adjacent grade, and the typical 4-inch thick select granular fill material. Construction of the home at Alternate Site A would minimize the need for the deeper footings as the foundation would sit on the bedrock layer approximately 3 to 6 feet below grade (refer to *Section 4.3*).

The project will disturb more than one acre, so both County and State permits are required. A National Pollutant Discharge Elimination System (NPDES) general permit coverage authorizing discharges of storm water associated with construction activities will be required for the project from the State Department of Health, Environmental Management Division, Clean Water Branch. Implementation of Best Management Practices (BMPs) are required by permit conditions, and will include erosion controls, sediment controls, and good housekeeping practices to prevent and minimize off site discharges. Maintenance of the erosion and sediment controls will be required during construction, to ensure BMPs remain effective.

BMPs to reduce and control soil erosion during construction will include use of geotextile fabric to cover temporarily bare soil where appropriate. Another method that could be used to prevent and control runoff is directing storm water that may flow onto or through the project area into an earth dike or stabilized watercourse. Additional BMPs will be used to intercept, slow or detain storm water, which traps sediment and allows settling and filtering of runoff. Such methods include use of filter socks, sediment barriers made of gravel bags, sandbags, fiber rolls or compost filter socks. The entrance to the property will be stabilized with gravel to reduce transfer of mud and sediment from construction vehicles to adjacent paved public roads, or a tire wash system may be employed. Specific BMPs appropriate to the site will be determined during review of the detailed construction plans and the required Erosion and Sediment Controls Plan.

Once construction is complete, long-term drainage controls will be in place and landscape plantings around the home site will stabilize soils. Long-term soil conditions at this property are anticipated to be improved through native plant introduction and increased plant diversity.



Soils **Figure 3-2**

3.3 CLIMATE

Existing Conditions

The climate at the project site is typical of that which characterizes most of the State of Hawaiʻi. It is relatively mild with constant temperatures throughout the year, moderate humidity, persistent northeasterly trade winds, and infrequent severe rainstorms. Visibility surrounding the existing sites is typically clear except when vog (derived from the words "volcanic" and "smog") is present. Vog is a result of erupting volcanoes on the island of Hawaiʻi. During prolonged periods of southerly Kona winds, the vog can affect islands across the entire State.

The Kailua District typically has a warm and dry climate. Normal monthly high temperatures in the area range from 80 degrees in January to 89 degrees in August for an average of 84 degrees. Normal month low temperatures range from 65 degrees in February and a high of 74 degrees in August for a monthly average of 70 degrees. Precipitation ranges from 0.44 inches in August to a high of 3.8 inches in December. The mean annual rainfall of the area is 40 inches per year, ranging from 1.5 inches per month in the comparatively dry months, to 6 inches per month in the relatively wetter months of November through March.

Anticipated Impacts and Mitigation Measures

The project will have no effect on climate conditions, and therefore, no mitigation is recommended.

3.4 NATURAL HAZARDS

Existing Conditions

3.4.1 FLOODING

The project site is located within flood Zone X, defined as an area determined to be outside the 0.2 percent annual chance of floodplain *(Figure 3-3)*. The project area is located well away from streams and coastal areas; further, the natural resources survey identified no aquatic habitats present on the existing site (AECOS 2014). See *Section 3.8.3 Storm Water Drainage* regarding runoff and drainage patterns on the parcel.

3.4.2 TSUNAMI

While tsunami inundation of low lying coastal areas is a natural phenomenon in Hawaiʻi, it is infrequent. The islands are exposed to the major tsunami wave generating areas of the Pacific Ocean. The project site's elevation ranges from 80 to 360 feet mean sea level and is outside both the City and County's tsunami evacuation zone and extreme tsunami evacuation zone.

3.4.3 SEISMIC ACTIVITY

The entire City and County of Honolulu lies in a seismic zone designated as Zone 2A. Under the Uniform Building Code seismic provisions, a Zone 2A area could experience seismic activity between .075 and .10 of the earth's gravitational acceleration ("g-force"). The project area generally is at a low risk from potential earthquake damage.

Flood Zone Designation **Figure 3-3**

3.4.4 HURRICANES AND TROPICAL STORMS

Hurricanes and tropical storms are giant whirlwinds in which air moves around a center of low pressure, reaching maximum velocity in a circular band. Tropical storms are categorized as an organized system of strong thunderstorms with defined circulation and maximum sustained winds of 39 to 73 miles per hour. Hurricanes are intense tropical weather systems with well-defined circulation and maximum sustained winds of 74 miles per hour or greater. These intense storms are often accompanied by heavy rainfall and flash flooding.

In the Northern Hemisphere, a hurricane's circulation includes low pressure and counter-clockwise inflow at the surface, and high pressure and clockwise outflow at upper levels. The overall diameter of the hurricane circulation is typically between 300 and 600 miles. A hurricane or tropical storm may create hazardous conditions from high winds, torrential rainfall, coastal and inland flooding and erosion, high surf, and storm surge, which may damage or destroy property and/or threaten lives. The general season for these storms in Hawaiʻi is between the months of June to December.

Hurricanes are considered to be relatively rare events in the Hawaiian Islands. Records show that strong wind storms have stuck all major Hawaiian Islands. The first officially recognized hurricane in Hawaiian waters was Hurricane Hiki in August 1950. Since that time, five hurricanes have caused serious damage in Hawaiʻi: Nina (1957), Dot (1959), Iwa (1982), Estelle (1986), and Iniki (1992).

Anticipated Impacts and Mitigation Measures

Zone X includes areas of minimal hazard from the principal source of flood in the area and the National Flood Insurance Program does not have any regulations for development within this district. No mitigation measures are required.

Because the project area is located away from the coastal area and the stream courses, the project area is not subject to stream flooding or coastal inundation. To prevent ponding or localized flooding resulting from storm run-off, drainage infrastructure in affected areas of the project will be provided to meet applicable design and construction standards. All construction will necessarily conform to relevant building codes to mitigate the risk of wind and seismic damage.

3.5 FLORA AND FAUNA

A botanical survey for the project site was conducted as part of a natural resources survey for the project by AECOS, Inc. in November 2013. The findings of the assessment are summarized in the following, and the report is included as *Appendix B*.

3.5.1 FLORA

Existing Conditions

The parcel is dominated by introduced plant species, including naturalized species and various ornamentals planted by neighboring land owners along the western side. As part of a natural resource survey conducted on the parcel, plant species were identified and abundance calculated with emphasis on the ridgeline, gulch bottoms, and areas adjacent to the developed subdivision lots. During the survey, conducted over three separate days in November 2013, the parcel's floristic composition was identified as that typical for lowland Oʻahu: native species accounted for only 3

percent of the plants encountered (8 percent if including Polynesian introductions), but constituted far less than 3 percent of the parcel's biomass.

In all, 86 taxa of vascular plants were recorded during the three-day botanical survey. None are of special interest or concern from a conservation perspective. Thirty-three of the taxa (comprising 38 percent of those recorded) were identified as ornamental plantings encroaching upon the parcel's western boundary, assumed to have been made by neighboring landowners. Three native species (all shrubs) exist on the parcel and are indigenous - those that arrived and survived prior to human contact in Hawaiʻi, and are also found outside of the Hawaiian Islands. Five species are considered "canoe" plants – those brought by early Polynesians. The dominant biomass of the parcel is fairly uniform: Guinea grass and koa haole scrub, with a mixture of other shrubs and herbs. Patches of introduced tree species (ironwood and Formosa koa) occur on the section of ridgeline, with forested slopes above developed house lots bordering the parcel.

The complete plant species list is in *Appendix B*; only those plants found across the overall parcel are included in *Table 3-1*.

Table 3-1: Non-native Plants

Scientific Name	Common Name	Status
Abutilon grandifolium	hairy abutilon	Naturalized
Acacia confusa	Formosa koa	Naturalized
Acacia farnesiana	klu	Naturalized
Asparagus densiflorus	asparagus "fern"	Naturalized
Asparagus plumosus	climbing asparagus "fern"	Naturalized
Asystasia gangetica	Chinese violet	Naturalized
Bambusa multiplex	hedge bamboo	Ornamental
Barleria repens	pink ruellia	Ornamental
Bidens alba	beggartick	Naturalized
Bidens cyanapiifolia	---	Naturalized
Blechnum appendiculatum	---	Naturalized
Canavalia cathartica *	Maunaloa vine	Naturalized
Carmonaretusa	Fukien tea	Naturalized
Casuarina equisetifolia	ironwood	Naturalized
Chamaecrista nictitans	Partridge pea	Naturalized
Chrysophyllum oliviforme	satinleaf	Naturalized
Citharexylum caudatum	fiddlewood	Naturalized
Clusia rosea	autograph tree	Naturalized
Coccinia grandis	scarlet-fruited gourd	Naturalized
Desmodium incanum	Spanish clover	Naturalized
Digitaria insularis	sourgrass	Naturalized
Hyptis pectinata	comb hyptis	Naturalized
Jasminum fluminense	Brazilian jasmine	Naturalized
Lantana camara	lākana, lantana	Naturalized

- continued -

Table 3-1: Non-native Plants		
Leucaena leucocephala	koa haole	Naturalized
Lygodium japonicum	Japanese climbing fern	Naturalized
Mimosa pudica	sensitive plant	Naturalized
Momordica charantia	wild bitter melon	Naturalized
Murraya paniculata	mock orange	Naturalized
Neonotonia wightii *	glycine vine	Naturalized
Ochna thomasiana	Mickey Mouse plant	Naturalized
Opuntia ficus-indica	pānini	Naturalized
Passiflora edulis	passion fruit vine	Naturalized
Passiflora suberosa	huehue haole	Naturalized
Pithecellobium dulce	ʻopiuma	Naturalized
Plantago major	common plantain	Naturalized
Portulaca oleracea	pigweed	Naturalized
Rivina humilis	coral berry	Naturalized
Santalum album *	white sandalwood	Naturalized
Schinus terebinthifolius	Christmas berry	Naturalized
Senna surattensis	scrambled egg plant, kolomana	Naturalized
Sideroxylon persimile *	bumelia	Naturalized
Solanum seaforthianum	---	Naturalized
Spathodea campanulata	African tulip tree	Naturalized
Stapelia gigantean	giant toad plant	Naturalized
Swietenia mahagoni	Cuban mahagony	Naturalized
Syzygium cuminii	Java plum	Naturalized
Urochloa maxima	Guinea grass	Naturalized
Urochloa mutica	California grass	Naturalized
Native and Early Polynesian Introduced plants		
Scientific Name	**Common Name**	**Status**
Cocos nucifera	*niu*, coconut	Polynesian
Dodonaea viscosa	ʻaʻaliʻi	Indigenous
Osteomeles anthyllidifolia	ʻulei	Indigenous
Waltheria indica	ʻuhaloa	Indigenous

Anticipated Impacts and Mitigation Measures

Under a Forest Stewardship Management Plan approved by the State Forest Stewardship Committee, the landowner has set goals to transform a 6-acre area of low-benefit, non-native dominated vegetation to a native and Hawaiian canoe-plant dominated lowland mesic forest over a 10-year period. The majority of the parcel will remain as is. The stewardship practices are described briefly in *Section 2.2.4*, and in more detail in the approved Forest Stewardship Management Plan (*Appendix A*). Soil conservation practices as described in the approved Conservation Plan (*Appendix A*) will be employed where needed to maintain permanent vegetation cover and reduce erosion.

The conservation practices to be used to reduce erosion and runoff will increase rainfall infiltration. The parcel does not include any wetlands, floodplains, or other sensitive ecosystems. The project will increase native and indigenous plant diversity on site, and provide a more stable forest and improved soils structure.

3.5.2 FAUNA

Avifauna

All of the birds detected during the survey represent avian species that have been introduced to the Hawaiian Islands. Three species [Red-vented Bulbul (*Pycnonotus cafer*), Java Sparrow (*Padda oryzivora*), and House Finch (*Haemorhous mexicanus*)] accounted for slightly more than 59 percent of the total number of individual birds recorded. Red-vented Bulbuls were the most frequently recorded species, accounting for 23 percent of the individual birds observed at five avian point count stations. The zoologist conducting the avian survey searched the remainder of the property for species and habitats not detected during the point counts at the five established stations. A total of 142 individual birds of 14 species, representing 11 separate families, were recorded during station counts (*Appendix B*).

Table 3-2: Non-native Birds

Scientific Name	Common Name
Acridotheres tristis	Common Myna
Cardinalis cardinalis	Northern Cardinal
Copsychus malabaricus	White-rumped Shama
Estrilda astrild	Common Waxbill
Garrulax canorus	Chinese Hwamei
Geopelia striata	Zebra Dove
Haemorhous mexicanus	House Finch
Leiothrix lutea	Red-billed Leiothrix
Padda oryzivora	Java Sparrow
Passer domesticus	House Sparrow
Pycnonotus cafer	Red-vented Bulbul
Sicalis flaveola	Saffron Finch
Streptopelia chinensis	Spotted Dove
Zosterops japonicus	Japanese White-eye

Although no seabirds were detected during the course of this survey, low numbers of several seabird species potentially overfly the site on occasion. There are no known nesting colonies of any of the Oʻahu resident seabird species on, or within close proximity of the subject property (AECOS 2014).

Mammals

Consistent with the location of the site and the highly disturbed habitats present, only non-native mammals were detected during the natural resource management survey. Several dogs (*Canis familiaris*) were heard barking from houses below the site. Scat, tracks, and sign of feral pig (*Sus scrofa*) were encountered at a number of locations within the site, but mostly in the area of the proposed house site and the trail connecting the site with the main (east) ridgeline trail. Although no rodents were detected during the course of the survey, it is likely that the four established Muridae found on Oʻahu - roof rat (*Rattus r. rattus*), brown rat (*Rattus norvegicus*), European house mouse (*Mus musculus domesticus*), and possibly black rat (*Rattus exulans hawaiiensis*) - use various resources in the area on a seasonal basis. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependent on them.

No Hawaiian hoary bats were detected during the course of this survey. A possibility exists that bats may occasionally use resources within the more densely treed parts of the site.

No species proposed for listing or listed under the federal endangered species act of 1973, as amended or the State of Hawaiʻi's (Hawaiʻi Revised Statutes – HRS - §195D) were recorded during the course of the natural resources survey (AECOS 2014).

Anticipated Impacts and Mitigation Measures

The current habitats on the property are neither unique nor important for any Federal or State listed avian or mammalian species currently known from the Island of Oʻahu. Existing habitat areas will be enhanced in the central portion of the property through selective removal of non-native species and planting of native species. Access for human trapping of feral pigs by the Pig Hunters Association of Oʻahu will be allowed as needed to minimize feral pig damage to soils. The project will not result in modification of any federally designated Critical Habitat, as there is none present on the parcel.

Night-flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds may collide with man-made structures and, if not killed outright, can be easy prey for feral mammals. Any exterior lighting created by the project will be shielded to reduce the potential for interactions between nocturnally flying seabirds and man-made structures. During construction, minimal night construction is anticipates; if large flood/work lights are needed at night, the lights will be placed on poles high enough to allow the beam to be pointed directly downward. Nighttime construction will be avoided during the seabird fledgling period (September 15 through December 15). To avoid adverse impacts on night-flying sea birds, permanent lights on site will be shielded and postioned so that the bulb is only visible from below. The position of the house will not allow it to be seen from coastal areas. Automatic motion sensor switch controls on outdoor lights will be considered where practicable.

Though Hawaiian Hoary Bat have not been confirmed on site, its endangered species status mandates protection. Removal or pruning of trees taller than 15 feet will be avoided during the pupping season June through mid-September. As an additional precaution, fencing for feral pigs will utilize straight, rather than barbed, wire.

3.6 AIR QUALITY

Existing Conditions

As required by the Clean Air Act (last amended in 1990), the U.S. EPA established the National Ambient Air Quality Standards (NAAQS) to protect public health and welfare and prevent the significant deterioration of air quality. These standards cover seven major air pollutants: carbon monoxide (CO), nitrogen oxides (NOX), ozone (O3), particulate matter smaller than 10 microns (PM10), particulate matter smaller than 2.5 microns (PM2.5), sulfur oxides (SOX), and lead. The State DOH, Clean Air Branch (CAB) has also established State Ambient Air Quality Standards (SAAQS) for six of these air pollutants to regulate air quality statewide. The SAAQS for carbon monoxide and nitrogen dioxide are more stringent than NAAQS (DOH 2010). Hawaiʻi also has a stringent standard for hydrogen sulfide, which is a common odorous pollutant associated with wastewater treatment facilities.

The DOH, CAB regularly samples ambient air quality at monitoring stations throughout the State and annually publishes this information. In general, air quality in the State of Hawaiʻi continues to be one of the best in the nation, and criteria pollutant levels remain well below NAAQS and SAAQS. Air quality monitoring data compiled by the DOH indicates that the established air quality standards for all monitored parameters are consistently met throughout the State and on the island of O'ahu.

Air quality at the project site is positively influenced by trade winds that regularly blow from a northeasterly direction moving generated air pollutants across the island and out to the open ocean. Problems with poor air quality and elevated pollutant levels generally occur when trade winds diminish or give way to southerly and southwesterly winds (known as Kona wind conditions). Kona winds often bring vog from the island of Hawaiʻi's active volcanoes, providing the greatest potential for air pollutant buildup.

Anticipated Impacts and Mitigation Measures

Construction

There will be two types of short-term air quality impacts that will result from the proposed construction project at the site: 1) fugitive dust generation dust from vehicle movement and soil excavation and 2) on-site/off-site emissions from moving construction equipment and commuting construction workers. State of Hawaiʻi Air Pollution Control regulations prohibit visible emissions of fugitive dust from construction activities at the property line. Most of the property will remain unaffected by the proposed action, with the existing vegetated areas remaining largely intact. In the limited work areas, a dust control program will be implemented to control dust from construction activities. Fugitive dust emission will be controlled through the mitigation measures such as watering active work areas, using wind screens, keeping adjacent paved roads clean, covering open-bodied trucks and limiting the area to be disturbed at any given time.

Operations

The project involves a residential home which will not affect existing air quality. No mitigation is required.

3.7 NOISE

Existing Conditions

Title 11, Chapter 46, of the Hawaiʻi Administrative Rules (HAR §11-46) defines maximum permissible sound levels which are intended to protect, control, and abate noise pollution from stationary sources and construction, industrial, and agricultural equipment. Maximum permissible sound levels for the property are shown below, relevant to the residential district for excessive noise sources during the day (7am to 10 pm) and night (10pm to 7am) at the property line where the activity occurs.

- Class A - Residential, conservation, preservation, public space, open space, or similar type zones – 55 decibel (dB) (day) and 45 dB (night)

Contributors to the existing background ambient noise levels within the project area is attributed to motor vehicle traffic along the neighboring streets and background ambient noise such as wind moving through vegetation, and birds.

Anticipated Impacts and Mitigation Measures

The project will not result in significant increases in ambient noise levels. While noise may be generated during the construction period, the project is not expected to impact the distant neighbors. Construction activities will be monitored by the State to comply with the provisions of the regulation for community noise control. The dominant noise sources during construction will be earth moving equipment. Noise levels associated with construction equipment typically range from 80 to 95 dB at 50 feet from the source. While significant impacts to neighboring areas are not anticipated, mitigation measures will be implemented to minimize construction noise impacts. These measures include limiting work to daytime hours and reducing truck/equipment idling when not in use.

Once the residential home is developed, ongoing noise impacts are not anticipated to occur. In addition, impacts to other noise sensitive areas are not expected, particularly since the project site is located well away from schools, hospitals, and nursing homes.

3.8 UTILITIES AND INFRASTRUCTURE

A Preliminary Engineering Report for the proposed project was prepared in 2014 and updated in December 2017 (*Appendix C*).

3.8.1 WATER SYSTEM

Existing Conditions

Public water supplies are currently not used at the project site. The City and County of Honolulu Board of Water Supply (BWS) operates two water meter systems (water mains) for two different pressure zones along Kanapuʻu Drive.

Probable Impacts and Mitigation Measures

The single-family residence will utilize public water supplies from 1711 Kanapuʻu Drive. Prior to property purchase, the landowner inquired as to the availability of water suitable for a residential

use on the property. BWS confirmed the existing water system is adequate and noted a final decision on availability of water would be confirmed with submittal of a building permit application. The location of the water meter will be on Kanapuʻu Drive, and applicable water system facility charges for resource development, transmission and daily storage will be assessed.

Based on the Board of Water Supply's "Water System Standards, 2002," the average daily demand for a single-family residence is about 500 gallons per day. The water meter is anticipated to be no larger than 1 inch. The water system will be sized according to the Uniform Plumbing Code (UPC), 1997. The home will have a fire sprinkler system and a fire hydrant located along the access road within the parcel. The standard required flow for the system will be designed at 500 gallons per minute (gpm) for a 1-hour period.

3.8.2 WASTEWATER

Existing Conditions

There is an existing 8-inch sewer main along Kanapuʻu Drive. The main is owned, operated, and maintained by the City and County of Honolulu. No wastewater treatment and/or disposal facilities exist on the project site. No wastewater is currently being generated, as the parcel is vacant.

Probable Impacts and Mitigation Measures

Based on the City's Wastewater System Standards, the dwelling will generate an average daily flow of about 320 gallons per day of wastewater. The proposed project will be serviced by a new 6-inch gravity lateral which will connect to the City and County of Honolulu existing 8-inch main along 1711 Kanapuʻu Drive street frontage. The landowner holds an approved sewer connection application contingent on approval of construction plans and payment of applicable wastewater system facility charges within the stipulated time frame.

3.8.3 STORM WATER DRAINAGE

Existing Conditions

Two ditches were designed and installed during the 1980s development of Kailua Bluffs to collect runoff and deliver it through a 54-inch culvert at the foot of the remainder lot (the MDHE parcel) to a storm water detention basin across Kanapuʻu Drive. The 54-inch culvert is owned and maintained by City and County of Honolulu (CCH). The culvert inlet has a capacity of 128.8 cubic feet per second. The two ditches have easements in favor of the property owners; the intake structure has an easement in favor of CCH. These ditches and culvert capture flow from a 22-acre portion of the project parcel. The rest of the parcel, approximately 14 acres, drains to the south.

The southern boundary of the parcel is bounded by Kahako Street and Kahako Place, where runoff is captured a ditch along the properties on Kahako Place. This ditch directs flow to a 12-foot diameter culvert that discharges to the storm water detention basin off the property. The ditch has an easement in favor of the property owners. These ditches are not well maintained; photographs show the ditches filled with debris, which may prevent runoff flow to the discharge points.

"Kapaʻa Silt Basin" was created as a detention basin during development of the Kailua Bluffs subdivision. The basin receives storm water from five outlets along Kahako Street (which includes

three drainage points from development mauka of Kalanianaʻole Highway), Kahako Place, Kanapuʻu Drive and Paukiki Street. The basin collects water from a 425-acre area (CCH 2008) (*Figure 3-4*).

The existing drainage runoff from the site's basin, based on the CCH 10-year, 1-hour interval, is 93.7 cubic feet per second (cfs). At the potentially higher intensity 50-year recurrence interval, 1-hour duration rainfall event, runoff could be 125.0 cubic feet per second (cfs) (*Appendix C*).

Probable Impacts and Mitigation Measures

Storm water runoff is part of the natural hydrologic process. Human activities on land, such as urbanization and agriculture, can alter natural drainage patterns. Runoff from urban and agricultural areas can introduce sediments, nutrients, pathogens, and toxic chemicals to storm water runoff. Federal, State and County regulations require that receiving waters be protected from pollutants associated with land disturbance, surface hardening and land use activities using implementation and maintenance of BMPs.

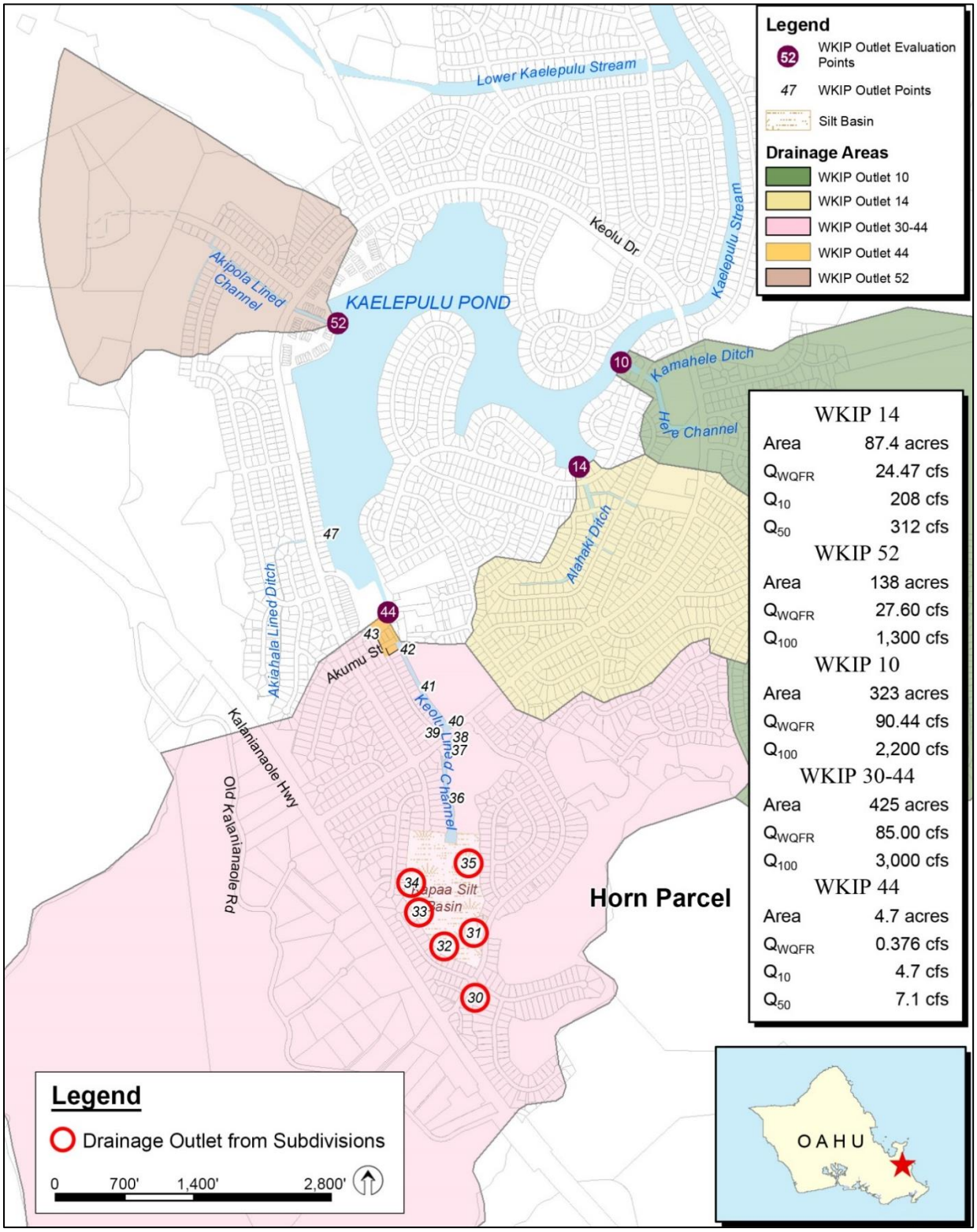
Recently revised City and County of Honolulu "Rules Relating to Water Quality" establish minimum requirements for the selection, design, implementation and maintenance of best management practices (BMPs) to protect receiving waters from pollutants associated with land disturbance and land use (Rules Relating to Water Quality of the Administrative Rules Title 20, Department of Planning and Permitting, Chapter 3). Minimal pollutants will be present on the residential site; as described in *Sections 2.2.4, 2.2.5, and 3.9*, no synthetic pesticides, fertilizers, or other typical home gardening products will be used.

Maintaining the current surface flow pattern and the vegetation on site will minimize disturbance to the existing on-site drainage. The approved Conservation Plan developed in cooperation with the Oʻahu Resource Conservation and Development Council describes conservation practices to be employed in the forest stewardship and agricultural areas that address maintaining permanent vegetation cover, creating vegetative barriers on slope contours to manage water flow and trap sediment.

The access road and single-family residence will be constructed within the 22-acre portion of the property which drains to the 54-inch culvert below Kanapuʻu Drive. As described in Existing Conditions, a 14-acre area of the parcel drains primarily south. Most of the property will remain unaffected by the proposed action, with the existing drainage areas and vegetated surfaces remaining largely intact. The project has been designed to minimize any adverse effect on the basic drainage pattern of the area. To the extent possible, basic drainage ways will not be altered nor will the extent of the land tributary to each drainageway be changed. The roof of the home site will add a small amount of impervious surface. Rain gutters will be used to collect rainwater, which will be routed through planter boxes or rain gardens around the home site and prompt infiltration to soils.

The project will result in an increase of storm drainage runoff from the 10-year, 1-hour intensity storm intensity of 93.7 cfs to approximately 95.3 cfs. The potential increase under the 50-year, 1-hour intensity storm event could increase from the current condition of 125 cfs to 127.1 cfs. The maximum increase is therefore less than 2.8 percent. This increase is not considered excessive and will be accommodated by existing gullies. No changes are anticipated to the existing drainageways. Calculations are provided in the Preliminary Engineering Report, included as *Appendix C*.

No significant storm drainage impacts are anticipated, as the small area of increased non-permeable surfaces on the 37-acre parcel will not significantly increase the quantity of storm water runoff.



Reprinted from City and County of Honolulu 2008: Storm Water Best Management Practices (BMP) Plan for Four Major Outlets at Kaelepulu Pond.

Storm Drainage Outlets to Kapa'a Silt Basin **Figure 3-4**

3.9 HAZARDOUS WASTE

Existing Conditions

Hazardous waste is defined as having a chemical composition or containing other properties that make it capable of causing illness, death, or some other harm to humans and other life forms when mismanaged or released into the environment (EPA 2005).

No hazardous waste materials have been identified on the property.

Anticipated Impacts and Mitigation Measures

Adverse impacts relating to the hazardous waste are not anticipated from the proposed project. In the short-term, fuels, lubricants paints, etc., on-site during construction will be managed by the contractor through appropriate storage protocols that prevent storm water contact with potentially hazardous materials.

For the long-term, no hazardous materials will be used on site. Forest stewardship and gardening will utilize natural fertilizers and pest control techniques as needed. The fruits and vegetables grown on-site for the family's consumption will use natural, non-synthetic fertilizers and no pesticides will be used.

3.10 ELECTRICAL AND COMMUNICATIONS

Existing Conditions

Currently there is no transmission of electrical power or communication infrastructure to the site, as it is undeveloped.

Anticipated Impacts and Mitigation Measures

The proposed project includes rooftop photovoltaic panels with battery backup to provide a portion of the energy to the single-family residence. The power produced will be provided to the HECO grid through electric lines on Kanapuʻu Drive. Telecommunications for the site will be extended from underground conduits on Kanapuʻu Drive (*Appendix C*).

3.11 TRAFFIC AND ROADWAYS

Existing Conditions

The project site is located near Kanapuʻu Drive and and Kahako Street. Access to the site will be from Kanapuʻu Drive, an existing two lane City and County road. A mid-day site inspection of these roads observed infrequent vehicle use of this portion of Kanapuʻu Drive.

Existing dirt roads suitable for foot traffic and 4-wheel drive vehicles used for maintenance of the site provide circulation within the project parcel.

Existing Bus Service

Bus service is provided approximately 0.2 miles from the project site entrance at 1711 Kanapuʻu Drive by routes along nearby Kalanianaʻole Highway, including Routes 57, 77 and Express 85 and 89.

Anticipated Impacts and Mitigation Measures

Significant impacts to existing traffic in the area are not anticipated to occur as a result of the project. The project is a residential home and will generate traffic typical of the use. The proposed project is anticipated to generate less than five trips during the AM and PM peak hours of traffic and will not impact the traffic operations on the roadways near the project site.

Existing bus service for the project site will not be affected by the project. The project will not generate any significant increases or decreases in the existing ridership.

While impacts to existing traffic and bus services are not anticipated to occur as a result of the project, if deemed appropriate, the Contractor will notify the City and County of Honolulu, Department of Transportation Services, Public Transit Division and Oʻahu Transit Services, Inc. (bus operations and para-transit operations) of the scope of work, location, proposed closure of any street, traffic lane, sidewalk, or bus stop and duration of project's at least two weeks prior to construction.

3.11.1 PARKING

Existing Conditions

Current parking for the parcel is along the curb near the 1711 Kanapuʻu Drive property entrance. The site is made up of vacant preservation land which is overgrown with tall brush and shrub vegetation.

Probable Impacts and Mitigation Measures

The project will require parking on the site. A designated parking area will be created to support the residential use at the home site. No mitigation measures are proposed.

3.12 SOCIO-ECONOMIC CHARACTERISTICS

Existing Conditions

The project site is located in the Kailua region of Windward Oʻahu, specifically, the subdivision known as Kailua Bluffs. Kailua is primarily a residential community, with a centralized commercial district along Kailua Road. It has a compact, easy-to-shop business district surrounded by mostly single family homes. In 2010, the population of the Kailua community was 38,635 persons (US Census Bureau).

Anticipated Impacts and Mitigation Measures

Development of the project is not expected to result in negative impacts to socioeconomic conditions. The project will involve the development of a residential home and will not significantly affect the existing population or general socio-economic character of the area.

The project will create short-term employment opportunities for the site work and general construction of the project. The overall labor required to support the project is not large enough to change the area's occupational character.

No specific socio-economic mitigation actions are recommended.

3.13 PUBLIC FACILITIES AND SERVICES

This section discusses the project's probable impact on public facilities and services of the project site and surrounding areas.

3.13.1 EDUCATIONAL FACILITIES

Existing Conditions

Educational facilities located near the project site include:

- Keolu Elementary School is located at 1416 Keolu Drive, approximately 0.5 miles away from the project site and is the closest public school educational facility.
- Kailua Intermediate School is located at 145 Kainalu Drive, approximately 2.8 miles away from the project site.
- Kailua High School is located at 451 Ulumanu Drive, approximately 2.3 miles away from the project site.

Anticipated Impacts and Mitigation Measures

The project is not expected to affect existing educational facilities near the project site. No mitigation is proposed.

3.13.2 RECREATIONAL FACILITIES

Existing Conditions

There are no existing recreational areas within the site. The closest park is Keolu Hills Neighborhood Park. There are also many other parks and beaches that are located within the Kailua Community, including Kailua Beach Park, Kailua District Park and Ka'elepulu Mini Park.

The property is only accessed by the current property owner, via a recently cleared road. There are no public access trails on the property. Fragments of a previously graded dirt road network persist in various parts of the parcel. This corridor/trail is not known to be of historic or cultural importance, and is not accessible to the public.

Anticipated Impacts and Mitigation Measures

The proposed project will not affect existing recreational facilities, therefore, no mitigation is recommended.

3.13.3 POLICE

Existing Conditions

The project site in Kailua is served by Honolulu Police Department (HPD) District 4 which covers the area between Waimānalo to Kahuku. The Kailua HPD station is located at 219 Kuʻulei Road, approximately 3.6 miles from the project site.

Anticipated Impacts and Mitigation Measures

This project should not impact police department's operations or ability to provide adequate protection services to the surrounding community. District 4 police protection should be adequate for to serve the proposed project. No adverse impacts or mitigation is proposed.

3.13.4 FIRE

Existing Conditions

Primary fire protection of the project area is served by the Olomana Fire Station (Station 39), which is located approximately 1.7 miles away from the project site. The second closest facility is the Kailua Fire Station (Station 18) which is about 3.7 miles away from the project site.

Anticipated Impacts and Mitigation Measures

Access to the property has been designed to comply with the fire and building code requirements. The access road will be 16 feet wide, with an additional 2 feet of clearance at each shoulder. The road design will include a turn-around near the home, and the fire code specified proximity to the home's exterior will be met. The home will have a fire sprinkler system, and a fire hydrant will be installed along the on-site access road (*Figure 2-3*).

The project is not expected to impact the Fire Department's operations or ability to provide fire protection services to the project areas and surrounding areas.

3.13.5 EMERGENCY MEDICAL SERVICES

Existing Conditions

Castle Medical Center is the nearest emergency hospital to the project site. Located approximately 2.2 miles from the project site, the average EMS response is three to five minutes.

Anticipated Impacts and Mitigation Measures

The proposed project will not impact the handling of EMS or medical emergencies. The Castle Medical Center will continue to function in its present location and will be accessible to the project site in Kailua.

3.13.6 SOLID WASTE MANAGEMENT

Existing Conditions

The existing project site is vacant; therefore, no solid waste is being generated and no form of solid waste disposal taking place on the site.

Anticipated Impacts and Mitigation Measures

The project will result in the generation of general solid waste; initial solid waste will be related to construction, and ongoing solid waste will be household-related. Waste management services are to be provided by the City and County of Honolulu, Residential Refuse Collection Service. Construction wastes are expected to be minimal since the site will require no demolition of existing structures. General City recycling practices will also be maintained by the landowner.

3.14 ARCHAEOLOGICAL AND HISTORICAL RESOURCES

Existing Conditions

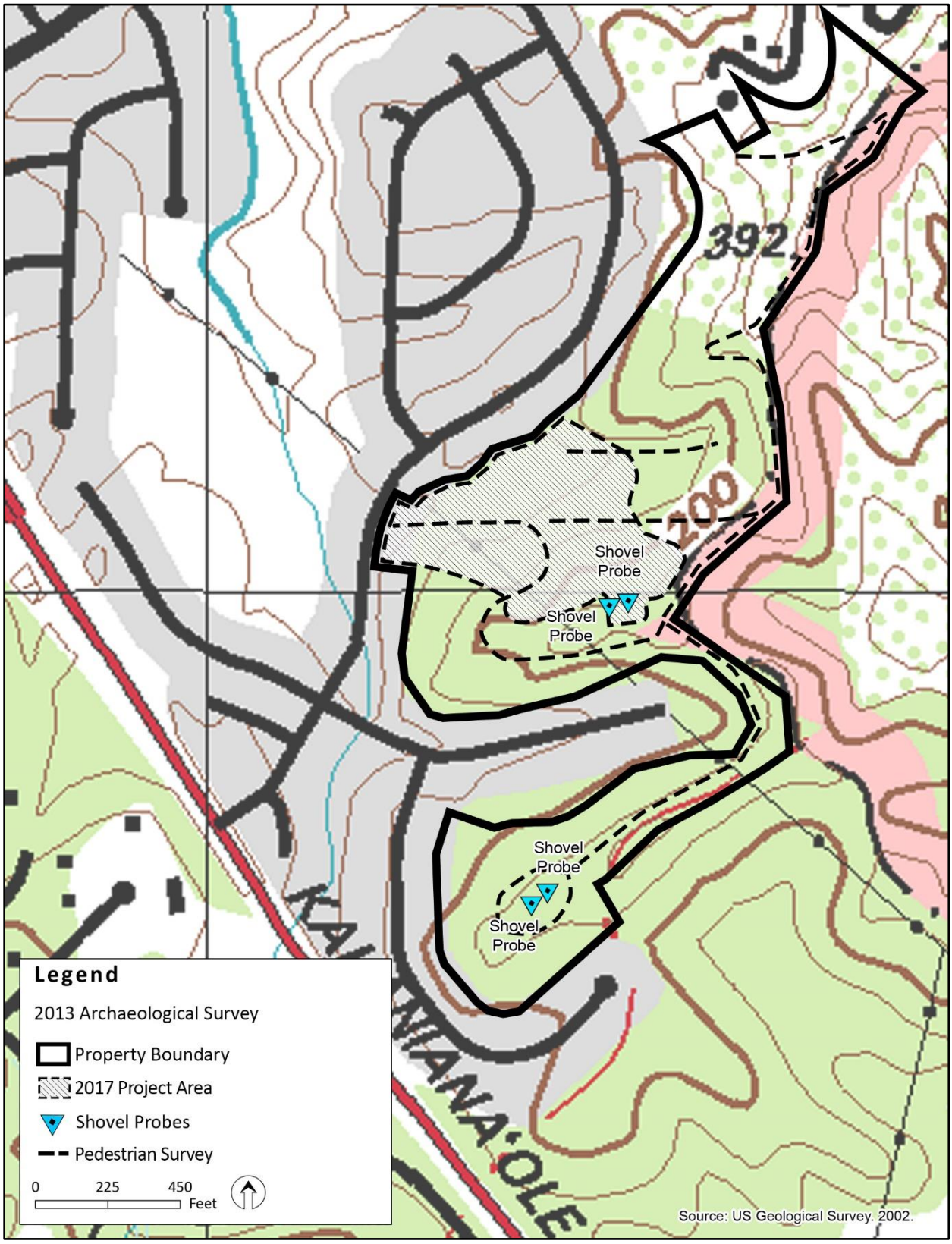
In September 2013, an Archaeological Inventory Survey was performed for the project site by Scientific Consultant Services, Inc. (SCS). The survey found five Historic Era artifacts on the ground surface only. No archaeological findings on the ground surface or within the subsurface of the roughly 5.5-acre area surveyed (*Figure 3-5*). While Inventory Survey-level investigations were completed, the resultant report was written as an Archaeological Assessment (AA), in accordance with the HAR §13-275-5(b)(5) statement "Results of the survey shall be reported either through an archaeological assessment, if no sites were found, or an archaeological survey report which meets the minimum standards set forth in Chapter 13-276."

Subsequent to submittal of a revised AA (Dagher et al. 2014) to the State Historic Preservation Division (SHPD), additional information was provided to SHPD as requested: a project scope of work; a map showing previous archaeological investigations in the area; and a map of the project area. To further identify whether any historic properties may be located on the parcel in anticipation of the proposed construction, a literature review was conducted by Keala Pono Archaeological Consulting LLC in December 2017. The literature review report is included as *Appendix D*.

Kailua was a culturally significant area with many of the natural resources that supported traditional subsistence activities such as fishing and kalo cultivation. Fishponds were maintained along the shoreline, and loʻi were farmed in the wetlands. These resources supported a large pre-contact population, and Kailua was chosen as the seat of governance and/or place of residence for many rulers of Oʻahu.

Historically, sugar and pineapple cultivation were attempted in Kailua, although neither enterprise was particularly lucrative. Cattle ranching had more success, with large tracts of land used for ranching in the late 1800s. The 20th century saw copra agriculture, dairy farming, increased housing, and military use in Kailua.

Previous archaeological research has identified a number of sites in the general Kailua and Waimānalo vicinity, though none have been identified on the parcel. Of nine heiau documented for Kailua, one (Kanahau heiau) was situated makai of Mount Olomana, and upland and west of the



Archaeological Survey **Figure 3-5**

project area. A 20th century family cemetery with headstone dates of 1928 and 1938 is sited along Kanapuʻu Drive at the edge of the Kapaʻa silt detention basin.

On the lower slopes of Keolu Hills, in BAFS, lithic scatters have been found. It is thought that the hills were a source of basalt that was imported to other pre-contact sites on BAFS. A previous archaeological inventory survey on the subject property itself did not identify anything of significance, therefore it is not expected that any archaeological sites or features will be found there. A larger scale survey of the nearby Kaopa Subdivision also had no findings, aside from the 20th century cemetery, which is located across the street from the current project area. Whereas pre-contact human burials are often found in sandy beach deposits, they are less likely to be encountered in the soils of the project area.

Anticipated Impacts and Mitigation Measures

Most of the property will remain unaffected by the proposed action. No historic properties were identified during the 2013 archeological survey of the site, however, there is a always the remote possibility of discovering cultural deposits in either a primary or secondary context. In the event historic or traditional cultural properties (i.e. cultural layers, etc.) are encountered during construction, work in the project area will cease until SHPD is notified, and appropriate protocols are carried out.

3.15 CULTURAL RESOURCES

Existing Conditions

A Cultural Impact Assessment (CIA) was completed for the project by SCS. The study was prepared in March 2014 and is included as *Appendix E*. The following section provides a description of the CIA and findings for the project area.

The project requires compliance with Act 50 Session Laws of Hawaiʻi 2000 and the State of Hawaiʻi environmental review process under Chapter 343, HRS, which requires consideration of a proposed project's effect on traditional cultural practices. Through document research and cultural consultation efforts, the report provided information that was applicable to the assessment of the project and its potential impacts to cultural practices. Hawaiian organizations, agencies, and community members have been contacted for both CIA studies in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the project area vicinities.

The noteworthy findings from this study include portions of two Land Commission Awards documented in the project area (LCA 44:2 awarded to Kalaʻau, signed by Kamehameha III, and LCA 4452-12, awarded to Queen Kalama) and cultural impact assessment inquiry responses from members of the Kailua community. Although the majority of contacted organizations and individuals did not respond to the cultural impact assessment inquiry of the property, three of the responses from members of the Kailua community noted that there is a possibility for historic cultural sites to be located on or near the property.

Anticipated Impacts and Mitigation Measures

The information presented in the CIA for the project site reveals no notable cultural activities took place on the parcel (*Appendix E*). No additional information was evident from the organizations

contacted, newspapers, and archival research. Therefore, it is reasonable to conclude that, pursuant to Act 50, the exercise of native Hawaiian rights, or any ethnic group, related to gathering, access or other customary activities will not be affected by the activities of the proposed home. Adverse effects are not anticipated since no cultural activities were identified to occur at the specific project area.

3.16 VISUAL RESOURCES

Existing Conditions

As described in *Section 3.5 Flora and Fauna*, the project site is covered with introduced plant species typical of low elevation Windward Oʻahu environs. On the west, northwest and southern parcel boundaries are the single-family homes with ornamental trees and landscaped yards that constitute a portion of the Kailua Bluffs subdivision (*Figure 3-6* Views 1 through 6).

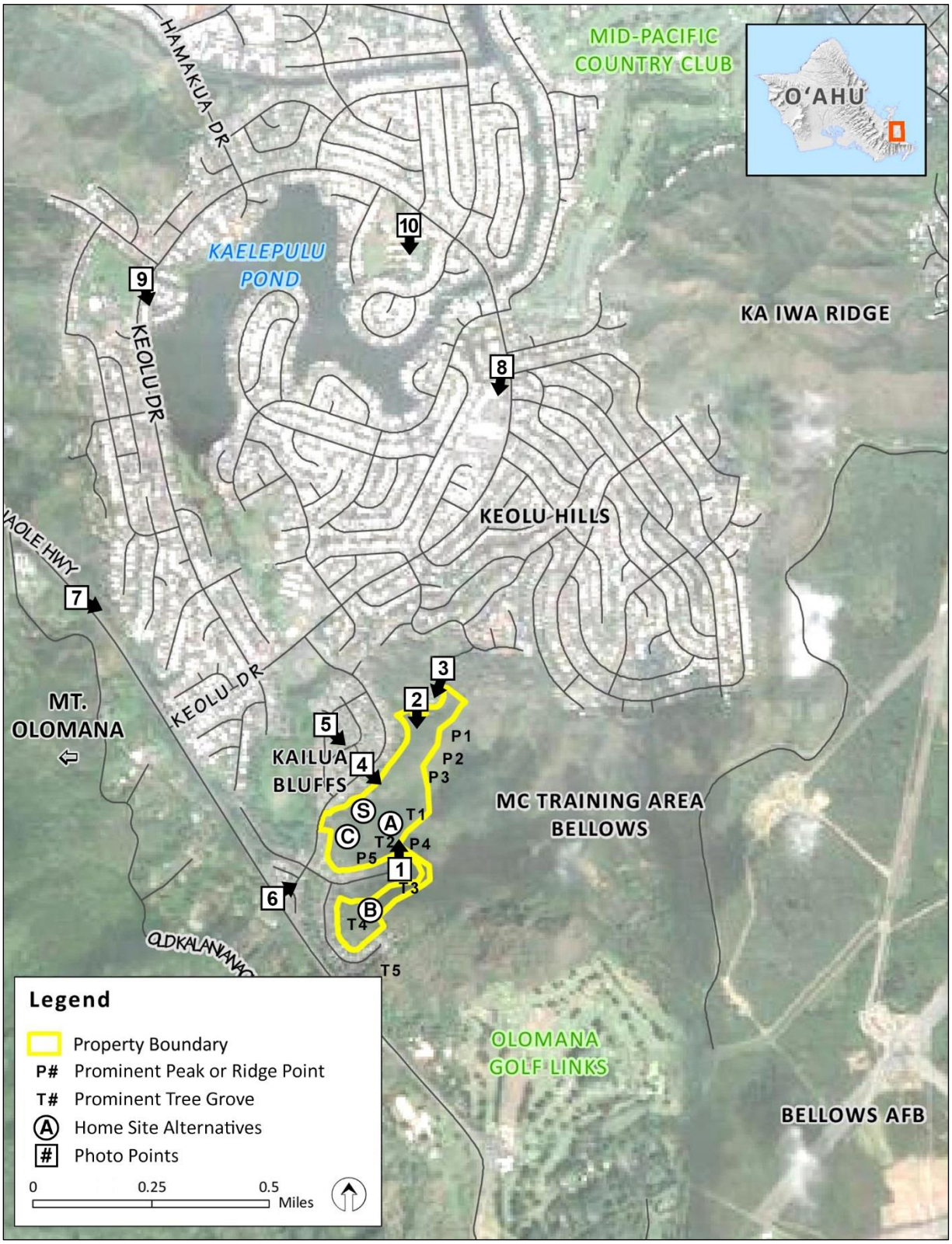
From the Kalanianaʻole Highway corridor, Mt. Olomana is a significant feature visible to the west of the highway; the project lies to the east (*Figure 3-6*). Along the highway looking east in the project vicinity, prominent views are of fences, vegetation and portions of homes in the Kailua Bluffs subdivision (*Figure 3-6* Views 6 and 7). From public spaces within the Enchanted Lakes community, the predominant view is of the Koʻolau Mountain range (*Figure 3-6* Views 8 through 10). Views of coastal headlands and mountains from the vantage points of the ocean, major roads, parks, and other public places will not be impacted by the project. Views of the often photographed and hiked Ka Iwa Ridge can be seen from the coast and beach known as Lanikai, which lies to the north and is visually separated from the parcel.

Anticipated Impacts and Mitigation Measures

As allowed on Conservation District land with appropriate permits, the single-family home with surrounding landscaping will fall within the maximum developable area of 5,000-square feet within the 36.9 acres. Nearly all (99.7 percent) of the parcel will remain open space. Portions of the home's roofline is anticipated to be visible from distant points in Kailua, and will reveal the home's elevation will be below that of the Keolu Summit subdivision homes north of the parcel.

The home will be most visible from within the Kailua Bluffs subdivision along a small portion of Kanapuʻu Drive north of the 1711 address near the subdivision road's crest (Views 4 and 5). Distant views of the access road will be screened by natural vegetation growth over time. The home will not be visible from Kahako Street, and will not be visible from Marine Corps Training Area Bellows and Waimānalo, or from any coastal area.

The access from Kanapuʻu Drive will be gated and fenced. From vantage points both mauka and makai of the site, the property will generally appear as a continuation of vacant preservation lands in the area. Siting of the home below the ridgeline is purposeful and to avoid silhouette against the skyline from any vantage point. The residence will blend with the surrounding land, to preserve the natural beauty of Kailua and Windward Oʻahu, and will not detract from the visual resources of the area. No significant impacts to scenic vistas or existing open preservation landscapes are anticipated.



Site Photo Key **Figure 3-6**

View 1. From Kahako Street Looking North Towards the Property

View 2. From Keolu Summit Water Tank Looking South Towards the Property

View 3. From Keolu Summit Development Looking South Towards the Property

View 4. From Kanapuʻu Drive

View 5. From Paukiki Street in Kailua Bluffs

View 6. From Kanapu'u Drive at Kalanianaole Highway

View 7. From Kalanianaole Highway Looking Southeast to Kailua Bluffs

View 8. From Enchanted Lake Shopping Center

View 9. From Kaʻelepulu Park and Elementary School

View 10. From Enchanted Lake Elementary School and Park

3.17 POTENTIAL CUMULATIVE AND SECONDARY IMPACTS

Cumulative effects are impacts, which result from the incremental effects of an activity when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. The MDHE parcel constitutes a minute amount (about 0.16 percent) of the 978-acre Ka'elepulu watershed. This watershed is occupied by 3,515 residences, 10 acres of commercial development, 4 schools, 24 miles of public roads, and 8 miles of storm drains. The family's vision to live on, and to steward the land by increasing vegetation diversity and soil cover is an improvement to the watershed and is consistent with the purpose of the Conservation District general subzone.

The project will not result in cumulative or secondary impacts. The proposed project involves construction of a single-family residence as constrained by the Conservation District Rules (HAR §13-5). Development of the site will be for personal use by a homeowner and will not result in long-term environmental or social impacts. The home will fit with the adjacent residential uses of the area.

Section 4.0

Alternatives to the Proposed Action

4.0 ALTERNATIVES TO THE PROPOSED ACTION

Under the Hawaiʻi Environmental Impact Statement laws, alternatives that can attain the objectives of the action are to be evaluated. This chapter discusses alternatives considered, some of which were discarded and some which were advanced for additional analyses. The alternative of "No Action" is considered as it presents the baseline against which the other alternatives are evaluated.

4.1 NO ACTION ALTERNATIVE

The No-Action Alternative would allow the property to continue in the form it has been in for the past few decades. In 2013, the new owner found the property to contain extensive illegal dumping material, clogged natural drainage courses, and substantial areas of erosion and habitat degradation due to invasive plants. Uncontrolled access allows a range of illegal activities occurring on this parcel, causing disruptions to the neighboring residential areas. More than a dozen neighboring properties had encroached onto the Conservation District land with unauthorized uses. Continuation of these conditions does not support the Conservation District objectives and degrades the land and vegetation cover.

This alternative is not viable as it deprives the landowner of a reasonable use of privately owned property.

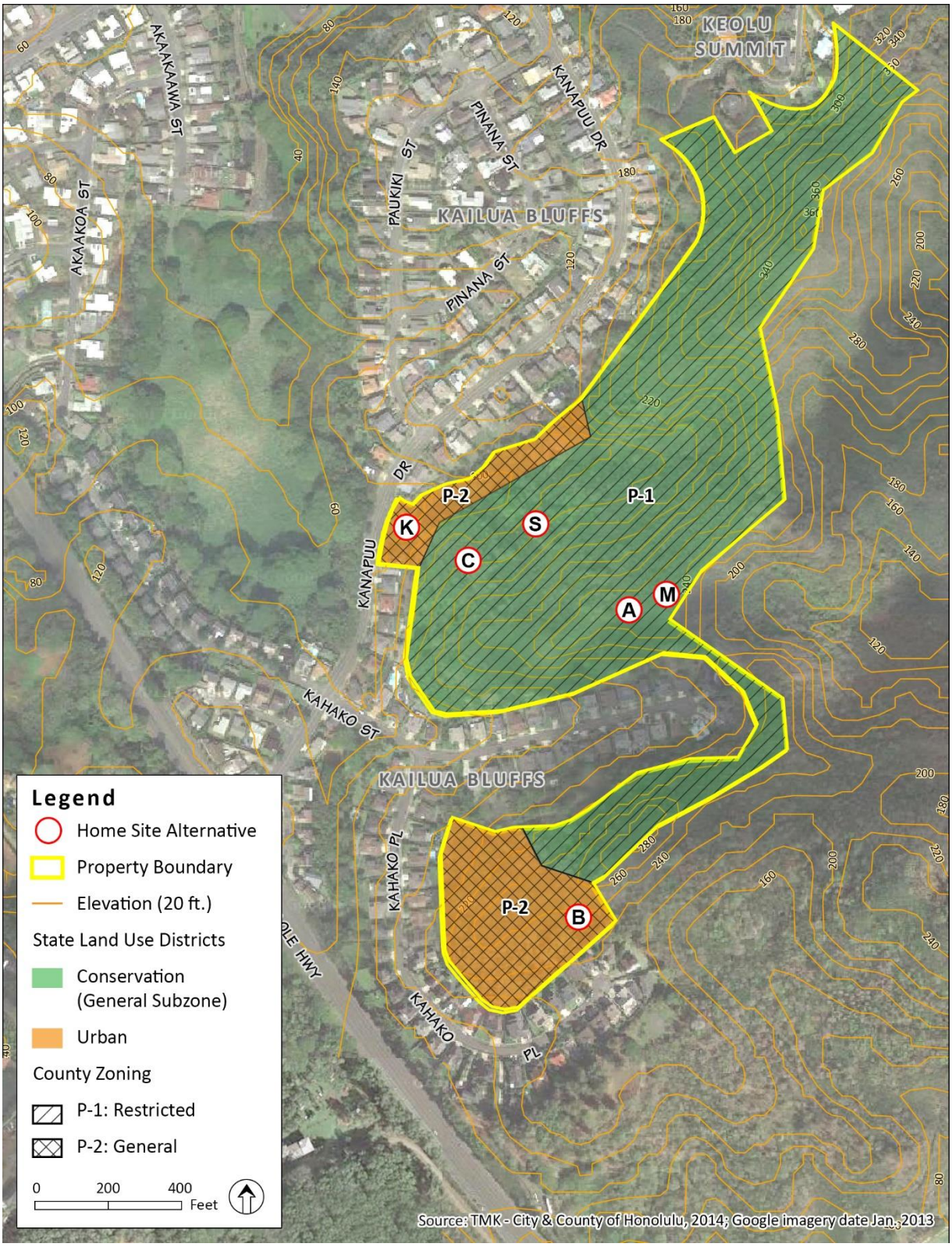
4.2 ALTERNATIVES CONSIDERED AND DISMISSED FROM FURTHER CONSIDERATION

4.2.1 SUBDIVISION FOR RESIDENTIAL USE PLAN ALTERNATIVE

The property has two areas (2.0 and 4.7 acres) of State Urban District land which could be utilized for a small residential subdivision or condominium development. Residential use would require County approvals for a Sustainable Communities Plan amendment and Zone Change from Preservation to Residential. The original development (*Section 1.2, Development History*) included 16 additional homes along two cul de sac that were not constructed. With conversion of the area to R-5 Residential zoning, a minimum of 16 single-family homesites could be created.

The potential for views and the naturalized setting of the larger parcel would likely make a small residential project such as this feel exclusive. New infrastructure expansion would be required to provide roadways and extend municipal water supply and wastewater service. The new development would increase the area's population and introduced associated community impacts of traffic from an estimated 20 to 50 vehicles associated with the homes, additional noise, visual impacts, drainage and runoff, erosion, and vegetation removal.

The alternative is not under consideration by the current landowner; however, it is included as it could be pursued should the parcel remain undeveloped. In comparison to the proposed action, the potential impacts of this alternative would be significantly greater.



Alternative Home Site Locations **Figure 4-1**

4.2.2 ALTERNATIVE HOME SITE LOCATIONS DISMISSED FROM FURTHER CONSIDERATION

Alternative Home Site M: Ridge-top

The ridgeline upslope from the site entrance at Kanapuu Drive provides a panoramic ocean view of neighbor islands across the Kaiwi Channel, and the near-shore island Mānana (commonly known as "Rabbit Island") with Makapuʻu Point and lighthouse to the southwest. Accessible by the remnant dirt road, alternate home site "M" sited along the ridge would also provide views of Waimānalo and the Koʻolau Ridge to the south, Mount Olomana to the southeast, Kaʻelepulu Pond (commonly known as Enchanted Lake) and the ridge of the MDHE parcel to the north. Site M would maximize the value of the home with a stunning ocean view.

Alternative Site M was immediately eliminated from consideration due to the intrusiveness of a silhouetted homesite atop a ridge and out of respect for the community and the naturalized environment valued by the landowner.

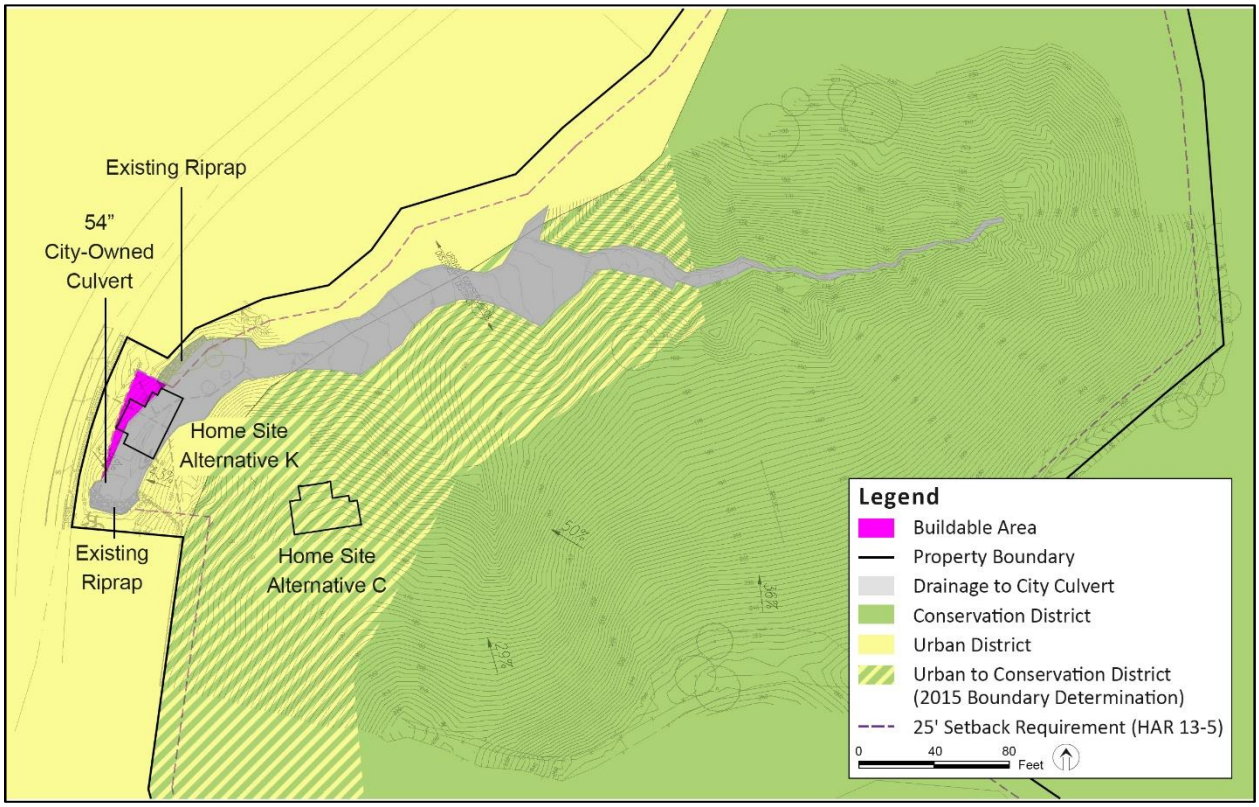
Alternative Home Sites B, C and K: Urban District

Three sites within the Urban District were evaluated as possible alternatives for the home site: B, C and K. Site B sits within the southernmost portion of the parcel, requiring an access road approximately half a mile in length from the property entrance at 1711 Kanapuʻu Drive. Once reaching the ridge, the access road would follow the ridgeline south to a relatively level site at 240 feet msl on the north-facing knob above, and out of view, of Kahako Place (*Figure 3-6* View 6). Due to the length of the driveway, this site was eliminated from further consideration (*Figure 4-1*).

Site C was initially selected as a site within the Urban District. However, the 2015 boundary determination identified a new boundary between Urban and Conservation, which shifted the Conservation District to include this site (see *Section 1.2* and *Figure 4-2*). This site was advanced for consideration as a viable alternative home site in the Conservation District (see following section).

Site K assesses an alternate home site as close to Kanapuʻu Drive as allowed by the set-back requirement. The Kailua Bluffs development is zoned R-5 under the Land Use Ordinance (LUO) of the City and County of Honolulu (Chapter 21 of the Revised Ordinances of Honolulu). R-5 residential zoning requires a setback of 10 feet from the street-side property boundary and 5 feet from the side and rear property boundaries. However, 1711 Kanapuʻu Drive was the "remainder lot" from the subdivision and remained in the State Conservation District which is P-1 zoning (restricted preservation district) per the LUO. All uses, structures and development standards for P-1 zoning are governed by the appropriate state agencies. For the Conservation District, DLNR is the state agency and Hawaii Administrative Rules Chapter §13-5 provides the guiding rules (more information contained in *Section 5.3* and *5.7*).

HAR §13-5 Exhibit 4, Single Family Residential Standards, requires a minimum setback of 25 feet for lots over one acre. As described in *Section 3.8.3 Storm Water Drainage*, the City-owned 54-inch culvert installed during the 1980 development of Kailua Bluffs lies at the 1711 Kanapuʻu Drive entrance aligned with a drainage swale. The need to retain the existing drainage pattern limits the buildable area near the Kanapuʻu Drive frontage, thus eliminating this site as a viable alternative (*Figure 4-2*).



Urban District and Buildable Area Evaluation **Figure 4-2**

4.3 VIABLE HOME SITE ALTERNATIVES

Three locations on the parcel were identified as viable alternative sites for the single-family residence: sites A, C and S. Site A is a relatively level site at approximately 250 feet msl elevation, below the primary ridge. The fragments of a previously graded dirt road network follow contours along the parcel's western slope that leads to the site and beyond.

Site C was identified as the closest, feasible buildable site to the property entrance at 1711 Kanapu'u Drive. This site would require construction of a new access road as it is not along the previously graded access. Site C overlooks homes on Kanapu'u Drive from a steep, wooded slope at approximately 150 feet msl.

Site S lies low on the parcel at approximately 120 feet msl. Sited on a slope that faces homes to the north/northwest, it is along a fragment of the previously graded road. Site S is slightly above the elongated and relatively flat depression formed at the base of the central parcel's radiating ridges.

Four criteria were defined to evaluate impacts to soils, the site structural feasibility, minimize impacts to vegetation, and to minimize and provide for health considerations of a disabled occupant:

1. Earth work required to establish home site and access road;
2. Distance to bedrock;
3. Retention of mature, non-invasive trees; and
4. Presence of health-risk irritants.

Earth Work

Rough order of magnitude (ROM) earth work was calculated to provide for comparison between alternatives. The lower elevation area in the Urban District requires fill to provide appropriate slope for two-wheel drive and emergency vehicle access road from Kanapu'u Drive. Earth work for Alt A and Alt S are the same in the Urban District (*Table 4-1*).

Based on the ROM earth work estimates, Alt C was dismissed from further evaluation. Alternate home locations A and S underwent further geotechnical evaluation to more clearly identify construction requirements for the foundation at each site. Earth work does not include non-expansive fill.

Table 4-1
Alternative Site Locations
Site Disturbance Summary

SFR Location Alternatives	Distance to Bedrock (ft)	Access Road Length (ft)	Earth work ROM (cubic yards)					
			Urban District			Conservation District		
			Cut	Fill	Net	Cut	Fill	Net
Alt A	3 - 6	1,220	30	1, 700	1,670 fill	4,670	5,600	930 fill
Alt C	n/a†	450	25	2,400	2,375 fill	12,675	1,100	11,575 cut
Alt S	10	450	30	1, 700	1,670 fill	1,530	4,800	3,270 fill

†*Alt C was dismissed from further evaluation due to excessive earth work*

Distance to Bedrock

Distance to bedrock is described in *Section 3.2*. Borings conducted for a geotechnical evaluation occurred at alternate sites A and S, which were advanced for further evaluation following earth work ROM estimates. The geotechnical borings reveal that the volcanic tuff (bedrock) at Alternate Site A lies from 3 to 6 feet below grade under the parcel's primarily clay soils. The bedrock layer (also volcanic tuff) for Site S is approximately 10 feet below grade (*Table 4-1*).

Foundation construction on bedrock requires a typical 12-inch embedment for perimeter edge footings with 4-inches of non-expansive soils, whereas construction on clay soils would require perimeter edge footing embedment approximately 36-inches below finished grade, with at least 36-inches of non-expansive fill. Thus, Alt S will require significantly more non-expansive fill brought to the site to prepare the foundation per geotechnical recommendations.

Retention of Trees

Mature Formosa koa (*Acacia confusa*) trees exist on the parcel. Visual screening for the home from the west would be provided by a cluster of trees at Alternate Site A. Alternate Site C would require clearing the cluster of trees to construct the home. Alternate Site S lies within an area of mixed tree species with no significant cluster of Formosa koa, though individual trees would require removal.

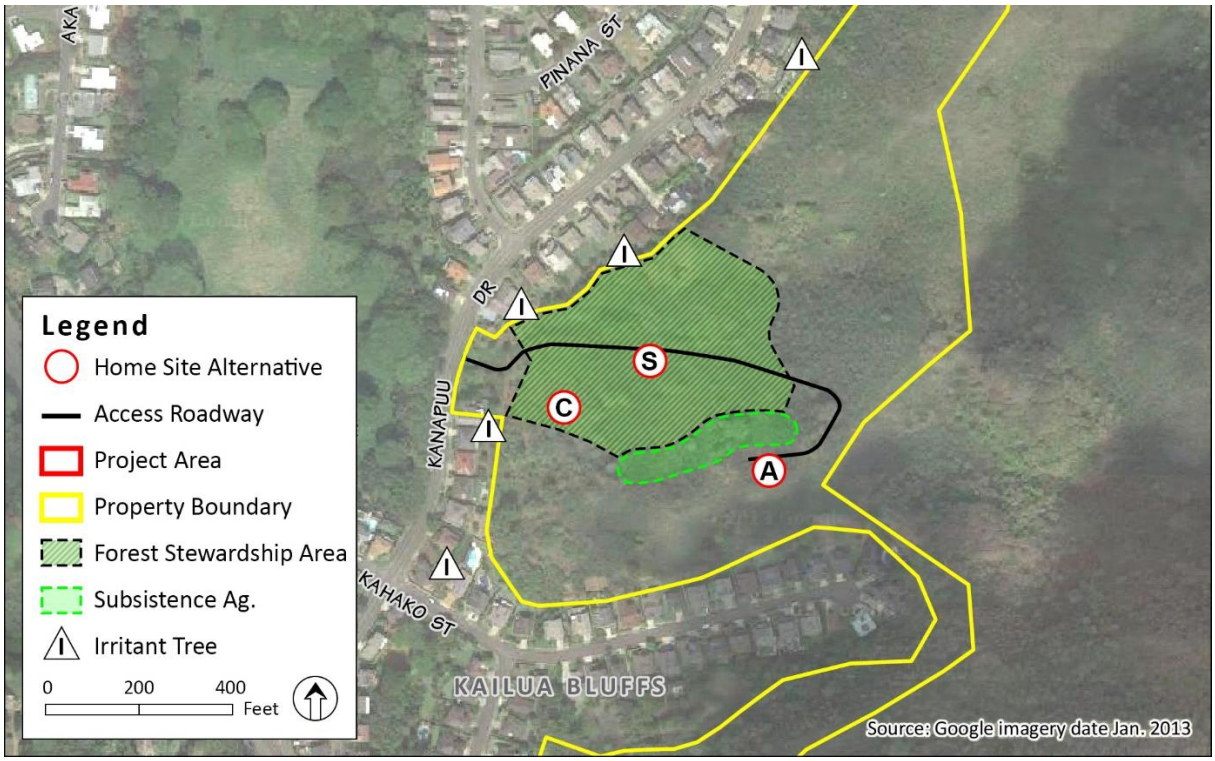
Health Risk Irritants

The home will be occupied by a retired U.S. Army Reserve officer who has been diagnosed as a disabled person with physical impairments that substantially limit one or more major life activities. All neighboring homes must be considered potential sources of chemicals and pesticides, as common household products labeled for use by homeowners can trigger the debilitating health condition

diagnosed by the landowner's physician. The disabling conditions require a living environment that meets four health considerations:

1. Distance from potential sources of chemical products and pesticides;
2. Distance from known irritant/allergen;
3. Avoidance of wet/damp areas that promote mold, mildew, moss and fungus conditions; and
4. Avoidance of conditions that restrict or limit air flow and quality.

Allergen/irritant sources known to occur surounding the property are shown in *Figure 4-3*.



Irritant Tree Locations **Figure 4-3**

Analyses of the health consideration criteria are summarized in *Table 4-2*.

Table 4-2
Alternative Site Locations
Health Considerations

SFR Location Alternatives	Approx. Distance to Neighbor (ft)	Approximate Distance to Closest Known Irritant (ft)	Natural Air Flow
Alt A	146	614	Open
Alt C	115	170	Somewhat restricted
Alt S	140	300	Restricted

4.4 DISCUSSION

Alternate A:

- The earth work is nearly balanced in the Conservation District with an estimated net fill of 930 cubic yards. The total (combined Urban and Conservation District) cut would be 4,700 cubic yards, with total (combined Urban and Conservation Districts) fill at 7,300 cubic yards (*Table 4-1*). The need for earth work can be further minimized through use of retaining features along the access road, which can be designed and installed with a goal of minimizing visual impacts from off-site.
- Bedrock exists at 3 to 4 feet depth at the site, allowing for typical footing embedment depth and the typical 4-inch non-expansive fill under the concrete slab-on-grade.
- Alternate A is the furthest from the closest neighbor and the furthest from the closest known environmental irritant (*Table 4-2*). The site is exposed to clean airflow off the Pacific Ocean to prevent transport of irritant sources such as pollens and chemicals to the home area. The site meets all health criteria required by the disabled landowner.
- The existing grove of Formosa koa trees would be retained to provide visual screening from the west.

Alternate C:

- The greatest amount of earth work in the Conservation District is required for Alt C as there is no level area, resulting in a net cut 11,575 cubic yards. The total would be cut would be 12,700 cubic yards, and total (combined Urban and Conservation District) fill would be 3,500 cubic yards (*Table 4-1*).
- This alterative was not advanced for geotechnical evaluation was due to the high earth work estimate.
- This location is the closest and most exposed to irritants from neighboring properties and environmental irritants at 115 feet and 170 feet, respectively (*Table 4-2*).
- Multiple clusters of mature Formosa koa trees would need to be removed to utilize the site.

Alternate S:

- The earth work in the Conservation District would result in net fill of 3,270 cubic yards. The total (combined Urban and Conservation District) cut would be 1,560 cubic yards and total (combined Urban and Conservation District) fill would be 6,500 cubic yards (*Table 4-1*).
- Bedrock at Alternate S is 10 feet below the clay soils, requiring greater quantities of non-expansive fill are needed to meet the construction specifications (36-inces of non-expansive fill) under the concrete slab-on-grade.
- Alternate S lies slightly above the elongated and relatively flat depression formed at the base of the central parcel's radiating ridges. The depression consolidates storm water at times of high rainfall and remains saturated longer than soils on slopes. The combination of mold-producing wet soils near this location, and restricted air flow as the primary ridge blocks trade winds from the east/northeast, results in a site with a high likelihood of creating a home environment that is hazardous to the landowner's health.
- Scattered mature Formosa koa trees would need to be removed to create the home site.

4.5 CONCLUSION

Alternate A is the only site that meets all health criteria required by the disabled landowner. Structurally, the site is close to bedrock and leveling will allow the foundation footings to be typical and require only typical importation of non-expansive fill to support the ground floor concrete slab-on-grade. Earth work for Alternate A has a closely balanced need for cut and fill. For these reasons, Alternate A has been selected as the home site. Impacts related to development at this site are evaluated in Chapter 3 of this EA.

Section 5.0

Applicable Land Use Plans and Policies

5.0 APPLICABLE LAND USE PLANS AND POLICIES

In this chapter, the project's consistency with applicable land use policies set forth in the Hawaiʻi State Plan, State Land Use Law, State Coastal Zone Management (CZM) Program, State 2050 Sustainable Plan, City and County of Honolulu General Plan, Koʻolaupoko SCP, Land Use Ordinance (LUO), and SMA are discussed.

5.1 HAWAIʻI STATE PLAN

The Hawaiʻi State Plan establishes a statewide planning system that provides goals, objectives, and policies that detail priority directions and concerns of the State of Hawaiʻi; relevant elements related to the project follow.

State goals under the Hawaiʻi State Planning Act (HRS Chapter 226) include:

- A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawaiʻi present and future generations.
- A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.
- Physical, social, and economic well-being, for individuals and families in Hawaiʻi, that nourishes a sense of community responsibility, of caring, and of participation in community life (Chapter 226-4, HRS).

Specific objectives and policies of the State Plan that pertain to the project are as follows:

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

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

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

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

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

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

(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaiʻi.

Section 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.

(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.

(4) Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawaiʻi's people.

Discussion:

The project design brings a land steward to the privately-owned land parcel. The landowner has developed a Forest Stewardship Management Plan with a qualified forest manager; as described in *Section 2.2.4*, the plan was approved by the State Forest Stewardship Committee as part of the State's Forest Stewardship program. In addition, a Conservation Plan was developed for the site under technical guidance from the local soil and water conservation service. Thus these private lands will be transformed from an un-managed parcel with noted encroachment and abuse by others, to a managed site with full-time landowner presence.

5.1.1 STATE FUNCTIONAL PLAN: CONSERVATION LANDS

In addition to the State Plan, Functional Plans were approved by the Governor to guide implementation of State and County actions in key areas primarily within programs administered or funded by agencies of the state. The Functional Plans identify priority issues and contain objectives, policies, and implementing actions to address priority issues, and include: Agriculture; Conservation Lands; Education; Employment; Energy; Health; Higher Education; Historic Preservation; Housing; Human Services; Recreation; Tourism; and Transportation.

The Conservation Lands Functional Plan was revised in 1991. The Conservation Lands Functional Plan addresses three issues: inventories of resources and background information and basic research; management; and education and public information.

Discussion:

The project will use a portion of privately-owned vacant Conservation District lands for the construction of a single-family residence with rooftop photovoltaic panels for electricity, access road, family subsistence garden and 6-acre forest stewardship area. The majority of the project parcel – 99.7 percent – will remain open space. Under a Forest Stewardship Management Plan approved by the State Forest Stewardship Committee, the landowner has set goals to transform a 6-acre area of low-benefit, non-native dominated area to a native and Hawaiian canoe-plant dominated lowland mesic forest over a 10-year period. In addition to improving plant diversity on the site, soil erosion will be reduced with increased rainwater infiltration. A botanical survey of the project area has shown that the parcel is dominated by non-native vegetation, and no rare or endangered plant species, animals, or habitats exist on the site.

Section 226-18 Objectives and policies for facility systems--energy.

(c) To further achieve the energy objectives, it shall be the policy of this State to:

(8) Support research and development as well as promote the use of renewable energy sources;

Discussion:

The project will include development of a small rooftop photovoltaic (PV) solar installation with battery backup. The single-family residence will produce the majority of its electrical need from a renewable energy source.

5.2 HAWAIʻI STATE LAND USE DISTRICT BOUNDARIES

Under the Chapter 205, HRS, all lands of the State are to be classified in one of four categories: urban, rural, agricultural, and conservation lands. The State Land Use Commission (LUC), an agency of the State DBEDT, is responsible for each district's standards and for determining the boundaries of each district (Chapter 205-2(a), HRS). The LUC is also responsible for administering all requests for district reclassifications and/or amendments to district boundaries, pursuant to Chapter 205-4, HRS, and the HAR, Title 15, Chapter 15 as amended. Under this Chapter, all lands in Hawaiʻi are classified into four land use districts: (1) Conservation, (2) Agricultural; (3) Urban, and (4) Rural.

Conservation lands are comprised of lands in existing forest and water reserve zones and include areas necessary for protecting watersheds and water sources, scenic and historic areas, parks, wilderness, open space, recreational areas, habitat for endemic plants, fish and wildlife, and all submerged lands seaward of the shoreline. Conservation Districts are administered by OCCL and governed by the BLNR, with allowable uses governed by rules promulgated by the State DLNR.

The Urban District generally includes lands characterized by "city-like" concentrations of people, structures and services. This District also includes vacant areas for future development. Jurisdiction of this district lies primarily with the respective counties. Generally, lot sizes and uses permitted in the district area are established by the respective County through ordinances or rules.

Discussion:

The project site contains both State Urban and Conservation District under the State of Hawaiʻi Land Use Commission *(Figure 1-3)*. As explained in *Section 1.2*, the property is a remnant parcel from development of the Kailua Bluffs subdivision in the 1980s, which required rezoning of Conservation District land to Urban District. The parcel's 36.89 acres were primarily Conservation District, with two small pieces in the Urban District. In 2014, the landowner consigned a survey to identify where the Urban District boundary fell within the parcel. Upon receiving the survey information, the Land Use Commission determined the boundary and confirmed the two Urban District pieces within the parcel are approximately 4.691 and 1.985 acres, for an approximate total of 6.676 acres.

5.3 CONSERVATION DISTRICT RULES: HAWAIʻI ADMINISTRATIVE RULES TITLE 13 CHAPTER 5

Title 13, Chapter 5 in the Hawaiʻi Administrative Rules (HAR §13-5) regulates the land use in the Conservation District for the purpose of conserving, protecting, and preserving the important natural and cultural resources of Hawaiʻi. Subzones within the Conservation District are classified as follows:

- Protective – To protect valuable natural and cultural resources in designated areas such as restricted watersheds, marine, plant, and wildlife sanctuaries, significant historic, archaeological, geological, and vulcanological features and sites; and other designated unique areas.
- Limited – To limit uses where natural conditions suggest constraints on human activities.
- Resource – To ensure, with proper management, the sustainable use of the natural resources of those areas.
- General – To designate open space where specific conservation uses may not be defined, but where urban use would be premature.
- Special – To provide for sustainable use of areas possessing unique developmental qualities that complement the natural resources of the area.

Discussion:

The proposed project falls within the General subzone, and the proposed uses are consistent with allowable uses in the General subzone per Conservation District Rules (HAR §13-5) with review and approval from OCCL and BLNR. Allowable land uses include one single-family residence, invasive species and tree removal, and land and resource management (see *Table 1-1* and *Section 2.2.1*). The home will comply with the Single-Family Residence standards as specified in Exhibit 4 of HAR §13-5. House and roof colors will be selected to blend with the surrounding area, and landscaping will be used to screen the home in accordance with the rules.

5.4 HAWAIʻI COASTAL ZONE MANAGEMENT PROGRAM

The CZM Act of 1972 (16 United States Code (USC), Section 1451), as amended through Public Law 104-150, created the coastal management program and the National Estuarine Research Reserve system. The coastal states are authorized to develop and implement a State coastal zone management program. The Hawaiʻi CZM Program received Federal approval in the late 1970s. Ten over-arching resources are addressed through both objectives and policies: (1) recreational resources, (2) historic resources, (3) scenic and open space resources, (4) coastal ecosystems, (5) economic uses, (6) coastal hazards, (7) managing development, (8) public participation, (9) beach protection, and (10) marine resources. Each County is responsible for designating a Special Management Area (SMA) that extends inland from the shoreline. Development within the County-designated SMA is subject to County approval to ensure the proposal is consistent with the Hawaiʻi CZM Program policies and objectives.

Discussion:

The project area is not within the SMA as delineated by the City and County of Honolulu; no Special Management Area determination is required under State statute, and no Special Management Permit is required under City and County of Honolulu ordinance. The Conservation District Use Application for the project will include a section on how the proposed land use complies with the provisions and guidelines in Chapter 205A, and will be reviewed by OCCL as part of its permit process.

5.5 HAWAIʻI 2050 SUSTAINABILITY PLAN

The Hawaiʻi 2050 Sustainability Plan is a long-term strategy with goals and objectives that respect culture, character, beauty, and history of the state's island communities; balance among economic, community, and environmental priorities; and an effort to meet the needs of the present without compromising the ability of future generations to meet their own needs.

The 2050 Plan delineates five goals toward a sustainable Hawaiʻi accompanied by strategic actions for implementation and indicators to measure success or failure. The goals and strategic actions that are pertinent to the project are as follows.

Goal One: Living sustainably is part of our daily practice in Hawaiʻi.

Strategic Actions: Develop a sustainability ethic.

Discussion:

The project support Hawaiʻi's movement towards living sustainably. Energy costs in Hawaiʻi are the highest in the United States, and the principal source of electricity is oil-fired plants that consume more than 400 million gallons of petroleum-based fuels annually. The project will include rooftop PV solar power generation with battery storage. The landowner will grow fresh produce and fruit for the family's use.

5.6 CITY AND COUNTY OF HONOLULU GENERAL PLAN

The General Plan of the City and County of Honolulu (1992 edition, as amended in 2002) is a statement of long-range socio-economic, environmental, and design objectives and policies to be achieved for the general prosperity and welfare for the people of the city. It is intended to serve as a guide for all levels of government, private enterprise, neighborhood and citizen groups, organizations, and individual citizens (City and County of Honolulu Revised Charter 2000, Sec. 6-1508). The General Plan provides objectives and policies intended to guide and coordinate City land use planning and regulation, and budgeting for operations and capital improvements. The project is consistent with the applicable objectives and policies of the General Plan, as described below.

Natural Environment

Objective A: To protect and preserve the natural environment.

- *Policy 1: Protect Oʻahu's natural environment, especially the shoreline, valleys, and ridges, from incompatible development.*
- *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 8: Protect plants, birds, and other animals that are unique to the State of Hawaiʻi and the Island of Oʻahu.*

5.6.1 KOʻOLAU POKO SUSTAINABLE COMMUNITIES PLAN

The Island of Oʻahu is divided into eight regional plan areas. Six areas (including Koʻolau Poko) are addressed in "sustainable communities plans" (SCP) in recognition of modest development patterns and rural characteristics. The 2016 revision of the Koʻolau Poko Sustainable Communities Plan (KPSCP) Section was adopted as Ordinance 17-42 in August 2017. The ordinance reflects the intent under the Honolulu General Plan that: " . . . this development plan ordinance . . . presents a vision for Koolau Poko's future development consisting of policies, guidelines, and conceptual schemes that will serve as a policy guide for more detailed zoning maps and regulations and public and private sector investment decisions."

Ordinance Section 24-6.2 acknowledges "The provisions of this article and the Koolau Poko SCP are not regulatory. Rather, they are established with the explicit intent of providing a coherent vision to guide all new public and private sector development within Koolau Poko. This article will guide public investment in infrastructure, zoning and other regulatory procedures. . ."

Discussion:

Section 24-6.5 of Ordinance 17-42 states: "In determining whether a proposed development is consistent with the Koolau Poko SCP, the responsible agency shall primarily take into consideration the extent to which the development is consistent with the vision, policies, and guidelines set forth in the Koolau Poko SCP." Development is defined in the ordinance as "any public improvement project, or any public or private project requiring a zoning map amendment." The proposed project is not a public improvement project. No zoning map amendment is required for this project.

5.7 CITY AND COUNTY OF HONOLULU LAND USE ORDINANCE GUIDELINES

The purpose of the LUO is to regulate land use in a manner that will encourage orderly development in accordance with adopted land use policies, including the County General Plan and development plans. The LUO is also intended to provide reasonable development and design standards. These standards are applicable to the location, height, bulk and size of structures, yard areas, off-street parking facilities, and open spaces, and the use of structures and land for agriculture, industry, business, residences or other purposes (Revised Ordinance for the City and County of Honolulu (ROH), Chapter 21).

Discussion:

The site is designated as P-1 Restricted Preservation District and P-2 General Preservation District by the County LUO *(Figure 1-3).* The purpose of the preservation districts is to preserve and manage major open space and recreation lands and lands of scenic and other natural resource value. It is intended that all lands within a state-designated Conservation District be zoned P-1 Restricted Preservation district. It is also the intent that lands designated Urban by the State, but well-suited to the functions of providing visual relief and contrast to the City's built environment or serving as outdoor space for the public's use and enjoyment be zoned P-2 General Preservation district. Areas unsuitable for other uses because of topographical considerations related to public health, safety and welfare concerns shall also be placed in this district. Pursuant to Section 21-3.40-1 of the LUO, the use and development standards of this zoning district shall be governed by the appropriate State agencies. See previous Section 5.3 Conservation District Rules. The project will obtain a CDUA permit approval from the BLNR.

5.7.1 SPECIAL MANAGEMENT AREA

The project area is not located within the SMA, which was established to preserve, protect, and where possible, to restore the natural resources of the coastal zone of Hawaiʻi. Special controls on developments within the SMA area are necessary to avoid permanent loss of valuable resources and foreclosure of management options. The review guidelines of Section 25-3.2 of the ROH are used by DPP and the City Council for the review of developments proposed in the SMA. These guidelines are derived from Section 205A-26 HRS.

Discussion:

The entire project area is not within the SMA as delineated by the County and, as such, does not require additional review under State CZM and County SMA rules.

Section 6.0

Findings Supporting Anticipated Determination

6.0 FINDINGS SUPPORTING ANTICIPATED DETERMINATION

6.1 ANTICIPATED DETERMINATION

This EA is largely based on a Final EA published April 8, 2015 in *The Environmental Notice* for which the OCCL issued a Finding of No Significant Impact (FONSI). Under the Conservation District Rules (HAR §13-5), an EA (or proof of an exemption) is required as part of a Conservation District Use Permit (see *Section 1.5 Permits and Approvals Required*). HRS §343-5(g) allows the use of a prior determination or FONSI ". . . an agency may consider and, where applicable and appropriate, incorporate by reference, in whole or in part, previous determinations of whether a statement is required and previously accepted statements. . . ." Thus per §343-5, the FONSI issued in 2015 could be relied upon for future proposed action used in an EA for that subsequent particular action. However, a new EA and CDUA is required for the currently refined proposed project.

The significance criteria outlined in HRS Chapter 343 and HAR §11-200-12 is listed below, with an assessment of the impacts from Chapter 3 noted where applicable. There are no significant adverse effects on the natural or human environment identified in this EA. A Finding of No Significant Impact (FONSI) is anticipated.

6.2 REASONS SUPPORTING THE ANTICIPATED DETERMINATION

The potential impacts of the residential improvements have been fully examined and discussed in this Draft Environmental Assessment. As stated earlier, there are no significant environmental impacts expected to result from the proposed action. This determination is based on the assessments as presented below for criterion (1) to (13).

1. Involve an irrevocable loss or destruction of any natural or cultural resources.

The proposed project is not anticipated to adversely impact any natural or cultural resources. As described in *Section 3.5 Flora and Fauna*, the existing habitats on the property are neither unique nor important for any Federal or State listed avian or mammalian species currently known from the Island of Oʻahu No threatened or endangered species would be impacted by the proposed action. Lighting and fencing will be installed in compliance with U.S. Fish and Wildlife Service guidance to minimize potential impact to transient species.

The archaeological and cultural landscapes have been documented in studies conducted specifically for the project area. As detailed in *Section 3.5*, *Section 3.14 and 3.15* of this report, a 2013 archaeological inventory survey the project area did not identify any archaeological sites. A larger scale survey of the nearby Kaopa (now known as Kailua Bluffs) Subdivision also had no findings, aside from the 20th century cemetery. Therefore, it is not expected that any archaeological sites or features will be found in the project area. In Hawaiʻi, the potential for the inadvertent discovery of subsurface historical or cultural resources is always considered, including the unknown possibility of iwi kūpuna (ancestral remains). Pre-contact human burials are often found in sandy beach deposits, and are less likely to be encountered in the soils of the project area.

If any cultural, historic, or archaeological resources are unearthed or ancestral remains are inadvertently discovered, the State Historic Preservation Division (SHPD) of DLNR will be notified. The treatment of these resources will be conducted in strict compliance with the applicable historic preservation and burial laws.

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

The proposed use will not curtail the range of beneficial uses of the environment. The land is privately owned and as such does not provide for public use. Since taking ownership, the landowner has removed items dumped on the property and initiated removal of dying trees and potential fire hazards. Twelve encroachments violating Conservation District rules and affecting 3.5 acres of the property within the Conservation District were identified and resolved, with another 12 encroachments onto the site's Urban District lands similarly resolved. Vegetation diversity of the central portion of the parcel will be enhanced under an approved Forest Stewardship Management Plan and implementation of land conservation activities. Active management will benefit these lands within the Conservation District.

Construction of a single-family home within the maximum developable area allowed by HAR §13-5 Conservation District Rules will occupy 5,000-square feet within the 36.9 acres, keeping nearly all (99.7 percent) of the parcel in open space. In summary, the project would actually increase beneficial uses of the environment by replacing vacant, untended land with a modest residential use as allowed under the applicable regulations, with a family subsistence garden and native landscape restoration.

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

The proposed action is consistent with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.

4. Substantially affects the economic or social welfare of the community or State.

The proposed action is a private action requiring expenditure by the landowner, and as such will have no adverse social or economic impact to the state. Short-term economic benefits anticipated during construction will include direct, indirect, and induced employment opportunities and multiplier effects, but not at a level that would generate significant economic expansion. The limited scale construction will have some positive economic impact.

5. Substantially affects public health.

The proposed action is consistent with existing land uses and will not substantially affect public health. Construction-related impacts of noise, dust, and emissions will be mitigated by compliance with the State Department of Health Administrative Rules, and will be short-term.

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

The proposed action will not have substantial secondary impacts, such as population changes or effects on public facilities.

7. Involves a substantial degradation of environmental quality.

The proposed action will not involve a substantial degradation of environmental quality. Chapter 3 of this EA is devoted to the minimization and best practices to be employed where needed to mitigate any impacts to environmental resources. Controls will be enacted as required by all applicable regulations and permit conditions during construction to prevent degradation of environmental quality.

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

The planned uses would not involve cumulative impacts and is not a precursor for other future actions.

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

The project area does not contain identified rare, threatened or endangered species or habitat. No impact is anticipated.

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

General temporary impacts associated with construction have been identified in this EA. Mitigation measures which are outlined in this EA will be applied during the on-going construction activity. No debris, petroleum products, or other construction-related substances or materials will be allowed to flow, fall, leach or otherwise enter the coastal waters. Best Management Practices will be adhered to during construction to minimize environmental pollution and damage. No detrimental long-term impacts to air, water, or acoustic quality are anticipated with the proposed action.

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

The planned residence is not in the shoreline area or an erosion prone, geologically hazardous area. Drainage and erosion controls are planned.

12. Substantially affects scenic vistas and view-planes identified in county or state plans or studies.

The planned residence and access road will only be visible from limited locations in the vicinity, as described and shown in *Section 3.16*. The preferred site for the residence is tucked among mature trees below the primary ridge, and at a lower elevation than the existing Keolu Summit development north of the parcel. No significant public views will be impacted.

13. Require substantial energy consumption.

The single family residence will be tied in to the island's electrical grid. A residential roof-top photovoltaic system is planned to provide the majority of the household's power needs. Additionally, energy-efficient systems for lighting and water heating will be employed to minimize energy demand.

6.3 SUMMARY

Based on the above findings, the residential action does not have significant socio-economic or environmental impacts. The Environmental Assessment recommends minimization and mitigation measures to alleviate potential impacts. The action is consistent with the Hawaiʻi State Land Use District Boundaries; the Hawaiʻi Coastal Zone Management Plan, the City's General Plan and Development Plan; the City's Zoning Ordinance, and Special Management Area regulations.

Section 7.0

Agencies and Parties Consulted

7.0 AGENCIES AND PARTIES CONSULTED

Table 7-1 lists the agencies, organizations, and individuals who were contacted during preparation of this Draft EA, and those that will be asked to review the Draft EA. The conservation and vegetation management elements of the proposed action were discussed at four open meetings. Stewardship concepts for the project were presented to the Forest Stewardship Advisory Committee (under the State Department of Land and Natural Resources Division of Forestry and Wildlife) in September 2016. Subsequently the Forest Stewardship Management Plan was developed, and reviewed and approved by the Committee on January 20, 2017. The site's Conservation Plan was initially discussed at the Windward Oʻahu Soil and Water Conservation District (WOSWCD) meeting on February 18, 2016, and the plan was approved at the WOSWCD July 2016 meeting in Kāneʻohe, Oʻahu.

DISTRIBUTION	Early Consultation	To Be Notified of Draft EA	Commented on Draft EA
Federal Agencies			
Department of the Interior Fish and Wildlife Service		X	
Department of the Interior Geological Survey, Pacific Islands Water Science Center		X	
Department of Agriculture National Resources Conservation Service	X	X	
State of Hawaiʻi Agencies			
Department of Agriculture		X	
Department of Accounting & General Services		X	
Department of Business, Economic Development and Tourism (DBEDT) Office of Planning		X	
Department of Health (DOH) Environmental Planning Office		X	
DOH Clean Water Branch		X	
Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife	X	X	
DLNR, Engineering Division		X	
DLNR, Land Division – Oʻahu District		X	
DLNR, Soil & Water Conservation District	X	X	
DLNR, State Historic Preservation Division	X	X	
DLNR, Office of Conservation and Coastal Land	X	X	

DISTRIBUTION	Early Consultation	To Be Notified of Draft EA	Commented on Draft EA
Department of Transportation		X	
Land Use Commission	X	X	
Office of Environmental Quality Control		X	
Office of Hawaiian Affairs		X	
University of Hawaiʻi Water Resources Research Center / Environmental Center		X	
City and County of Honolulu Agencies			
Board of Water Supply	X	X	
Department of Community Services		X	
Department of Design and Construction		X	
Department of Environmental Services		X	
Department of Facility Maintenance		X	
Department of Parks and Recreation		X	
Department of Planning and Permitting		X	
Department of Transportation Services		X	
Honolulu Police Department		X	
Honolulu Fire Department	X	X	
Kailua Neighborhood Board # 31		X	
Elected Officials			
State House Rep. Cynthia Thielen (District 50)		X	
State House Rep. Chris Lee (District 51)		X	
State Senator Jill Tokuda (District 24)		X	
State Senator Laura Thielen (District 25)		X	
Councilmember Ikaika Anderson (Council District 3)		X	
Libraries/Repositories			
DBEDT Research Library	n/a	X	
Hawaiʻi State Library	n/a	X	
Kailua Public Library	n/a	X	

Organizations			
Enchanted Lake Residents Association		X	
Forest Solutions, Inc.	X	X	
Hawaiʻi Agricultural Research Center	X	X	
Hui Kū Maoli Ola	X	X	
Hui o Koʻolaupoko	X	X	
Kailua Bluffs Neighborhood Watch		X	
National Tropical Botanical Garden	X	X	
Oʻahu Invasive Species Council		X	
Oʻahu Resource Conservation and Development Council	X	X	
The Lani-Kailua Outdoor Circle		X	
University of Hawaiʻi College of Tropical Agriculture and Human Resources	X	X	

*Distribution of DEA to be via on-line link to *The Environmental Notice* of the Office of Environmental Quality Control and the project website.

Section 8.0

List of References

8.0 LIST OF REFERENCES

AECOS, Inc. 2014. Natural Resource Survey for 1711 Kanapuʻu Drive, Kailua, Oʻahu. Authors: Eric Guinther and Reginald David. January 17.

Baker, H.L. et al. L.S. Land Study Bureau, University of Hawaiʻi. 1965. Detailed Land Classification, Island of Oʻahu.

City and County of Honolulu, Department of Environmental Services (CCH). 2008. Storm Water Best Management Practices (BMP) Plan for Four Major Outlets at Kaelepulu Pond, Kailua, Hawaii. Prepared by Earth Tech AECOM and TEC, Inc. November.

City and County of Honolulu, Department of Planning and Permitting. 2016. *Koʻolau Poko Sustainable Communities Plan*. April.

City and County of Honolulu, The Bus. 2013. Accessed at: http://thebus.org/

City and County of Honolulu, Planning Department. 1992. General Plan for City and County of Honolulu.

Environmental Communications, Inc. May 2013. Final Environmental Assessment for the Kailua District Park Softball Field Lighting System Replacement. Prepared for the Department of Design and Construction. Accessed at: http://oeqc.doh.hawaii.gov/Shared%20Documents/EA_and_EIS_Online_Library/Oahu/2010s/2012-06-08-FEA-Kailua-District-Park-Softball-Field-Lighting-System-Replacement.pdf

Fujishima, Karen Y., and Pow-Foong Fan. 1977. Hydrothermal minerology of Keolu Hills, Oahu, Hawaii. American Mineralogist, Volume 62, pages 564 – 582.

Giambelluca, T.W., Q. Chen, A.G. Frazier, J.P. Price, Y.-L. Chen, P.-S. Chu, J.K. Eischeid, and D.M. Delparte, 2013: Online Rainfall Atlas of Hawaiʻi. Bull. Amer. Meteor. Soc. 94, 313-316, doi: 10.1175/BAMS-D-11-00228.1. Accessed at: http://rainfall.geography.hawaii.edu/interactivemap.html

State of Hawaiʻi, Department of Agriculture. 1977. Agricultural Lands of Importance to the State of Hawaiʻi.

State of Hawaiʻi. Hawaiʻi Revised Statutes, Chapter 226, Hawaiʻi State Planning Act. Accessed at: http://hawaii2050.org/images/uploads/HRS226_StatePlanningAct.pdf

State of Hawaiʻi, Department of Business, Economic Development, and Tourism, OSP, Coastal Zone Management Program. 1996. Hawaiʻi's Coastal Nonpoint Pollution Control Program Management Plan, Volume I.

State of Hawaiʻi, Department of Health. 2013. Annual Summary of the 2012 Hawaii Air Quality Data. Accessed at: http://health.hawaii.gov/cab/files/2013/05/aqbook_2012.pdf

State of Hawaiʻi, Department of Land and Natural Resources, Office of Conservation and Coastal Lands. February 2004. Conservation District Use Application Instructions.

State of Hawaiʻi Land Use Commission (LUC). 2013. State Land Use Districts. Accessed at: http://luc.hawaii.gov/about/state-land-use-districts/.

State of Hawaiʻi Land Use Commission (LUC). 1981. Docket No. A80-487 Decision and Order. Accessed at: http://luc.state.hi.us/canchonolulu/a80-487lonestar1st.pdf

State of Hawaiʻi Land Use Commission (LUC). 1987. Docket No. A80-487. Decision on Motion to Redistrict Second Increment. Accessed at: http://files.hawaii.gov/luc/canchonolulu/a80-487lonestar2nd.pdf

U.S Department of Agriculture, Natural Resource Conservation Service. 1972. Soil Conservation Service, in cooperation with the University of Hawaii Agricultural Experiment Station. Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.

Appendix A

Agency-Approved Plans

Forest Stewardship Management Plan
Conservation Plan for MDHE LLC

Forest Stewardship Management Plan

Forest Stewardship Management Plan

Keolu, Kailua Ahupuaʻa, Koʻolaupoko District

Forest Solutions Inc.

PO Box 250
Paʻauilo, HI 96776

Responsible Forester:

Willie Rice
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1. CLIENT AND PROPERTY INFORMATION

Client

Landowner Name:	MDHE LLC. / Dawn Horn, managing member
Address:	1711 Kanapuu Drive Kailua, HI 96734
Email:	kailuadawn@gmail.com
Phone | Fax:	+1 (808) 225-7873
TMK number:	(1) 4-2-004:001
State Zoning:	Urban 6.7 acres, Conservation (General subzone) 30.2 acres
County Zoning:	Restricted Preservation District (P-1) 30.2 acres, General Preservation District (P-2) 6.7 acres
Total property acreage:	36.9 acres
Proposed stewardship area:	6 acres
Elevational range:	80 ft – 390 ft
Slope:	5% - 70%
Perennial/Intermittent Streams:	None

Consultant

Company:	Forest Solutions, Inc.
Name:	Willie Rice
Title:	Senior Forester
Address:	42-378 Kalapahapu´u Road P.O. Box 250 Pa´auilo, HI 96776
Email:	willie_rice@forestsolutionsinc.com
Phone | Fax:	+1 (808) 776-9900 x238 | +1 (808) 776-9901
Plan Completion Date:	

2. FSP SIGNATURE PAGE

Professional Resource Consultant Certification:

I have prepared (or revised) this Forest Stewardship Plan. Resource professionals have been consulted and/or provided input as appropriate during the preparation of this plan.

Prepared by: Forest Solutions. Inc.

Professional Resource Consultant's Signature/Date: R. Willie Rice

Professional Resource Consultant's Name: Willie Rice

Applicant Certification:

I have reviewed this Forest Stewardship Plan and hereby certify that I concur with the recommendations contained within. I agree that resource management activities implemented on the lands described shall be done so in a manner consistent with the practices recommended herein.

Prepared for: MDHE LLC

Applicant Dawn Horn, Managing Member

Applicant's Signature/Date. 3/21/2017

Applicant's Name: Dawn Horn

State Forester's Approval:

This plan meets the criteria established for Forest Stewardship Plans by Hawaii's Forest Stewardship Advisory Committee. The practices recommended in the plan are eligible for funding according to state of Hawai'i Forest Stewardship Program guidelines and administrative rules.

Approved by: Division of Forestry and Wildlife Administrator

State Forester's Signature/ Date: 3/30/17

Date

State Forester's Name: David G. Smith

Approved by: Forest Stewardship Advisory Committee

Committee Signature/Date: January 20, 2017

3. Executive Summary

The goal for this Forest Stewardship Management Plan is to transform a low-benefit, non-native dominated landscape to a native and Hawaiian canoe plant lowland mesic forest and shrubland with improved habitat, increased biodiversity and a healthier functioning ecosystem on TMK (1)-4-2-004:001 in Kailua, Oʻahu. The property is 36.9 acres, of which only 6 acres is currently proposed for indigenous and endemic plant restoration. The scope of this Forest Stewardship Management Plan spans ten (10) years from date of initial implementation, and would strive to establish 0.6 acres of forest per year via undesirable plant removal and native and Hawaiian canoe plant replacement, using primarily manual methods. This management plan has the following management objectives:

i. Transform the non-native species dominated landscape and convert it to a native and Hawaiian canoe plant lowland mesic forest and shrubland.
ii. Improve the functioning of the watershed by increasing biodiversity, managing forest health, preventing fires, improving rainwater infiltration, and reducing soil erosion and sedimentation.
iii. Enhance native wildlife habitat by re-establishing more endemic and indigenous plant species in a diverse native plant and agroforestry community.

The current natural resource concerns on the property include invasion of noxious and invasive species, soil erosion and sedimentation, low biodiversity and a lack of native species.

In the long term the vision of the applicant is to restore and maintain a healthy forest habitat on their property. A thriving native plant community will provide a focal point on the landscape for native fauna and flora, and support a healthy lifestyle for all its inhabitants.

4. Introduction

4.1. Project background and objectives

The goal for this Forest Stewardship Management Plan is to transform a low-benefit, non-native dominated landscape into a native plant dominated lowland forest and shrub land with native, Hawaiian canoe, and agroforestry plants to improve habitat, increase biodiversity and a healthier ecosystem functioning. To achieve the objectives of removing non-native species dominated landscapes and convert to native species dominated forest, the targeted management practices will suppress non-native species in the main planting areas, restore native plant species, control the feral pig population, manage the community interface areas, and mitigate the wildfire threat. To achieve the objective of improving the functioning of the watershed, the management approaches will be to reduce erosion and sedimentation and improve storm water runoff quality for the benefit of the downslope wetland ecosystem. The vision for this property is for current and future generations to live a low impact, energy efficient, sustainable lifestyle and over time restore forest health, and expand native plant, pollinator and wildlife habitat throughout the entire property.

4.2. Site description

4.2.1.1. Parcel and location

The MDHE LLC property, TMK (1)-4-2-004:001, spans elevations between 80 and 390 feet above sea level, on the east side of the Koʻolau mountain range, Kailua ahupuaʻa, Koʻolaupoko district, Oʻahu (Figure 1). The western edge is bordered by 81 individual lot owners within the communities of Kailua Bluffs and Keolu Summit. The eastern border follows along a ridgeline between 280 and 360 feet, which is the boundary to Bellows Marine Corps Training Area and the dividing line between the ahupuaʻa of Kailua and Waimānalo.

The topographical relief is high on the property, with slopes from 5-70% and aspects in all cardinal directions.

Access to the property is via Kanapuʻu Drive in the Kailua Bluffs community. Kanapuʻu Drive can be accessed off either of the main thoroughfares of Kalanianaole Highway or Keolu Drive. There are a few unimproved and steeply sloped roads within the property which are accessible only to off-road vehicles. The best access is currently via foot along cleared pathways because only slow progress can be made through the dense brush.

The area proposed for restoration is approximately 6 acres and located near the property access point off Kanapuʻu Drive. The site encompasses a portion of a small valley on the property including the drainage path at the valley floor, which only experiences overland flows during heavy rainfall. The majority of the 6 acre site is on a hillside with an aspect of northwest and a slope of approximately 45%.

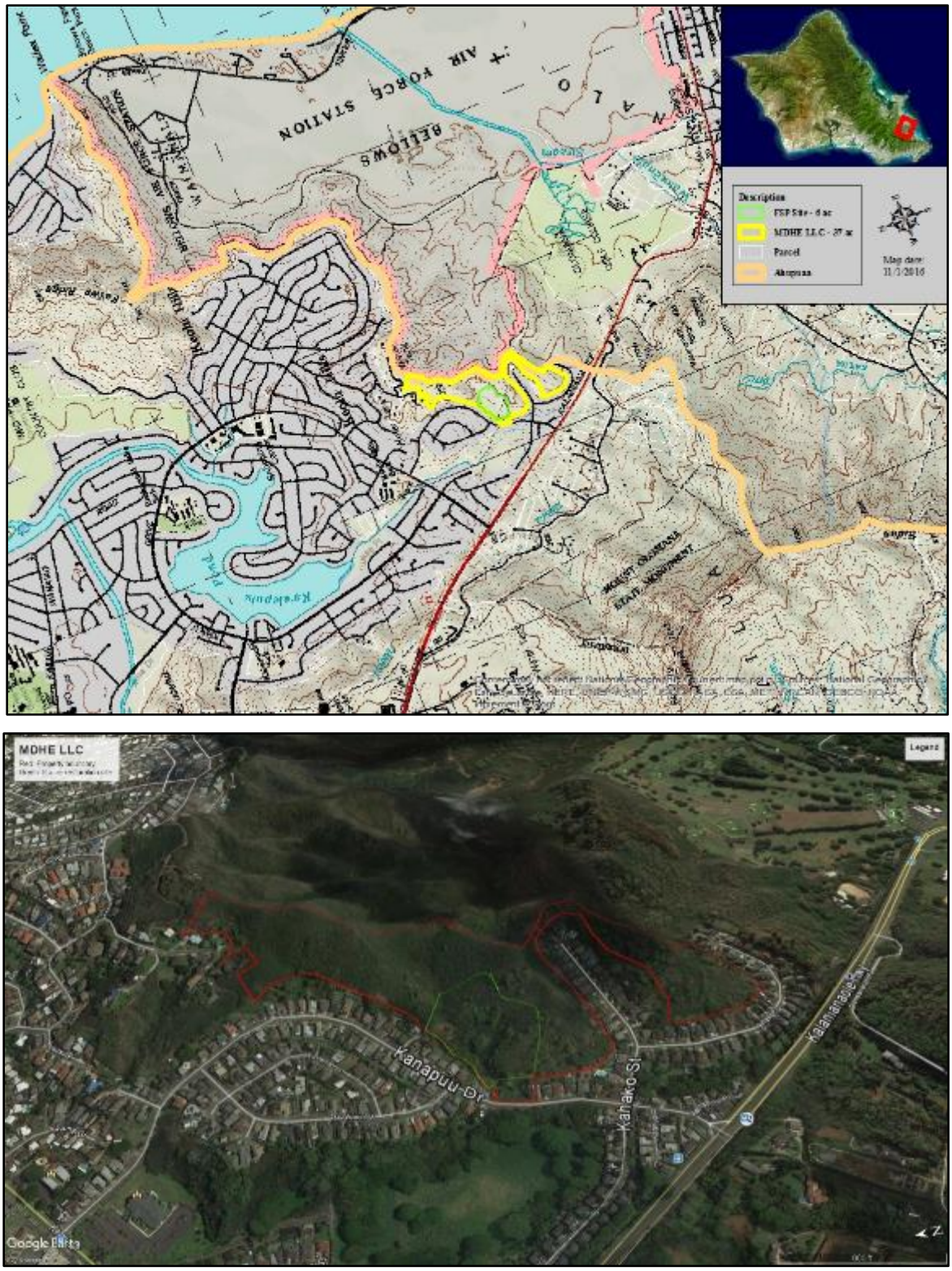


Figure 1. Topographical and perspective maps of the property and restoration site featured in the Forest Stewardship Management Plan. Access is via Kanapu'u drive and the red area indicates the property boundary and green is the project area (6 acres).

4.2.2. Site History

4.2.2.1. Land use history

This property has a long history of agricultural use despite being adjacent to a popular residential area. The parcel was a part of a ranch which used the land for grazing cattle. The use prior to this is unknown, but the land is within the Lowland Mesic Forest and Shrubland zone and therefore it is expected that a native forest was present prior to conversion to pasture for cattle.

There are two areas on the property which were zoned as Urban areas because they were part of the adjacent urban development known as Kailua Bluffs. This occurred between 1980 and 2003. However, the Urban zoned land was never subdivided from the larger parcel and thus always remained undeveloped and natural.

During a reconnaissance of the property we found remnant fencing providing proof the land was used for cattle. The severely degraded quality of the vegetation and dominating presence of invasive species is also typical of land once used for pasture.

No management activities of any kind have occurred on the property for decades, except for intermittent feral pig control.

4.2.2.2. Historical or cultural resources

As part of the Final Environmental Assessment (EA) completed by Group 70 International, Inc. in March, 2015 an archeological inventory survey was conducted by Scientific Consultant Services, Inc. which determined that "no cultural activities were identified to occur at the specific project site" and "no historic properties were identified during the archaeological survey of the site".

In the unlikely event that objects of historical, cultural, or archaeological importance are discovered during any forest management activities, work near the find will halt and these items will be reported to the State Historic Preservation Division of the Department of Land and Natural Resources (SHPD, dlnr@hawaii.gov, (808) 692-3015).

4.2.2.3. Aesthetic values and infrastructure

Exceptional views exist throughout the property (Figure 2) and because of its prominence the ridge itself adds aesthetic value to the landscape. Preserving and enhancing these aesthetic values will be achieved through best management practices for all proposed forestry activities. Restoring a native landscape will also enhance the aesthetic value, as well as improve healthy functioning of the forest ecosystem.

A home site is a part of the planned development on the property and will be adjacent to the forest restoration area (Figure 3). Other near term infrastructure improvements include a driveway for property access with the installation of culverts to maintain the natural drainage.

There are several instances of illegal encroachment where neighbors have altered the landscape and vegetation. As directed by the DLNR, OCCL encroaching neighbors were required to remove hard surface and structural encroachments such as hot tubs, golf tees, chicken coops, lanais, storage sheds, fences, and non-retaining walls. An encroaching CRM wall and concrete swale between the subject property and the Keolu Summit subdivision was resolved by issuance of an After-The-Fact Conservation District Use Permit (CDUP) No.

OA 3721 dated September 8, 2014. Landscaping and brush clearing encroachments were resolved by requiring the neighbors to cease activity and allow the affected areas to grow over naturally.

Figure 2 a & b. Aesthetic features on the property include exceptional views both mauka and makai. These features would be preserved within the context of the proposed management activities.

Figure 3. Map showing the layout of the property and proposed developments.

Figure 4. Photo showing current foot path for site access, future proposed driveway site, encroaching plantings, and lower edge of FSP restoration site.

4.3. Plant ecosystems and forest health

4.3.1.1. Current vegetation description

Across the property, the species composition is almost entirely non-native, invasive alien species. The Final EA of March, 2015 states, "the floristic composition was identified as that typical for lowland Oahu: native species accounted for only 3% of the plants encountered." This number is measured from species richness or the biodiversity of the ecosystem. "The parcel is dominated by introduced plant species, including naturalized species and various ornamentals planted by neighboring landowners (encroachment)" (Final EA, March 2015). Dominant plant species include Guinea grass, koa haole, and Formosa koa.

The 6-acre restoration site is similar to the rest of the property. However, it includes some of the best planting habitat within the property as evidenced by the current vegetation cover and well established encroachment plantings of ornamentals. The large Formosa koa found on this northerly aspect is between 2 and 12 inches in diameter and reaches a height of approximately 40-feet (Figure 5). The understory has a less dense Guinea grass cover and an increased non-native species richness of shrubs and herbaceous plants. In comparison, the majority of the property is a monotypic stand of haole koa and Guinea grass (Figure). It is apparent that the habitat and climate at this microsite is different from the rest of the property and will help future restoration work be more successful than planting at the top of the windy and sunny ridge.

Figure 5. Photo taken within the 6-acre restoration site showing the growth of existing vegetation.

Along boundaries with neighboring land owners, there are various plants such as fruit trees, ti and ornamentals that are encroaching on to the site and surviving as naturalized species. These plantings are only surviving because of supplementary watering, which is a technique that would also be a part of the restoration plan.

Table 1. Plant species present on the property, list adapted from the Final Environmental Assessment, 2015.

Species name	Species	Status	Abundance	HWRA‡	Encroaching
Trees					
papaya	*Carica papaya*	Naturalized	Rare	2	X
ironwood	*Casuarina equisetifolia*	Naturalized	Rare	21	
satinleaf	*Chrysophyllum oliviforme*	Naturalized	Occasional	7	
fiddlewood	*Citharexylum spinosum*	Naturalized	Rare	7	
autograph tree	*Clusia rosea*	Naturalized	Rare	9	
common fig	*Ficus carica*	Ornamental	Rare	#N/A	X
fern tree	*Filicium decipiens*	Naturalized	Rare	2	X
macadamia nut	*Macadamia integrifolia*	Ornamental	Rare	-1	X
horseradish tree	*Moringa oleifera*	Ornamental	Rare	1	X
opiuma	*Pithecellobium dulce*	Naturalized	Rare	14	
plumeria	*Plumeria rubra*	Ornamental	Rare	-5	X
monkeypod	*Samanea saman*	Naturalized	Rare	4	X
white sandalwood	*Santalum album*	Naturalized	Rare	-3	
bumelia	*Sideroxylon persimile*	Naturalized	Common	8	
African tulip tree	*Spathodea campanulata*	Naturalized	Rare	14	
Cuban mahogany	*Swietenia mahagoni*	Naturalized	Rare	2	
Java plum	*Syzygium cumini*	Naturalized	Occasional	9	
tropical almond	*Terminalia catappa*	Naturalized	Rare	4	X
Manila palm	*Veitchia merrillii*	Ornamental	Rare	-2	X
niu, coconut	*Cocos nucifera*	Introduced	Rare	---	
kou	*Cordia subcordata*	Introduced	Rare	---	X
maia, banana	*Musa* sp. Hybrid	Introduced	Rare, clumped	---	
Bushes/Shrubs					
Formosa koa	*Acacia confusa*	Naturalized	Common	10	
kiu	*Acacia farnesiana*	Naturalized	Uncommon	14	
Fukien tea	*Carmona retusa*	Naturalized	Abundant	4	
croton	*Codiaeum variegatum*	Ornamental	Rare	-4	X
lantana	*Lantana camara*	Naturalized	Occasional	32	
koa haole	*Leucaena leucocephala*	Naturalized	Very Abundant	15	
mock orange	*Murraya paniculata*	Naturalized	Occasional	6	
common guava	*Psidium guajava*	Naturalized	Uncommon	21	
coral berry	*Rivina humilis*	Naturalized	Common	11	
Christmas berry	*Schinus terebinthifolius*	Naturalized	Occasional	19	
kolomona haole	*Senna surattensis*	Naturalized	Uncommon	0	
a'ali'i	*Dodonea viscosa*	Indigenous	Rare		
ulei	*Osteomeles anthyllidifolia*	Indigenous	Uncommon		

‡ https://sites.google.com/site/weedriskassessment/

Table 2. Plant species list adapted from the Final Environmental Assessment, 2015, continued.

Species name	Species	Status	Abundance	HWRA‡	Encroaching
Grasses					
giant reed	*Arundo donax*	Naturalized	Rare	12	X
hedge bamboo	*Bambusa multiplex*	Ornamental	Rare	5	
California grass	*Brachiaria mutica*	Naturalized	Uncommon	12	
swollen fingergrass	*Chloris barbata*	Naturalized	Uncommon	20	X
sourgrass	*Digitaria insularis*	Naturalized	Common	20	
red sprangletop	*Leptochloa panicea*	Naturalized	Rare	12	X
barnyard grass, Japanese millet	*Echinochloa crus-galli*	Naturalized	Rare	8	X
mexican weeping bamboo	*Otatea acuminata*	Ornamental	Rare	4	X
Guinea grass	*Panicum maximum*	Naturalized	Very Abundant	17	
NO NATIVE GRASSES					
Ferns					
palm fern, hammock fern	*Blechnum appendiculatum*	Naturalized	Uncommon	17	
Japanese climbing fern	*Lygodium japonicum*	Naturalized	Rare	23	
NO NATIVE FERNS					
Herbaceous plants and Vines					
Chinese violet	*Asystasia gangetica*	Naturalized	Abundant	12	
hairy abutilon	*Abutilon grandifolium*	Naturalized	Uncommon	6	
sisal, malina	*Agave sisalana*	Naturalized	Rare	10	X
	Agave sp.	Ornamental	Rare	#N/A	X
aloe	*Aloe vera*	Naturalized	Rare	#N/A	X
asparagus "fern"	*Asparagus densiflorus*	Naturalized	Uncommon	15	
climbin asparagus "fern"	*Asparagus plumosus*	Naturalized	Uncommon	#N/A	
pink ruellia	*Barleria repens*	Ornamental	Uncommon	#N/A	
beggartick	*Bidens alba*	Naturalized	Rare	12	
	Bidens cyanapiifolia	Naturalized	Uncommon	#N/A	
maunaloa vine	*Canavalia cathartica*	Naturalized	Uncommon	#N/A	
	Cereus sp.	Ornamental	Rare	#N/A	X
partridge pea	*Chamaecrista nictitans*	Naturalized	Uncommon	0	
scarlet-fruited gourd	*Coccinia grandis*	Naturalized	Rare	21	
Spanish clover	*Desmodium incanum*	Naturalized	Uncommon	#N/A	
money tree cultivar	*Dracaena marginata*	Ornamental	Rare	-1	X
sanderiana	*Dracaena sanderiana*	Ornamental	Rare	#N/A	X
garden spurge	*Euphorbia hirta*	Naturalized	Uncommon	#N/A	X
milk-stripped euphorbia	*Euphorbia lactea*	Ornamental	Rare	8	X
comb hyptis	*Hyptis pectinata*	Naturalized	Occasional	#N/A	
Brazilian jasmine	*Jasminum fluminense*	Naturalized	Common	16	

‡ https://sites.google.com/site/weedriskassessment/

Table 3. Plant species list adapted from the Final Environmental Assessment, 2015, continued.

Species name	Species	Status	Abundance	HWRA‡	Encroaching
Herbaceous plants and Vines					
sensitive plant	*Mimosa pudica*	Naturalized	Rare	#N/A	
wild bitter melon	*Momordica charantia*	Naturalized	Rare	13	
glycine vine	*Neonotonia wightii*	Naturalized	Uncommon	7	
Mickey Mouse plant	*Ochna thomasiana*	Naturalized	Uncommon	8	
cochineal cactus	*Opuntia cochenillifera*	Naturalized	Rare	#N/A	X
panini	*Opuntia ficus-indica*	Naturalized	Rare	#N/A	
passion fruit vine	*Passiflora edulis*	Naturalized	Rare	6	
huehue haole	*Passiflora suberosa*	Naturalized	Occasional	12	
niuri	*Phyllanthus debilis*	Naturalized	Uncommon	#N/A	X
common plantain	*Plantago major*	Naturalized	Rare	#N/A	
pigweed	*Portulaca oleracea*	Naturalized	Rare	#N/A	
wedelia	*Sphagneticola trilobata*	Naturalized	Rare	13	
giant toad plant	*Stapelia gigantea*	Naturalized	Uncommon	3	
ti, ki	*Cordyline fruticosa*	Introduced	Rare	---	X
yellow wood sorrel, ihi ai	*Oxalis corniculata*	Introduced	Uncommon	---	
uhaloa	*Waltheria indica*	Indigenous	Occasional	---	

‡ https://sites.google.com/site/weedriskassessment/

Table 4. Avian species list adapted from Final EA March, 2015.

Species name	Species	Status
Avian Species		
Spotted Dove	*Streptopelia chinensis*	Alien
Zebra Dove	*Geopelia striata*	Alien
Red-vented Bulbul	*Pycnonotus cafer*	Alien
Japanese White-eye	*Zosterops japonicus*	Alien
Chinese Hwamei	*Garrulax canorus*	Alien
Red-billed Leiothrix	*Leiothrix lutea*	Alien
White-rumped Shama	*Copsychus malabaricus*	Alien
Common Myna	*Acridotheres tristis*	Alien
Saffron Finch	*Sicalis flaveola*	Alien
Northern Cardinal	*Cardinalis cardinalis*	Alien
House Finch	*Haemorhous mexicanus*	Alien
House Sparrow	*Passer domesticus*	Alien
Common Waxbill	*Estrilda astrild*	Alien
Java Sparrow	*Padda oryzivora*	Alien

4.3.2. Historic vegetation description (Lowland Mesic Forest and Shrubland)

The original defined, but now extinct forest type in this area is lowland mesic forest and shrubland. The existing vegetation is reminiscent of this forest structure with some low stature forested areas amongst shrub and grass lands. This native ecosystem would have been heavily disturbed by the Hawaiians as this was their living zone or wao kanaka. Within this area they would have collected many daily items from the forest. In more recent history these mesic areas have been dominated by Guinea grass and haole koa pasture, see Figure . The lands are well suited for this purpose, and it is not surprising the resultant dominance by pasture weeds currently.

Figure 6. Monotypic stand of haole koa and Guinea grass populates the majority of the property and provides very little good or diverse habitat.

A typical lowland mesic forest consists of a diverse, low in stature, tree canopy dominated by ʻōhiʻa, koaiʻa, lama, olopua or halapepe amongst many other characteristic species. The understory is variable and species tend to aggregate, depending upon the habitat, whether they be shrubs, ferns or herbaceous plants. ʻAʻaliʻi would be the most common shrub species, accompanied by ferns such as *Asplenium* spp., *Dicranopteris* spp. and *Pteris* spp[1].

Because of the use of this forest zone by the Hawaiians, many Polynesian introduced species would also have been present such as niu (coconut), hala, kou, kukui, milo and hau. Other species that would have been used for food and construction would also have been found here and cultivated to provide the essentials of everyday life.

[1]NatureServe. 2009. International Ecological Classification Standard: Terrestrial EcologicalClassifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of06 February 2009.

4.3.3. Pathogens, insects and invasive animals

During a brief site visit, no pervasive pathogens or insect problems were observed or discussed with the property owner. Given the location of the property we expect that typical pathogens and insects would be present that could affect plantings such as twig borers, thrips and gall wasps. Constant watchfulness for these threats should always be sustained as they can rapidly change.

The most problematic mammal known on the property is the feral pig (*Sus scrofa)*. Feral pigs have been managed to keep their population low through regular trapping and hunting, however because the property is not currently fenced they are transient. Other mammals that are most likely present, but not observed during the site visit include monogoose (*Herpestes javanicus*), cat (*Felis catus*), feral peacock (*Pavo cristatus*) and rodents.

During the March, 2015 Final EA avian and mammal survey, all species detected were alien to Hawaii. The findings of the survey are consistent with the location and with the highly-disturbed nature of habitat present on the property (Final EA, March 2015). The long-term objective is to enhance or re-introduce native wildlife to the area, such as native invertebrates and pollinators. In order to accomplish this objective first steps are to re-establishing native plant species in a diverse native plant community.

4.3.4. Wildfire

Wildfire is and will continue to be the highest threat on this property due to its location within a dry zone, among wildlands and homes, and with the existing vegetative cover. The wildfire mitigation component is an essential part of this plan to be maintained.

The Oahu fire department will handle all fire response as typical, there is no further fire response plans or actions proposed under this plan for the property.

4.3.5. Hydrology

4.3.5.1. Streams and wetlands

The property does not contain any streams or wetlands. It does however have several drainage areas which are unmarked, but within topographical gulches. There are two primary gulches that see overland flow following heavy rain events.

There are also several drainage ditches along the boundary of the property and project site which were constructed by the adjacent subdivision developer. These drainage ditches were designed to collect runoff and carry it to the runoff detention basin below, which was also constructed as part of the development.

4.3.5.2. Rainfall patterns

Mean annual rainfall in this location is 40 inches per year and ranges from 1.5 inches per month in the comparatively dry summer months to 6 inches per month (Figure) in the relatively wetter months of November through March[2].

[2] Giambelluca, T.W., Q. Chen, A.G. Frazier, J.P. Price, Y.-L. Chen, P.-S. Chu, J.K. Eischeid, and D.M. Delparte, 2013: Online Rainfall Atlas

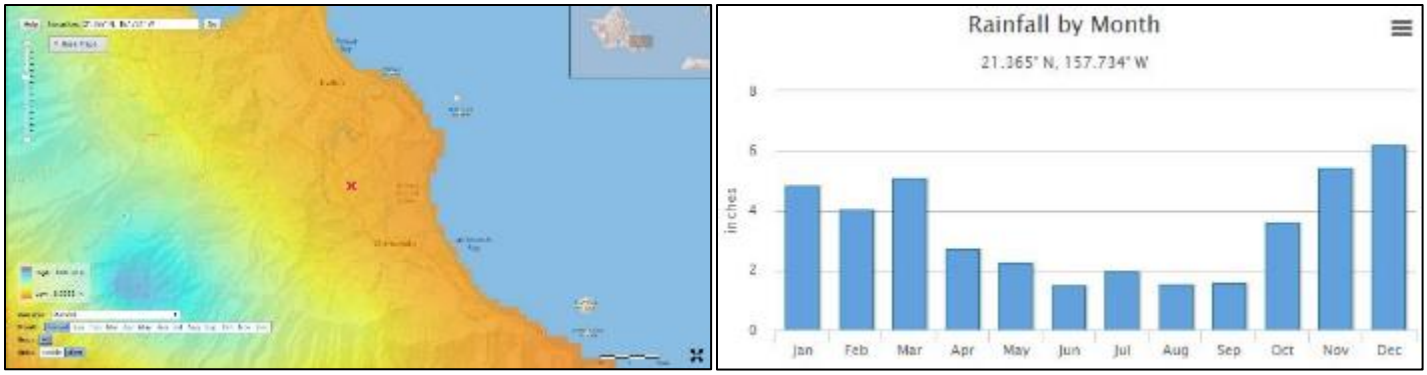


Figure 7. The property is located at the "X" and is within a mesic area.

4.3.6. Soils

4.3.6.1. Soil classification

The soil type across the site is Papa'a clay (map unit PYF) of basalt parent material. These are moderately deep soils, with depth to the first restrictive layer between 40 and 60 inches, well drained with high runoff[3]. There is also a small strip of Alaeloa silty clay on the northern edge of the restoration site adjacent to the lot owners. It is an older substrate soil.

4.3.7. Threatened and endangered species

Endangered species were not observed on the property during the site visit. An assessment for threatened and endangered species was completed as part of the March, 2015 Final EA natural resource survey and no flora or fauna was found on the entire property that was either threatened, endangered, candidate or rare. Other non-native birds observed on the property can be found in the Final EA[4].

4.4. Additional threat assessments

In addition to the threat of wildfire and the ongoing problem of invasive species dominance, there are several other threats to this property and the proposed restoration project including vandalism and sedimentation. Vandalism in particular is very real because of the property's long boundaries with both a heavily populated community and wildlands where people can trespass without knowledge. The existing encroachments of the current neighbors show that it is likely that illegal trespassing will continue to occur and that this may result in vandalism to the restoration project area.

Although sedimentation does occur on the property it is currently insignificant. However, if clearing were to increase, the exposed soil would be vulnerable to erosion. This can easily be mitigated through the use of best management practices.

[3]http:// http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx
[4] MDHE LLC. Final Environmental Assessment, 2015

Figure 8. FSP site map. Hatching shows a rough layout of the patchwork establishment protocol.

5. Management Prescriptions

A following set of forest management prescriptions for the 6-acre restoration site are recommended as implementing actions necessary to achieve the management objectives. These implementing actions include the removal of undesirable non-native brush, the re-establishment of conservation cover protected by maintained fuel breaks, and other forest stewardship management practices including:

1) Fencing
2) Tree/shrub site preparation
3) Irrigation
4) Tree/shrub establishment
5) Groundcover establishment
6) Mulching
7) Weed Control
8) Forest health and protection
9) Monitoring

The management prescriptions listed above are in sequential order of operation.

The project is planned to be implemented over 10 years with approximately 0.6 acres established every year, so that most management practices will occur in a cyclical manner annually.

5.1. Fencing (NRCS code 382)

Fencing is the first step toward re-establishing a native forest that is in an area threatened by pigs and trespassing. A 4-foot hogwire fence will be installed along the perimeter boundary of the 6-acre restoration area. Difficulties encountered will include topographic relief and brush. In order to make a strong fence that will endure, proper alignment, marking, and clearing will occur prior to installation. An approximate 8-foot path should be cut along the alignment where the fence is to be installed. All brush should be removed within this path so that the fence can be safely and properly unrolled.

The fence will follow the following recommendations:

1. 4-ft (47-inch) hogwire (woven wire), 12-14 gauge, galvanized steel, with smaller openings along the ground
    a. Strung approximately 2-inches above ground
2. 6-foot galvanized T-post
    a. Spaced between 12-15 ft and at all low and/or high points
3. Either 8-ft x 4-5-inch diameter pressure treated wood or 6-ft x 2-inch diameter galvanized steel pipe posts (with water tight end caps), braced in corners and at gates.
    a. Spacing approximately 200-ft
4. Single strand 12-gauge barbwire
    a. Strung between ground and hogwire
5. All galvanized clips, gates, and other hardware

6. An additional single or double strand of smooth 12-gauge wire can be strung at the top if the budget allows (barbed wire will not be used here).

It is important to get the fence line as straight as possible so that it can be pulled to an appropriate tension. This will prevent sagging and premature fence failure from falling trees and branches.

In order to deter illegal trespassing by vandals and neighbors encroaching on to the property for their own benefit "No Trespassing" signs will be put up along the perimeter fence.

5.2. Site preparation (NRCS code 315, 384, 490)

Planting areas will need to be prepared using a combination of invasive tree removal, herbaceous vegetation control, and digging. The first step of site preparation will include the removal of all undesired invasive and noxious plants. No herbicide will be used to control undesirable species because of the landowners' adverse reactions to herbicides and such; primarily mechanical methods will be used. The application of potassium nitrate will be evaluated as an alternative method of weed control. Motor-manual site preparation includes saws, weed whackers, brush cutters, loppers, weed wrench and hand pulling. Some larger Formosa koa will be left to provide protection for new plantings, however they will be removed as native vegetation becomes established. These trees will be carefully limbed and then felled to limit injury to recent plantings. Bagging seed heads of this species will also be evaluated and if deemed safe and practicable will be also be implemented. The second step in site preparation will involve digging individual holes for seedlings. A pick axe or gas auger can be used to dig holes approximately 1.5' deep and 1' in diameter. Holes should be dug immediately before planting, potentially on the same day, to minimize soil compaction or rain-induced runoff.

In order to effectively prepare the planting site prior to planting, timing is important. It is not feasible to clear the entire 6-acre area and plant it soon afterwards. Instead a patchwork management protocol will be used to establish small, non-adjacent areas (Figure 8). No new area will be prepared until the previous area has been planted and established. This patchwork protocol will help to prevent sedimentation and improve the aesthetics of the restoration project to neighboring land owners. The schedule of operations prescribes restoration of 0.3 acre semi-annually or once every 6 months, which is an area approximately 100' x 100'. This will allow for full restoration of the 6-acre site within 10 years.

5.3. Irrigation (NRCS code 441)

Micro-irrigation or drip irrigation is recommended to be used to help with seedling survival and establishment. An irrigation specialist should be consulted to determine the best system for the project's needs. A specialist will incorporate such things as water pressure, nozzle quantity, nozzle outputs and pipe size so that all plants receive consistent and ample volumes of water.

Due to the patchwork establishment protocol, all irrigation components should be reusable and moved as necessary from cell to cell. Plants will be irrigated via the landowners' county water connection and receive water until they become established. Once plants are established than irrigation lines will become available for a new establishment area.

5.4. Groundcover, shrub and tree establishment (NRCS code 612, 327)

Hand planting will be accomplished using a pick-axe, tree spade or dibble as appropriate for the nursery stock. The soil surface should be perforated to a depth slightly greater than the length of the seedling root stock, and the seedling should be placed into this hole. The root collar should be marginally lower than the level of the soil, between 1/8” and 1/4", with the root mass oriented vertically; the tip of the root mass should not bend outwards (so-called “J-rooting”). Soil is then covered around the root system and slightly compacted so that the possibility of air pockets is removed. Air pockets will prevent the roots from growing.

Spacing and distribution of tree species should conform to approximately 20’ x 20’ grid system. Plants growing in larger pots will be planted first, because of their soil and root resource of the pot they will become established more readily. This is approximately 109 trees per acre. At this density, canopy cover will be achieved in appropriate time frame. Canopy species, such as, ulu, kukui, kamani, and hala all have a large canopy to provide substantial amount of shade cover. The distribution of tree, shrub and groundcover species should be planted irregular to mimic a natural setting. An ideal distribution is 25% tree species, 35% shrub species and 40% groundcover species.

5.5. Nutrition (NRCS code 590)

A fertilizer treatment assists with early seedling growth and development, and is recommended to help establish native seedlings. At planting, a 4-oz. dose of fertilizer is distributed evenly within a 12” diameter area centered on the seedling stem. An organic low dose fertilizer can be used such as chicken manure (3-2-2 or similar).

Table 5. Species list and approximate density per acre[5,6]

Total trees per acre <40			
Genus	Species	Common	Recommended Density (/ac)
Acacia	*koaia*	koaia	<40
Aleurites	*moluccana*	kukui	<10
Alphitonia	*ponderosa*	kauila	<10
Artocarpus	*altilis*	ulu, breadfruit (v	<10
Calophyllum	*inophyllum*	kamani	<40
Cocos	*nucifera*	niu, coconut	<40
Cordia	*subcordata*	kou	<40
Diospyros	*sandwicensis*	lama	<40
Erythrina	*sandwicensis*	wili wili	<5
Meterosideros	*polymorpha*	ohia	<40
Musa	sp. Hybrid	maia, banana	<20 (clumped)
Nestegis	*sandwicensis*	olopua	<40
Pandanus	*tectorius*	hala	<10
Pleomele	spp.	halapepe	<20
Thespesia	*populnea*	milo	<40

Total shrubs per acre 100 - 200		
Genus	Species	Common
Broussonetia	*papyrifera*	wauke
Ceasalpinia	*pulcherrima*	ohai alii
Chenopodium	*oahuense*	aweoweo
Cordyline	*fruticosa*	ki, ti
Dodonaea	*viscosa*	aalii
Lageneria	spp.	ipu
Morinda	citrifolia	noni
Osteomeles	*anthyllidifolia*	ulei
Piper	*methysticum*	awa
Saccharum	*officinarum*	ko, sugar cane
Sida	*fallax*	ilima
Touchardia	*latifolia*	olona
Vitex	*rotundifolia*	pohinahina
Wikstroemia	spp.	akia

Total groundcovers per acre 200 - 300		
Genus	Species	Common
Asplenium	spp.	fern
Colocasia	*esculenta*	kalo
Curcuma	*domestica*	olena
Dioscorea	*alata*	uhi
Heteropogon	contortus	pili
Ipomoea	*batatas*	uala
Nephrolepis	*cordifolia*	kupukupu
Oxalis	corniculata	ihi ai
Pteris	spp.	fern
Tacca	*leontopetaloid*	pia
Waltheria	*indica*	uhaloa

[5] The ecological classification for Lowland Mesic Forest can be consulted for further species recommendations (NatureServe, 2009).
[6] http://pubs.usgs.gov/of/2012/1192/, this publication by USGS can be referenced for further recommendations by locale.

5.6. Mulching (NRCS code 484)

Mulching includes the use of various methods to suppress competition prior to and after plantings. Various methods are proposed for the site, dependent on the availability of materials and efficacy of results. They include:

- Black sheet mulching (reused as sites are established)
- Cardboard (as sheet mulch)
- Traditional clean mulch at an application of a minimum depth of 2-inches

5.7. Weed Control (NRCS code 314, 327)

Taking into consideration the landowners adverse reaction to herbicide, shade canopy will be the primary prescription to control understory invasive weed species. The weed control prescription is designed to release the restoration plantings by removing the shade and competition of the overstory of Formosa koa as the native plants grow. This operation will occur intermittently and as required based on the vegetative growth rates of the understory. In conjunction with the canopy cover, manual and mechanical control will be required to remove and/or control intermediate invasive weeds. Tools to accomplish this task may consist of but not limited to, brush cutters, chainsaws, pole saws, picks and loppers. Another prescription is mulching around the seedlings, using the methods proposed in **Section 5.6**, of which will be tested for cost effectiveness.

Ongoing weed control maintenance will be necessary for post-planting competition control until native vegetation canopy has closed. Three to four competition control entries are anticipated per year (0.6 acres), as the project progresses the maintenance areas will increase. A rigorous plan of maintenance should be followed during wet times of the year to keep weeds from out competing native plants. The overarching objective, however, is to maintain a clean growing site for early plant development.

5.8. Forest health and protection (NRCS code 666)

The primary concern to forest health now is the presence of pigs throughout the property. Although they have been managed in the past, they require ongoing trapping, removal and monitoring, especially given the upcoming restoration.

Traps will continue to be used and maintained by the Oahu Pig Hunters Association. In addition, the use of game cameras placed in strategic locations will provide important data on population trends. The data collected monthly from the game cameras will provide feedback to management to either increase, reduce or continue the same level of pig trapping/hunting pressure.

Wildfire mitigation will also be practiced to protect the restoration area. A fuelbreak will be maintained at the width of approximately twice the height of adjacent vegetation along the fenceline, which utilized the area cleared for installing the fence. Keeping this area clear will also help maintain the fence.

5.9. Ecological monitoring (NRCS code 595)

Some degree of ecological monitoring is an important component of forest management. For the scale of tree planting proposed in this Forest Stewardship Management Plan, the landowner can maintain an effective monitoring program by conducting a quantitative assessment one per year by simply counting seedlings which have survived and comparing this number to the seedlings planted within the 0.3-acre forest restoration cells. A progress statement of performance that includes overall percent survival of reforested cell and photos should be documented. This will provide feedback on the efficacy of prescriptions.

The perimeter fence around the restorations area will require ongoing monitoring and maintenance to ensure ungulates (principally feral pigs) are excluded from the project area.

Although zoological monitoring is beyond the scope of this management plan, the landowner may implement an ancillary or passive zoological monitoring program to track observations as vegetation composition changes.

6. Budget and Schedule

The preceding management prescriptions are planned around a specific budget and implementation schedule based around the patchwork protocol. Each prescription is assigned to a corresponding USDA NRCS code, and is given a per-unit cost. Costs for site preparation, establishment, pruning, protection and monitoring are calculated on a per-acre basis. Costs of seedlings are calculated per individual plant, and costs of fencing, irrigation and mulching are calculated on a unit cost per feet or square feet. An annual budget for each of ten (10) years is provided below in **Table 6**. A detailed budget is presented for the first year of the project with a monthly schedule of work and expenditures. **Budgets have been prepared such that operational costs are allocated by year. The total project budget is $110,652 (not including the management plan component) for ten years, or an average of $11,000 per year.**

Table 6. Annual budget expenditures to implement restoration in the context of this Forest Management Plan. Operational

costs in the first year of the project will be greater due to fence construction and irrigation.

Yearly Activities Schedule & Budget	Total Cost	Year									
		1	2	3	4	5	6	7	8	9	10
Fence construction	$15,200	$15,200	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tree/Shrub site prep.	$9,600	$ 960	$ 960	$ 960	$ 960	$ 960	$ 960	$ 960	$ 960	$ 960	$ 960
Irrigation	$15,600	$ 6,240	$ 1,040	$ 1,040	$ 1,040	$ 1,040	$ 1,040	$ 1,040	$ 1,040	$ 1,040	$ 1,040
Mulching	$17,550	$ 1,755	$ 1,755	$ 1,755	$ 1,755	$ 1,755	$ 1,755	$ 1,755	$ 1,755	$ 1,755	$ 1,755
Tree/Shrub estab.	$3,288	$ 1,884	$ 156	$ 156	$ 156	$ 156	$ 156	$ 156	$ 156	$ 156	$ 156
GC estab. seedlings	$6,760	$ 676	$ 676	$ 676	$ 676	$ 676	$ 676	$ 676	$ 676	$ 676	$ 676
Weed control	$39,600	$ 720	$ 1,440	$ 2,160	$ 2,880	$ 3,600	$ 4,320	$ 5,040	$ 5,760	$ 6,480	$ 7,200
Forest Health	$2,500	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250
Monitoring	$554	$ 90	$ 52	$ 52	$ 52	$ 52	$ 52	$ 52	$ 52	$ 52	$ 52
	Subtotal:	$27,775	$ 6,329	$ 7,049	$ 7,769	$ 8,489	$ 9,209	$ 9,929	$10,649	$11,369	$ 12,089
	Applicant share:	$13,888	$ 3,164	$ 3,524	$ 3,884	$ 4,244	$ 4,604	$ 4,964	$ 5,324	$ 5,684	$ 6,044
	FSP Share:	$13,888	$ 3,164	$ 3,524	$ 3,884	$ 4,244	$ 4,604	$ 4,964	$ 5,324	$ 5,684	$ 6,044
	Applicant running total:	**$13,888**	**$ 17,052**	**$20,576**	**$24,460**	**$28,705**	**$33,309**	**$38,273**	**$43,598**	**$49,282**	**$ 55,326**
	FSP running total:	**$13,888**	**$ 17,052**	**$20,576**	**$24,460**	**$28,705**	**$33,309**	**$38,273**	**$43,598**	**$49,282**	**$ 55,326**
	Running total:	**$27,775**	**$ 34,104**	**$41,152**	**$48,921**	**$57,409**	**$66,618**	**$76,547**	**$87,195**	**$98,564**	**$110,652**

Table 7. Monthly work schedule and expected budget expenditures. Beside fence construction this work schedule should be replicated each budget year in the same order, however actual budget figures may change according to required workload.

Monthly Activity Schedule & Budget	Cost unit^{-1}	# Unit	Unit	Month											
				1	2	3	4	5	6	7	8	9	10	11	12
Fence construction	$9.50	1,600	feet	$15,200	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tree/Shrub site prep.	$1,600	0.6	acres	$ -	$ 480	$ -	$ -	$ -	$ -	$ -	$ 480	$ -	$ -	$ -	$ -
Irrigation	$6.50	240	feet	$ -	$ -	$ 3,120	$ -	$ -	$ -	$ -	$ -	$ 3,120	$ -	$ -	$ -
Mulching	$0.75	2,340	sq.ft	$ -	$ -	$ 878	$ -	$ -	$ -	$ -	$ -	$ 878	$ -	$ -	$ -
Tree/Shrub estab.	$12.00	157	seedlings	$ -	$ -	$ -	$ 942	$ -	$ -	$ -	$ -	$ -	$ 942	$ -	$ -
GC estab. seedlings	$6.50	104	seedlings	$ -	$ -	$ -	$ 338	$ -	$ -	$ -	$ -	$ -	$ 338	$ -	$ -
Weed control	$1,200	0.6	acres	$ -	$ -	$ -	$ -	$ 720	$ -	$ -	$ -	$ -	$ -	$ 720	$ -
Forest Health	$417	0.6	acres	$ -	$ -	$ -	$ -	$ -	$ 125	$ -	$ -	$ -	$ -	$ -	$ 125
Monitoring	$150	0.6	acres	$ -	$ -	$ -	$ -	$ -	$ 45	$ -	$ -	$ -	$ -	$ -	$ 45
			Subtotal:	$15,200	$ 480	$ 3,998	$ 1,280	$ 720	$ 170	$ -	$ 480	$ 3,998	$ 1,280	$ 720	$ 170
			Applicant share:	$ 7,600	$ 240	$ 1,999	$ 640	$ 360	$ 85	$ -	$ 240	$ 1,999	$ 640	$ 360	$ 85
			FSP Share:	$ 7,600	$ 240	$ 1,999	$ 640	$ 360	$ 85	$ -	$ 240	$ 1,999	$ 640	$ 360	$ 85
			Monthly subtotal:	**$15,200**	**$ 480**	**$ 3,998**	**$ 1,280**	**$ 720**	**$ 170**	**$ -**	**$ 480**	**$ 3,998**	**$ 1,280**	**$ 720**	**$ 170**
			Running total:	**$15,200**	**$15,680**	**$19,678**	**$20,958**	**$21,678**	**$21,848**	**$21,848**	**$ 22,328**	**$26,325**	**$ 27,605**	**$28,325**	**$ 28,495**

7. References

Giambelluca, T.W., Q. Chen, A.G. Frazier, J.P. Price, Y.-L. Chen, P.-S. Chu, J.K. Eischeid, and D.M. Delparte, 2013: Online Rainfall Atlas of Hawaiʻi. *Bull. Amer. Meteor. Soc.* 94, 313-316, doi: 10.1175/BAMS-D-11-00228.1.

Group 70 International, Inc., MDHE Final Environmental Assessment, March, 2015.

Leary, J., Beachy, J., Hardman, A. 2012. Practitioner's guide for effective non-restricted herbicide techniques to control and suppress invasive woody species in Hawaiʻi. CTAHR.

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of 06 February 2009.

Price, J.P., Jacobi, J.D., Gon, S.M., III, Matsuwaki, D., Mehrhoff, L., Wagner, W., Lucas, M., and Rowe, B., 2012, Mapping plant species ranges in the Hawaiian Islands—Developing a methodology and associated GIS layers: U.S. Geological Survey Open-File Report 2012–1192, 34 p., 1 appendix (species table), 1,158 maps, available at http://pubs.usgs.gov/of/2012/1192/.

USDA NRCS Soil Data Viewer. http://soildatamart.nrcs.usda.gov/templates.aspx

Conservation Plan for MDHE LLC

Conservation Plan

for

MDHE LLC.

Prepared in cooperation with the

O'AHU RESOURCE CONSERVATION AND DEVELOPMENT COUNCIL

May 2016
Amended July 2016

Cooperator Information:

Property Name & Operator:	MDHE LLC. / Dawn Horn (Managing Member)
Mailing Address:	129 S Kalaheo Ave Kailua, HI 96813
Phone:	808-225-7873
Email:	kailuadawn@gmail.com

Site Description:

Property Address:	1711 Kanapuu Drive Kailua, HI 96734
Location of Site:	1711 Kanapuu Drive is adjacent to the Kailua Bluffs neighborhood in Kailua. The property consists of one TMK that has an approximate area of ~37 acres and consists of Conservation land (~30.5 acres) and Urban land (~6.5 acres). Property will be utilized for subsistence agriculture (~0.6 acres) with ~6 acres for re-introduction of native and "canoe" species.
Tax Map Key #(s):	4-2-004-001
Size of Property:	~37 acres
Type of Operation:	Subsistence agriculture (~0.6 acres) and native plant re-introduction.
Rainfall:	~45-55 inches annually.
Elevation:	70-375 ft.
Soils:	The property is dominated by Papa'a series 35-70 percent slopes (PYF). A small area of 'Alaeloa series 15-35 percent slopes occurs on one edge of the property near Kanapuu Drive.

Purpose:
The conservation plan is designed to document and address the resource concerns involving soil, water, plants, animals and air found on the property. The plan will aid the client in achieving sound use and management of the resources to prevent resource degradation and assure their sustained and productive use in the future.

Owner/Operator's Objectives:
With this plan, MDHE LLC. intends to minimize soil erosion, manage runoff, and reduce sedimentation.

Resource Concerns:
1. Soil erosion and condition
2. Plant condition
3. Water runoff

Conservation practices / activities that address resource concerns:

1. **Vegetative barrier.** Permanent strips of stiff, dense vegetation established along the general contour of slopes or across concentrated flow areas.
2. **Tree/shrub establishment.** Establishing woody plants by planting seedlings or cuttings, direct seeding, or natural regeneration.
3. **Brush management.** The management or removal of woody (nonherbaceous or succulent) plants including those that are invasive and noxious.
4. **Drip irrigation (microirrigation).** An irrigation system for frequent application of small quantities of water on or below the soil surface: as drops, tiny streams or miniature spray through emitters or applicators placed along a water delivery line.
5. **Conservation cover.** Establishing and maintaining permanent vegetative cover.
6. **Access road.** A travel-way for equipment and vehicles constructed as part of a conservation plan.
7. **Mulching.** Applying plant residues or other suitable materials produced off site, to the land surface.

Natural Resources Conservation Service guidelines for each conservation practice have been added and can be found in Appendix C.

Schedule of Conservation Practice Implementation

Operator: MDHE LLC. / Dawn Horn (Managing Member)
Tax Map Key #: 4-2-004-001

Schedule of Conservation Practice Implementation will follow a schedule of "Year 1", "Year 2", up through "Year 5". Some of the projects proposed for the property (home site, driveway, etc.) are dependent on seeking outside permits. "Year 1" suggests the first year after all permits needed for each project are granted.

Vegetative Barrier

Vegetative barriers will be installed in areas with concentrated flow. Barriers will require periodic maintenance in the form of either mowing, trimming, and/or reseeding. Vetiver along with native Hawaiian plant species will be used.

Practice Code	Description	Location	Quantity (~)	Planned Date	Installation Date
Vegetative Barrier (601)	Permanent strips of stiff, dense vegetation established along the general contour of slopes or across concentrated flow areas.	Surrounding existing culvert (Site A)	75 linear ft.	Year 1	
		Site A	625 linear ft.	Year 1	

Tree/Shrub Establishment

Native and "canoe" tree and shrub species will be installed on property with the aims of long-term erosion control, improving and restoring natural diversity on property and enhancing aesthetics. Approximately ~6 acres is slated for work with the Forest Stewardship Program (FSP) to restore native and "canoe" species in the project area.

Trees and shrubs established will be inspected periodically and protected from competing vegetation and/or wild pig damage. Replanting will be required when survival is inadequate.

Practice Code	Description	Location	Quantity (~)	Planned Date	Installation Date
Tree/Shrub Establishment (612)	Establishing woody plants by planting seedlings or cuttings, direct seeding, or natural regeneration.	Proposed FSP Site (Site A)	6 acres	Years 1-5	

Brush Management

Clearing and disposal methods shall be in accordance with federal, state, and local laws. Methods must address the impacts to erosion control, air and water quality, and the safety of the public and property. Brush management will be utilized in combatting invasive plant species in areas of conservation cover, vegetative barriers, and tree/shrub establishment on the property. Proposed species list for brush management can be viewed in Appendix A but it is not an exhaustive list.

For brush management along the southern property boundary, approximately 3-10 feet width from property boundary will be actively maintained for preventative drainage issues. See Appendix B for further information.

Practice Code	Description	Location	Quantity (~)	Planned Date	Installation Date
Brush Management (314)	The management or removal of woody (nonherbaceous or succulent) plants including those that are invasive and noxious.	Proposed FSP Site (Site A)	6 acres	Years 1-5	
		Southern boundary of property	4000 linear ft.	Ongoing	Ongoing

Irrigation System, Microirrigation (Drip Irrigation)

The irrigation system's installation shall be overseen by an irrigation specialist. The irrigation water supply shall be tested and assessed for physical, chemical and biological constituents to determine suitability and treatment requirements for use in a microirrigation system. Operator will operate and maintain the system to ensure that it functions properly, including periodic inspections and the prompt repair or replacement of damaged components.

Practice Code	Description	Location	Quantity (~)	Planned Date	Installation Date
Irrigation System, Mircoirrigation (441)	An irrigation system for frequent application of small quantities of water on or below the soil surface: as drops, tiny streams or miniature spray through emitters or applicators placed along a water delivery line.	Subsistence Agriculture Plot	0.6 acres	Year 1	

Conservation Cover

Maintenance measures must be adequate to control noxious weeds and other invasive species in areas of conservation cover. Native species will be planted whenever possible to fill in any gaps in cover.

Practice Code	Description	Location	Quantity (~)	Planned Date	Installation Date
Conservation Cover (327)	Establishing and maintaining permanent vegetative cover.	All land not engaged in other practices	29 acres	Existing	Existing

Access Road

Roads shall be located to serve the purpose intended, to facilitate the control and disposal of surface and subsurface water, to control or reduce erosion, and to make the best use of topographic features. Roads shall be located where they can be maintained and where water management problems are not created. To reduce potential pollution, roads shall be located away from water bodies and watercourses.

An operation and maintenance plan will be developed and carried out for the life of the practice. Periodic inspections of culverts after each major runoff event shall be conducted and restoration of flow capacity as needed.

The "Proposed Access Driveway" for property will seek outside permits prior to its construction.

Practice Code	Description	Location	Quantity (~)	Planned Date	Installation Date
Access Road (560)	A travel-way for equipment and vehicles constructed as part of a conservation plan.	East border of property (Site K)	925 ft.	Existing	Existing
		Site B	1650 ft.	Existing	Existing
		Access Driveway	1220 ft.	Year 1	

Mulching

Mulch will be used on areas to conserve soil moisture, reduce energy use associated with irrigation, provide erosion control and facilitate the establishment of vegetative cover. Mulched areas will be periodically inspected and mulch shall be reinstalled as needed to accomplish the intended purposes.

Practice Code	Description	Location	Quantity (~)	Planned Date	Installation Date
Mulching (484)	Applying plant residues or other suitable materials produced off site, to the land surface.	Subsistence Agriculture Plot	0.6 acres	Ongoing	Ongoing

Cultural Resources

An Archaeological Inventory Survey was performed for the project site in September 2013 and updated in March 2015 by Scientific Consultant Services, Inc. (SCS). A Cultural Impact Assessment (CIA) was completed by SCS in March 2014 and updated in March 2015. The State Department of Historic Preservation (SHPD) was consulted during the preparation and update of these studies.

"Adverse effects are not anticipated since no cultural activities were identified to occur at the specific project site."

Final Environmental Assessment, Prepared by Group 70 International, Inc., March 2015, Section 3.15.

"Most of the property will remain unaffected by the proposed action, with most existing areas remaining unaffected. While no historic properties were identified during the archaeological survey of the site, there is a remote possibility of discovering cultural deposits and/or human burials in either a primary or secondary context."

Final Environmental Assessment, Prepared by Group 70 International, Inc., March 2015, Section 3.14.

"In the event that historic or traditional cultural properties (i.e. cultural layers, etc.) are encountered during construction, work in the project area will cease until SHPD (State Historic Preservation Division) is notified and appropriate protocols are carried out."

Final Environmental Assessment, Prepared by Group 70 International, Inc., March 2015, Section 3.14.

Critical/Threatened Species and Critical Habitat

"No species proposed for listing or listed under the federal endangered species act of 1973, as amended or the State of Hawai'i's (H.R.S. 195D) were recorded during the course of the natural resources survey (AECOS 2014)."

"The current habitats on the property are neither unique nor important for any Federal or State listed avian or mammalian species currently known from the Island of O'ahu. Existing habitat areas will be enhanced in the central portion of the property through selective removal of nonnative species and planting of native species. Access for human trapping of feral pigs by the Pig Hunters Association of O'ahu will be allowed as needed to minimize feral pig damage to soils. The project will not result in modification of any federally designated Critical Habitat, as there is none present on the subject property."

Final Environmental Assessment, Prepared by Group 70 International, Inc., March 2015, Section 3.5.2.2.

Appendix A

Non-Native Plant Species Found at 1711 Kanapuu Drive
Final Environmental Assessment, Prepared by Group 70 International, Inc., March 2015
Section 3.5.1; pages 39-40.

Table 3-1: Non-native Plants		
Scientific Name	**Common Name**	**Status**
Abutilon grandifolium	hairy abutilon	Naturalized
Acacia confuse	Formosa koa	Naturalized
Acacia farnesiana	klu	Naturalized
Asparagus densiflorus	asparagus "fern"	Naturalized
Asparagus plumosus	climbing asparagus "fern"	Naturalized
Asystasia gangetica	Chinese violet	Naturalized
Bambusa multiplex	hedge bamboo	Ornamental
Barleria repens	pink ruellia	Ornamental
Bidens alba	beggartick	Naturalized
Bidens cyanapiifolia	---	Naturalized
Blechnum appendiculatum	---	Naturalized
Canavalia cathartica *	Maunaloa vine	Naturalized
Carmonaretusa	Fukien tea	Naturalized
Casuarina equisetifolia	ironwood	Naturalized
Chamaecrista nichitans	Partridge pea	Naturalized
Chrysophyllum oliviforme	satinleaf	Naturalized
Citharexylum caudatum	fiddlewood	Naturalized
Clusia rosea	autograph tree	Naturalized
Coccinia grandis	scarlet-fruited gourd	Naturalized
Desmodium incanum	Spanish clover	Naturalized
Digitaria insularis	sourgrass	Naturalized
Hyptis pectinata	comb hyptis	Naturalized
Jasminum fluminense	Brazilian jasmine	Naturalized
Lantana camara	*lākana*, lantana	Naturalized

Table 3-1: Non-native Plants		
Leucaena leucocephala	*koa haole*	Naturalized
Lygodium japonicum	Japanese climbing fern	Naturalized
Mimosa pudica	sensitive plant	Naturalized
Momordica charantia	wild bitter melon	Naturalized
Murraya paniculata	mock orange	Naturalized
Neonotonia wightii *	glycine vine	Naturalized
Ochna thomasiana	Mickey Mouse plant	Naturalized
Opuntia ficus-indica	*pānini*	Naturalized
Passiflora edulis	passion fruit vine	Naturalized
Passiflora suberosa	*huehue haole*	Naturalized
Pithecellobium dulce	'opiuma	Naturalized
Plantago major	common plantain	Naturalized
Portulaca oleracea	pigweed	Naturalized
Rivina humilis	coral berry	Naturalized
Santalum album *	white sandalwood	Naturalized
Schinus terebinthifolius	Christmas berry	Naturalized
Senna surattensis	scrambled egg plant, *kolomona*	Naturalized
Sideroxylon persimile *	bumelia	Naturalized
Solanum seaforthianum	—	Naturalized
Spathodea campanulata	African tulip tree	Naturalized
Stapelia gigantean	giant toad plant	Naturalized
Swietenia mahagoni	Cuban mahagony	Naturalized
Syzygium cuminii	Java plum	Naturalized
Urochloa maxima	Guinea grass	Naturalized
Urochloa mutica	California grass	Naturalized

Appendix B

Letter between MDHE LLC. (Managing Member, Dawn Horn) and Department of Land and Natural Resources, Office of Conservation and Coastal Lands (Administrator, Sam Lemmo)

COR: OA-14-120b March 13, 2015

DAVID Y. IGE
GOVERNOR OF HAWAII

CARTY S. CHANG
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DANIEL S. QUINN
INTERIM FIRST DEPUTY

W. ROY HARDY
ACTING DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF: OCCL: AJR

COR: OA-14-120b

MAR 13 2015

Dawn R. Horn
c/o MDHE LLC
129 South Kalaheo Drive
Kailua, HI 96734

SUBJECT: CONSERVATION DISTRICT APPROVAL FOR GRASS CUTTING
Kailua Bluffs, Ko'olaupoko District, Island of Oahu
TMK: (1) 4-2-004:001

Dear Ms. Horn,

Based on a recent site visit by staff from the Office of Conservation and Coastal Lands (OCCL) you are requesting approval to conduct grass cutting on the subject parcel which is located within the State Land Use (SLU) Conservation District General Subzone.

According to the information provided, and observations made in the field by OCCL staff, you are proposing to allow invasive guinea grass that has overgrown adjacent to an existing drainage swale to be cut for upkeep purposes. Based on covenants placed on adjacent landowners, the management and maintenance of the swale falls to them, not the landowner of the subject parcel. At this time the existing drainage swale has become filled with vegetative debris and could become clogged, severely impacting the capability of the drainage swale (**Exhibit 1**). You are currently requesting permission to allow the adjacent landowners to continue the upkeep of the existing swale by cutting the overgrown invasive grass upslope of the swale. The proposed area to be cut will be a swath, parallel to the swale, approximately 3-10 ft. wide along the length of the exposed swale. No grubbing or grading is proposed.

According to our rules, Hawaii Administrative Rules (HAR) §13-5-22, P-12 **LAND AND RESOURCE MANAGMENT** (A-1) *Basic land management, <u>including routine weed control, clearing of understory,</u> and tree pruning, utilizing chemical and mechanical control methods, which involves no grubbing or grading, in accordance with state and federal laws and regulations in an area less than one acre.*

The Office of Conservation and Coastal Lands therefore <u>has no objections to your request to conduct routine weed control</u> on the subject parcel. Pursuant to Hawaii Administrative Rules (HAR)

(HAR) §13-5, these actions are uses for which no permit is required. The OCCL requests that the correspondent adhere to the following general conditions:

1. That in issuing this letter, the Department and Board has relied on the information and data that the correspondent has provided in connection with the letter. If, subsequent to this letter, such information and data prove to be false, incomplete or inaccurate, this letter may be modified, suspended or revoked;

2. The correspondent shall implement typical Best Management Practices (BMP) while conducting any land use in the conservation district;

3. The proposed project is minor in scope and may be considered an exempt action pursuant to Hawaii Revised Statutes (HRS), §343, as amended, and Hawaii Administrative Rules (HAR), §11-200-5, Environmental Impact Statement Rules and §11-200-8, Exempt Classes of Action; and

4. If the scope of the project changes or the cumulative natural resource impacts is perceived to be moderate or major, the department may require additional authorizations or approvals for the proposed land use.

Should you have any questions concerning this correspondence, or require additional information on the Conservation District please contact Alex J. Roy, M.Sc. of our Office of Conservation and Coastal Lands staff at 808-587-0316 or via email at alex.j.roy@hawaii.gov

Sincerely,

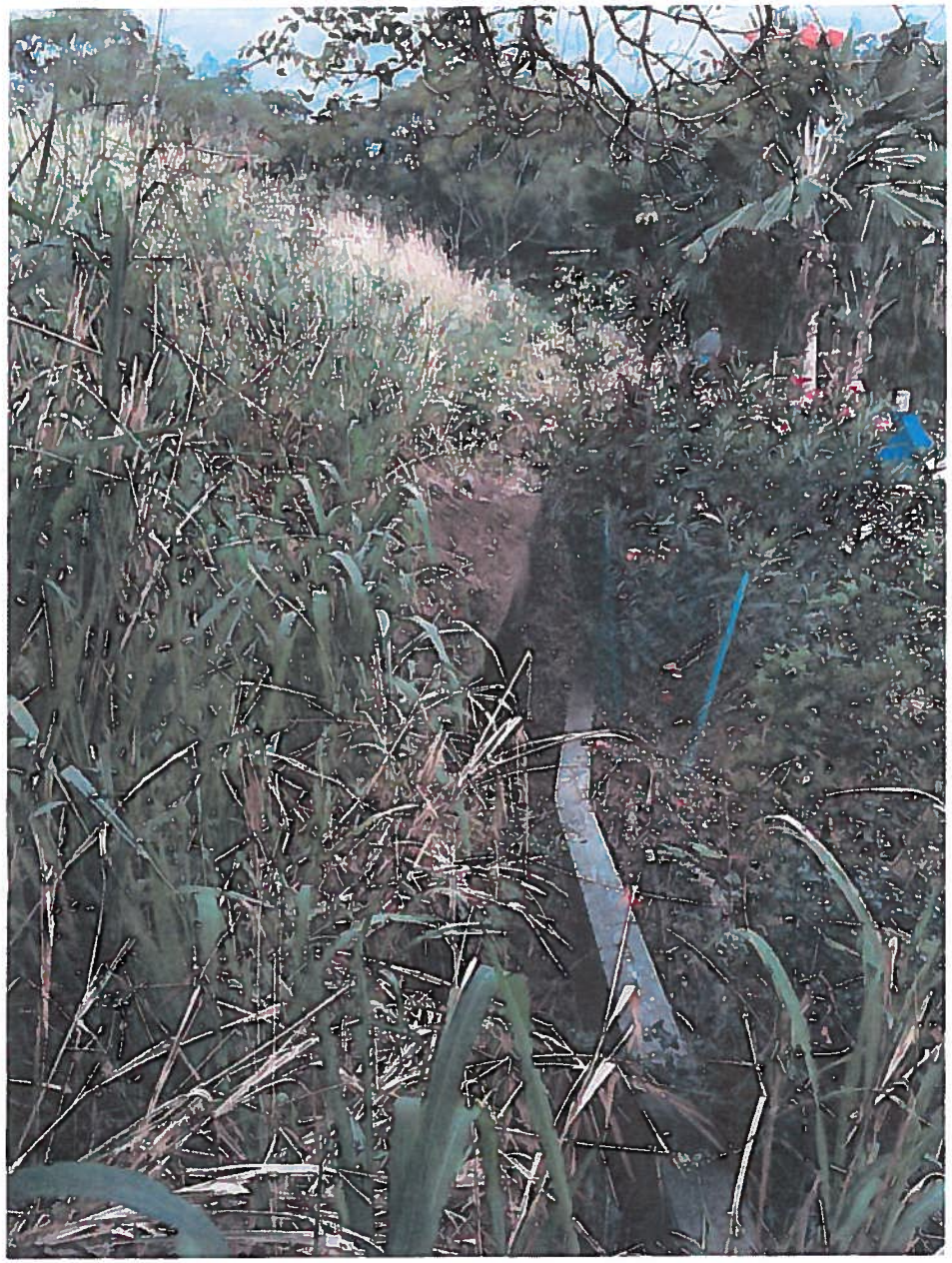
Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

CC: *Chairperson*
ODLO
CCH – DPP

Attachments: *Exhibit 1*

EXHIBIT 1

COR: OA-14-120B



Appendix C

Natural Resources Conservation Service (NRCS) Conservation Practices Guidelines

(See attached)

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

ACCESS ROAD

(Ft.)

CODE 560

DEFINITION

A travel-way for equipment and vehicles constructed as part of a conservation plan.

PURPOSE

To provide a fixed route for vehicular travel for resource activities involving the management of timber, livestock, agriculture, wildlife habitat, and other conservation enterprises while protecting the soil, water, air, fish, wildlife, and other adjacent natural resources.

CONDITIONS WHERE PRACTICE APPLIES

Where access is needed from a private or public road or highway to a land use enterprise or conservation measure, or where travel ways are needed in a planned land use area.

Access roads range from seasonal use roads, designed for low speed and rough driving conditions, to all-weather roads heavily used by the public and designed with safety as a high priority. Some roads are only constructed for a single purpose; i.e. control of forest fires, logging and forest management activities, access to remote recreation areas, or access for maintenance of facilities.

CRITERIA

Access roads shall be designed to serve the enterprise or planned use with the expected vehicular or equipment traffic. The type of vehicle or equipment, speed, loads, soil, climatic, and other conditions under which vehicles and equipment are expected to operate need to be considered.

Where general public use is anticipated, roads shall be designed to meet applicable federal, state and local criteria.

Location. Roads shall be located to serve the purpose intended, to facilitate the control and disposal of surface and subsurface water, to control or reduce erosion, to make the best use of topographic features, and to include scenic vistas where possible. The roads should generally follow natural contours and slopes to minimize disturbance of drainage patterns. Roads shall be located where they can be maintained and where water management problems are not created. To reduce potential pollution, roads shall be located away from water bodies and watercourses. Overland flow should not be impeded. Utilize buffers where possible to protect waterbodies.

Alignment. The gradient and horizontal alignment shall be adapted to the intensity of use, mode of travel, the type of equipment and load weights, and the level of development.

Grades normally should not exceed 10 percent except for short lengths. Maximum grades of 18 percent should only be exceeded if necessary for special uses such as logging roads, field access roads, fire protection roads or other roads not accessible for use by the general public.

For stream crossings, the road should be aligned so that it crosses perpendicular to the channel as much as possible.

Width. The minimum width of the roadbed is 14 ft for one-way traffic and 20 ft for two-way traffic. The roadbed width includes a tread-width of 10 feet for one-way traffic or 16 feet for two-way traffic. Each type of road also

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requires 2 feet of shoulder width on each side. Single-lane logging or special-purpose roads can have a minimum width of 10 feet, with greater widths at curves and turnouts. The two-way traffic width shall be increased approximately 4 feet for trailer traffic. The shoulder width may be either gravel or grass.

Turnouts shall be used on single lane roads where vehicles travel in both directions on a limited basis. Where turnouts are used, road width shall be increased to a minimum of 20 feet for a distance of at least 30 feet.

Side Slopes. All cuts and fills shall be designed to have stable slopes of a minimum of 2 horizontal to 1 vertical on heights of less than 4 feet. For short lengths, rock areas, or very steep hillsides, steeper slopes may be permitted, if soil conditions warrant and special stabilization measures are installed.

Areas with geological conditions and soils subject to slides shall be avoided or treated to prevent slides.

Drainage. The type of drainage structure used will depend on the intended use and runoff conditions. Culverts, bridges, fords, or grade dips for water management shall be provided at all natural drainage ways. The capacity and design shall be consistent with sound engineering principles and shall be adequate for the class of vehicle, type of road, development, or use. When a culvert or bridge is installed in a drainage way, its minimum capacity shall convey the design storm runoff without causing erosion or road overtopping. Table 1 lists minimum design storm frequencies for various road types.

Table 1

Road Type	Storm Frequency
Forest Access Roads, Farm Field Access Roads	2 year - 24 Hour
Farm Driveways, Recreation Facility Access Roads	10 year - 24 Hour
Public Access Roads, Camp grounds, etc.	25 year - 24 Hour

An erosion-resistant low point or overflow area may be constructed across the access road to supplement culvert capacity on non-public use roads. Culverts, bridges, fords and hardened overflow areas should be installed so the road crossing does not significantly impact fish migration.

Roadside ditches shall be adequate to provide surface drainage for the roadway and deep enough, as needed to serve as outlets for subsurface drainage. At a minimum, the roadside ditch shall be 1.0 foot below the top of road surface to provide internal drainage. Ditch channels shall be designed to be on stable grades or protected with structures or linings for stability.

Water-breaks, water-bars, diversions or broad based dips may be used to control surface runoff on low-intensity use forest, ranch or similar roads. On steep grades where runoff and erosion is anticipated down the road, water bars should be considered. Water bars must be constructed of materials that are compatible with the use and maintenance of the road surface. Water bar discharge areas must be well vegetated or have other erosion resistant materials. See Figure 1 Recommended Spacing of Relief Culverts and Water Bars Based on Soil Type.

Surface crowning can also help direct road runoff into the side drainage ditches. Unobstructed flow into the ditches must be maintained to prevent flows from causing roadside erosion. Provide a turnaround at the end of dead end roads. In some areas, turnarounds may also be desirable for stream, lake, recreation, or other access purposes.

Provide parking space as needed to keep vehicles off the road or from being parked in undesirable locations.

Surfacing. Access roads shall be given a wearing course or surface treatment if required by traffic needs, soil, climate, erosion control, or particulate matter emission control. The type of treatment, if needed, depends on local conditions, available materials, and the existing road base. If these factors or the volume of traffic is not a problem, no special treatment of the surface is required. On weak bearing capacity soils such as silts, organics, and

clays, the surface treatment should be underlain with a geotextile material specifically designed for road stabilization applications when the road is used on a regular basis.

Unsurfaced roads may require controlled access to prevent damage or hazardous conditions during adverse climatic conditions.

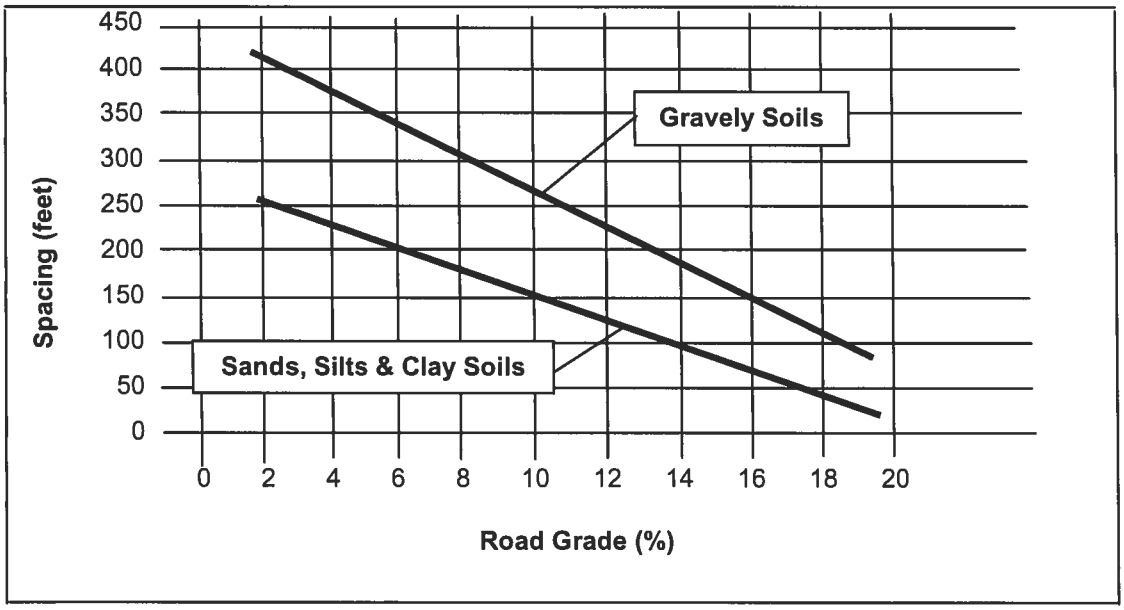
Toxic and acid-forming materials shall not be used on roads. This should not be construed to prohibit use of chemicals for dust control and snow and ice removal after considering potential impacts on stabilizing vegetation.

Utilize additional conservation practices to reduce the potential for generation and transport of particulate matter emissions.

Construction Operations. Construction operations should be carried out in such a manner that erosion and air and water pollution are minimized and held within legal limits. Construction shall include the following requirements as necessary for the job:

1. Trees, stumps, roots, brush, weeds, and other objectionable material shall be removed from the work area.
2. Unsuitable material shall be removed from the roadbed area.
3. Grading, sub-grade preparation, and compaction shall be done as needed.
4. Surfacing shall be done as needed.
5. Measures must be in place to limit the generation of particulate matter during construction.

Figure 1. Recommend Spacing of Relief Culverts and Water Bars Based on Soil Types



Traffic Safety. Passing lanes, turnouts, guardrails, signs, and other facilities as needed for safe traffic flow shall be provided. Traffic safety shall be a prime factor in selecting the angle and grade of the intersection with public highways. Preferably, the angles shall be not less than 85 degrees. The public highway shall be entered either at the top of a hill or far enough from the top or a curve to provide visibility and a safe sight distance. The clear sight distance to each side shall not be less than 300 feet or as required by local regulations.

Erosion Control. If soil and climatic conditions are favorable, roadbanks and

disturbed areas shall be vegetated as soon as possible and skid trails, landings, logging, and similar roads shall be vegetated after harvesting or seasonal use is completed (see Critical Area Planting-342). If the use of vegetation is precluded and protection against erosion is needed, protection shall be provided by non-vegetative materials, such as gravel or other organic or inorganic material (see Mulching 484), or in accordance with local regulations.

Roadside channels, cross drains, and drainage structure inlets and outlets shall be designed to be stable (see Structure for Water Control). If protection is needed, riprap or other similar materials shall be used.

Watercourses and water quality shall be protected during and after construction by erosion-control facilities and maintenance. Filter strips, water and sediment control basins, and other conservation practices shall be used and maintained as needed.

CONSIDERATIONS

Consider visual resources and environmental values during the planning and designing of the road system.

When available, consider using organic bio-degradable materials as a surface treatment.

Access roads should be located where minimal adverse impacts will affect wetlands, water bodies, watercourses, wildlife habitat, and air quality. Consideration should be given to the following:

- Effects on downstream flows or aquifers that would affect other water uses or users.
- Effects on the volume and timing of downstream flow to prohibit undesirable environmental, social, or economic effects.
- Short-term and construction-related effects of this practice on the quality of on-site downstream water courses.
- Overall effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that would be carried by runoff from construction activities.
- Effects on wetlands and water-related wildlife habitats that would be associated with the practice.
- Establishing vegetation on road shoulders wider than the 2-4 ft.
- Limiting the number of vehicles and vehicle speed will reduce the potential for generation of particulate matter and decrease safety and air quality concerns.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing access roads shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An operation and maintenance plan will be developed and carried out for the life of the practice:

1. Inspect culverts, roadside ditches, water bars and outlets after each major runoff event and restore flow capacity as needed.
2. Minimize the damage to vegetative buffers adjacent to the road when it is necessary to chemically treat the road surface to maintain erosion protection.
3. Maintain vegetated areas in adequate cover to meet the intended purpose(s).
4. Fill low areas in travel treads and re-grade, as needed, to maintain road cross section.
5. Inspect roads with water-bars periodically to insure proper cross section is available and outlets are stable.
6. Conservation practices that limit particulate matter emissions should be incorporated into long-term maintenance plans.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

BRUSH MANAGEMENT

(Ac.)

CODE 314

DEFINITION

The management or removal of woody (non-herbaceous or succulent) plants including those that are invasive and noxious.

Purpose

- Create the desired plant community consistent with the ecological site.
- Restore or release desired vegetative cover to protect soils, control erosion, reduce sediment, improve water quality or enhance stream flow.
- Maintain, modify, or enhance fish and wildlife habitat.
- Improve forage accessibility, quality and quantity for livestock and wildlife.
- Manage fuel loads to achieve desired conditions.

CONDITIONS WHERE PRACTICE APPLIES

On all lands except active cropland where the removal, reduction, or manipulation of woody (non-herbaceous or succulent) plants is desired.

This practice does not apply to removal of woody vegetation by prescribed fire (use Prescribed Burning (338)) or removal of woody vegetation to facilitate a land use change (use Land Clearing (460)).

CRITERIA

General Criteria Applicable to All Purposes

Brush management will be designed to achieve the desired plant community based on species composition, structure, density, and canopy (or foliar) cover or height.

Brush management will be applied in a manner to achieve the desired control of the target woody species and protection of desired species. This will be accomplished by mechanical, chemical, burning, or biological methods either alone or in combination. When prescribed burning is used as a method, the Prescribed Burning standard (338) will also be applied.

When the intent is to manage trees for silvicultural purposes, use Forest Stand Improvement (666).

NRCS will not develop biological or chemical treatment recommendations except for biological control utilizing grazing animals. In such cases, Prescribed Grazing (528) is used to ensure desired results are achieved and maintained. NRCS may provide clients with acceptable biological and/or chemical control references.

Follow-up treatments may be necessary to achieve objectives.

Additional Criteria for Creating the Desired Plant Community Consistent with the Ecological Site

Use applicable Ecological Site Description (ESD) State and Transition models, to develop specifications that are ecologically sound and defensible. Treatments must be congruent with dynamics of the ecological site(s) and keyed to state and plant community phases that have the potential and capability to support the desired plant community. If an ESD is not available, base specifications on the best approximation of the desired plant community composition, structure, and function.

Additional Criteria for Restoring or Releasing Desired Vegetative Cover to Protect Soils, Control Erosion, Reduce Sediment, Improve Water Quality or Enhance Stream Flow

Choose a method of control that results in the least amount of soil disturbance if soil erosion potential is high and revegetation is slow or uncertain leaving the site vulnerable to long-term exposure to soil loss.

In conjunction with other conservation practices, the number, sequence and timing of soil disturbing operations shall be managed to maintain soil loss within acceptable levels using approved erosion prediction technology.

Additional Criteria to Maintain, Modify or Enhance Fish and Wildlife Habitat

Brush management will be planned and applied in a manner to meet the habitat requirements for wildlife species of concern as determined by an approved habitat evaluation procedure.

Conduct treatments during periods of the year that accommodate reproduction and other life-cycle requirements of target wildlife and pollinator species and in accordance with specifications developed for Wetland Wildlife Habitat Management (644) and Upland Wildlife Habitat Management (645).

Additional Criteria to Improve Forage Accessibility, Quality and Quantity for Livestock and Wildlife

Timing and sequence of brush management shall be planned in coordination with specifications developed for Prescribed Grazing (528).

Additional Criteria to Manage Fuel Loads to Achieve Desired Conditions

Control undesirable woody plants in a manner that creates the desired plant community, including the desired fuel load, to reduce the risk of wildfire, facilitate the future application of prescribed fire.

CONSIDERATIONS

Consider using Integrated Pest Management (595) in support of brush management.

Consider the appropriate time period for treatment. Some brush management activities can be effective when applied within a single year; others may require multiple years of treatment(s) to achieve desired objectives.

Consider impacts and consequences to obligate species (species dependent on the target woody species) when significant changes are planned to existing and adjacent plant communities.

Consider impacts to wildlife food supplies, space, and cover availability when planning the method and amount of brush management.

State issued licenses may be required when using chemical pesticide treatments.

For air quality purposes, consider using chemical methods of brush management that minimize chemical drift and excessive chemical usage and consider mechanical methods of brush management that minimize the entrainment of particulate matter.

PLANS AND SPECIFICATIONS

Plans and specifications for the treatment option(s) selected by the decision maker will be recorded for each field or management unit where brush management will be applied.

Prepare brush management plans and specifications that conform to all applicable federal, state, and local laws. These documents will contain the following data as a minimum:

1. Goals and objectives clearly stated.
2. Pre-treatment cover or density of the target plant(s) and the planned post-treatment cover or density and desired efficacy.
3. Maps, drawings, and/or narratives detailing or identifying areas to be treated, pattern of treatment (if applicable), and areas that will not be disturbed.
4. A monitoring plan that identifies what should be measured (including timing and frequency) and that documents the changes in the plant community (compare with objectives) will be implemented.

For Mechanical Treatment Methods: Plans and specifications will include items 1 through 4, above, plus the following:

- Types of equipment and any modifications necessary to enable the equipment to adequately complete the job.

- Dates of treatment to best effect control
- Operating instructions (if applicable)
- Techniques or procedures to be followed

For Chemical Treatment Methods: Plans and specifications will include items 1 through 4, above, plus the following:

- Acceptable chemical treatment references for containment and management or control of target species
- Evaluation and interpretation of herbicide risks associated with the selected treatment(s)
- Acceptable dates or plant growth stage at application to best effect control and dampen reinvasion
- Any special mitigation, timing considerations or other factors (such as soil texture and organic matter content) that must be considered to ensure the safest, most effective application of the herbicide
- Reference to product label instructions

For Biological Treatment Methods: Plans and specifications will include items 1 through 4, above, plus the following:

- Acceptable biological treatment references for containment and management or control of target species
- Kind of grazing animal to be used, if applicable
- Timing, frequency, duration and intensity of grazing or browsing
- Desired degree of grazing or browsing use for effective control of target species
- Maximum allowable degree of use on desirable non-target species
- Special mitigation, precautions, or requirements associated with the selected treatment(s)

OPERATION AND MAINTENANCE

Operation: Brush management practices shall be applied using approved materials and procedures. Operations will comply with all local, state, and federal laws and ordinances.

Success of the practice shall be determined by evaluating post-treatment regrowth of target species after sufficient time has passed to monitor the situation and gather reliable data. Length of evaluation periods will depend on the woody species being monitored, proximity of propagules (seeds, branches, and roots) to the site, transport mode of seeds (wind or animals) and methods and materials used.

The operator will develop a safety plan for individuals exposed to chemicals, including telephone numbers and addresses of emergency treatment centers and the telephone number for the nearest poison control center. The National Pesticide Information Center (NPIC) telephone number in Corvallis, Oregon, may also be given for non-emergency information: **1-800-858-7384**

Monday to Friday

6:30 a.m. to 4:30 p.m. Pacific Time

The national Chemical Transportation Emergency Center (CHEMTRAC) telephone number is: 1-800-424-9300

- Follow label requirements for mixing/loading setbacks from wells, intermittent streams and rivers, natural or impounded ponds and lakes, and reservoirs.
- Post signs, according to label directions and/or federal, state, tribal, and local laws, around fields that have been treated. Follow restricted entry intervals.
- Dispose of herbicides and herbicide containers in accordance with label directions and adhere to federal, state, tribal, and local regulations.
- Read and follow label directions and maintain appropriate Material Safety Data Sheets (MSDS). MSDS and pesticide labels may be accessed on the Internet at: http://www.greenbook.net/
- Calibrate application equipment according to recommendations before each seasonal use and with each major chemical and site change.
- Replace worn nozzle tips, cracked hoses, and faulty gauges on spray equipment.
- Maintain records of Brush/shrub control for at least two years. Herbicide application

records shall be in accordance with USDA Agricultural Marketing Service's Pesticide Recordkeeping Program and state-specific requirements.

Maintenance: Following initial application, some regrowth, resprouting, or reoccurrence of brush may be expected. Spot treatment of individual plants or areas needing re-treatment should be completed as needed while woody vegetation is small and most vulnerable to desired treatment procedures.

Review and update the plan periodically in order to:

- incorporate new IPM technology;
- respond to grazing management and complex plant population changes; and
- avoid the development of plant resistance to herbicide chemicals.

REFERENCES

Branson, F. A, G. F. Gifford, K. G. Renard, R. F Hadley, and E. H. Reid, ed. 1981. Rangeland Hydrology, 2nd ed., Society for Range Management, CO.

Heady, H. F. and D. Child, 1994. Rangeland Ecology and Management, Westview Press, CO.

Holechek, J. L., R. D. Pieper and C. H. Herbel. 2000. Range management principles and practices, 5th edition. Prentice Hall, NJ.

Krausman, P. R., ed. 1996. Rangeland Wildlife. Society for Range Management, CO.

Monsen, S. B., R. Stevens, and N.L. Shaw, comps. 2004. Restoring Western Ranges and Wildlands, Volume 1. Gen. Tech. Rep. RMRS-GTR-136-1, USDA, Forest Service, Fort Collins, CO.

United States Department of Agriculture, Natural Resources Conservation Service. 2003. National Range and Pasture Handbook. Washington, DC.

United States Department of Agriculture, Natural Resources Conservation Service. 2008. General Manual: Title 190 – Ecological Sciences: Part 404 – Pest Management.. Washington, DC.

Valentine, J. R., 1989. Range Developments and Improvements, 3rd ed. Academic Press, MA.

Vavra, M., W. A. Laycock, R. D Pieper, eds. 1994. Ecological Implications of Livestock Herbivory in the West. Society for Range Management, CO.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

CONSERVATION COVER

(Ac.)

CODE 327

DEFINITION

Establishing and maintaining permanent vegetative cover

PURPOSE

This practice may be applied to accomplish one or more of the following:

- Reduce soil erosion and sedimentation.
- Improve water quality.
- Improve air quality
- Enhance wildlife habitat and pollinator habitat.
- Improve soil quality
- Manage plant pests

CONDITION WHERE PRACTICE APPLIES

This practice applies on all lands needing permanent vegetative cover. This practice does not apply to plantings for forage production or to critical area plantings.

CRITERA

General Criteria Applicable to All Purposes

Species shall be adapted to soil, ecological sites, and climatic conditions.

Species planted shall be suitable for the planned purpose and site conditions.

Seeding rates and methods shall be adequate to accomplish the planned purpose. Certified seed shall be used.

Planting dates, planting methods and care in handling and planting of the seed or planting stock shall ensure that planted materials have an acceptable rate of survival. Vegetative planting material (e.g. sprigs, rhizomes, bulbs) shall be from a reliable supplier.

Site preparation shall be sufficiently adequate to eliminate weeds for establishment and growth of selected species.

Timing and use of equipment shall be appropriate for the site and soil conditions.

All nutrients shall be applied following the nutrient management requirements in the Field Office Technical Guide (FOTG).

Additional Criteria to Reduce Soil Erosion and Sedimentation

The amount of plant biomass and cover needed to reduce wind and water erosion to the planned soil loss objective shall be determined using the current approved wind and/or water erosion prediction technology.

Additional Criteria for Improving Air Quality

In perennial crop systems such as orchards, vineyards, berries and nursery stock, vegetation established shall provide full ground coverage in the alleyway during mowing and harvest operations.

To sequester carbon, plant cover established will result in a positive CO_2 equivalent value when determined by the current approved carbon prediction technology.

Additional Criteria for Enhancing Wildlife Habitat and Pollinator Habitat

Grasses, forbs, shrubs and/or legumes shall be planted in a diverse mix to promote bio-diversity and meet the needs of the targeted species of wildlife.

Additional Criteria to Improve Soil Quality

Plants will be selected on the basis of producing high volumes of organic material to maintain or improve soil organic matter. The amount of biomass needed will be determined using the current soil condition index procedure.

Additional Criteria to Manage Plant Pests

In perennial crop systems such as orchards, vineyards, berries and nursery stock, permanent vegetative cover shall be established and managed according to Land Grant University Integrated Pest Management (IPM) recommendations for the target pest species.

CONSIDERATIONS

This practice may be used to promote the conservation of wildlife species in general, including threatened and endangered species.

Certified seed and planting stock that is adapted to the site should be used when it is available.

Inoculating legume seed with the proper Rhizobium bacteria should be considered on sites where the legumes to be planted have not been previously grown.

Mowing may be needed during the establishment period to reduce competition from broadleaf annual weeds.

On sites where annual grasses are an expected weed problem it may be necessary to postpone nitrogen fertilizer application until the planted species are well established.

Where applicable this practice may be used to conserve and stabilize archeological and historic sites.

Consider rotating management and maintenance activities (e.g. mow only one-fourth or one-third of the area each year) throughout the managed area to maximize spatial and temporal diversity.

Where wildlife management is an objective, the food and cover value of the planting can be enhanced by using a habitat evaluation procedure to aid in selecting plant species and providing or managing for other habitat requirements necessary to achieve the objective.

Where pollinator and wildlife habitat are primary purposes consider less dense seeding rates as long as soil loss is within tolerable soil loss limits.

Use native species that are appropriate for the identified resource concern and management objective. Consider trying to re-establish the native plant community for the site

If a native cover (other than what was planted) establishes, and this cover meets the intended purpose and the landowner's objectives, the cover should be considered adequate.

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. They shall include, but are not limited to:

- recommended species,
- seeding rates and dates,
- establishment procedures,.
- other management actions needed to insure and adequate stand

Specifications shall be recorded using approved specifications sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

Mowing and harvest operations in perennial crop systems such as orchards, vineyards, berries and nursery stock shall be done in a manner which minimizes the generation of particulate matter.

If wildlife habitat enhancement is a purpose, maintenance practices and activities shall not disturb cover during the reproductive period for the desired species. Exceptions should be considered for periodic burning or mowing when necessary to maintain the health of the plant community.

Maintenance measures must be adequate to control noxious weeds and other invasive species.

To benefit insect food sources for grassland nesting birds, spraying or other control of noxious weeds shall be done on a "spot" basis to protect forbs and legumes that benefit native pollinators and other wildlife.

REFERENCES

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool and D.C. Yoder. 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE), Agricultural Handbook Number 703.

Revised Universal Soil Loss Equation Version 2 (RUSLE2) website (checked September 2010): http://fargo.nserl.purdue.edu/rusle2_dataweb/

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION SYSTEM, MICROIRRIGATION

(Ac.)

CODE 441

DEFINITION

An irrigation system for frequent application of small quantities of water on or below the soil surface: as drops, tiny streams or miniature spray through emitters or applicators placed along a water delivery line.

PURPOSE

This practice may be applied as part of a conservation management system to achieve one or more of the following purposes:

- Efficiently and uniformly apply irrigation water and maintain soil moisture for plant growth.
- Prevent contamination of ground and surface water by efficiently and uniformly applying chemicals.
- Establish desired vegetation.
- Reduce energy use.

CONDITIONS WHERE PRACTICE APPLIES

On sites where soils and topography are suitable for irrigation of proposed crops and an adequate supply of suitable quality water is available for the intended purpose(s).

Microirrigation is suited to vineyards, orchards, field crops, windbreaks, gardens, greenhouse crops, and residential and commercial landscape systems. Microirrigation is also suited to steep slopes where other methods would cause excessive erosion, and areas where other application devices interfere with cultural operations.

Microirrigation is suited for use in providing irrigation water in limited amounts to establish desired vegetation such as windbreaks, living snow fences, riparian forest buffers, and wildlife plantings.

This practice standard applies to systems with design discharge less than 60 gal/hr at each individual lateral discharge point.

NRCS Conservation Practice Standard, Irrigation System, Sprinkler (442), applies to systems with design discharge of 60 gal/hr or greater at each individual lateral discharge point.

CRITERIA

General Criteria Applicable to All Purposes

The system shall be designed to uniformly apply water and/or chemicals while maintaining soil moisture within a range for good plant growth without excessive water loss, erosion, reduction in water quality, or salt accumulation.

Microirrigation systems consist of point-source emitter (drip, trickle, and bubbler), surface or subsurface line-source emitter, basin bubbler, and spray or mini sprinkler systems.

The system shall include all irrigation appurtenances necessary for proper operation. Appurtenances shall be sized and positioned in accordance with sound engineering principles and site-specific features.

Appurtenances include but are not limited to totalizing flow measurement devices, water filtration, air vent valves, vacuum relief valves, pressure relief valve(s), water control valve(s), pressure gauges, pressure regulators, and pressure reducers.

Water Quality. The irrigation water supply shall be tested and assessed for physical, chemical and biological constituents to determine suitability and treatment requirements for use in a microirrigation system.

Emitter discharge rate. The design discharge rate of applicators shall be determined based on manufacturer's data for expected operating conditions. The discharge

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

rate shall not create runoff within the immediate application area.

For bubbler irrigation, a basin beneath the plant canopy shall be required for water control, and applications shall be confined to the basin area.

Number and spacing of emitters. The number and spacing of emitters along a lateral line shall be adequate to provide water distribution to the plant root zone and percent plant wetted area (P_w). Procedures found in NRCS National Engineering Handbook (NEH), Part 623, Chapter 7, Trickle Irrigation, shall be used to calculate Pw.

Operating pressure. The design operating pressure shall be in accordance with published manufacturer recommendations. The system operating pressure must compensate for pressure losses through system components and field elevation effects.

Emitter manufacturing variability. The manufacturer's coefficient of variation (Cv) shall be obtained and used to assess the acceptability of a particular product for a given application.

The C_V shall be less than 0.07 for point source emitters and less than 0.20 for line source emitters.

Allowable pressure variations.

Manifold and lateral lines. Manifold and lateral lines, operating at the design pressure, shall be designed to provide discharge to any applicator in an irrigation subunit or zone operated simultaneously such that they will not exceed a total variation of 20 percent of the design discharge rate. Internal pressure shall not exceed manufacturer recommendations during any phase of operation.

Main and submain lines. Main and submain lines shall be designed to supply water to all manifold and lateral lines at a flow rate and pressure not less than the minimum design requirements of each subunit. Adequate pressure shall be provided to overcome all friction losses in the pipelines and appurtenances (valves, filters, etc.). Mains and submains shall maintain flow velocities less than 5 ft/sec during all phases of operation, unless special consideration is given to flow conditions and measures taken to adequately protect the pipe network against surge.

Main and submain lines shall be designed and installed to meet the applicable criteria in NRCS Conservation Practice Standard, Irrigation Pipeline (430).

Emission Uniformity. Pipe sizes for mains, submains, and laterals shall maintain subunit (zone) emission uniformity (EU) within recommended limits as determined by procedures contained in NEH, Part 623, Chapter 7, Trickle Irrigation.

Filters. A filtration system (filter element, screen, strainer, or filtration) shall be provided at the system inlet. Under clean conditions, filters shall be designed for maximum head loss of 5 psi. Maximum design head loss across a filter before cleaning shall be based on manufacturer recommendations. In the absence of manufacturer data the maximum permissible design head loss across a filter is 10 psi before filter cleaning is required.

The filter shall be sized to prevent the passage of solids in sizes or quantities that might obstruct the emitter openings. Filtration systems shall be designed to remove solids based on emitter manufacturer recommendations. In the absence of manufacturer data or recommendations, filtration systems shall be designed to remove solids equal to or larger than one-tenth the emitter opening diameter.

The filter system shall provide sufficient filtering capacity so that backwash time does not exceed 10% of the system operation time. Within this 10% time period, the pressure loss across the filter shall remain within the manufacturer's specification and not cause unacceptable EU.

Filter/strainer systems designed for continuous flushing shall not have backwash rates exceeding 1.0% of the system flow rate or exceeding the manufacturer's specified operational head loss across the filter.

Air/Vacuum relief valves. Vacuum relief shall be designed and installed to prevent ingestion of soil particles if there are summits in system laterals.

Air/vacuum relief valves shall be installed on both sides of all block or manifold water supply control valves.

Pressure regulators. Pressure regulators shall be used where topography and the type of applicator dictate their use. Pressure regulators shall not be planned to compensate for improperly designed pipelines.

System flushing. Appropriate fittings shall be installed above ground at the ends of all mains, submains, and laterals to facilitate flushing. The system shall be designed and installed to provide a minimum flow velocity of 1 ft/sec during flushing. During flushing submain and manifold (pipelines located downstream from a control valve) velocities shall not exceed 7 ft/sec velocity. Each flushing discharge outlet shall include a pressure gauge and/or Schrader valve tap.

Water Management Plan. An Irrigation Water Management Plan meeting the requirements of NRCS Conservation Practice Standard, Irrigation Water Management (449), shall be developed for use with this practice.

Additional Criteria Applicable to Efficiently and Uniformly Apply Irrigation Water

Depth of application. Net depth of application shall be sufficient to replace the water used by the plant during the plant peak use period or critical growth stage. Gross depth of application shall be determined by using field application efficiencies consistent with the type of microirrigation system planned. Applications shall include adequate water for leaching to maintain a steady state salt balance.

System capacity. The system shall have either (1) a design capacity adequate to meet peak water demands of all crops to be irrigated in the design area, or (2) enough capacity to meet water application requirements during critical crop growth periods when less than full irrigation is planned. The rationale for using a design capacity less than peak daily irrigation water requirement shall be fully explained and agreed upon by the end user. Design capacity shall include an allowance for reasonable water losses (evaporation, runoff, and deep percolation) during application periods.

The system shall have the capacity to apply a specified amount of water to the design area within the net operation period. Minimum system design capacity shall be sufficient to deliver the specified amount of water in 90% of the time available, but not to exceed 22 hours of operation per day.

Subsurface Drip Irrigation (SDI). Tubing depth and spacing are soil and crop dependent. Emitter line depth shall consider the auxiliary irrigation methods used for leaching, germination, and initial development. Maximum lateral line distance from the crop row shall be 24 inches for annual row crops and 48 inches for vineyard and orchard crops. EU shall be designed for a minimum of 85 percent.

Additional Criteria Applicable to Preventing Contamination of Ground and Surface Water

Chemigation and Chemical Water Treatment. System EU shall not be less than 85 percent where fertilizer or pesticides, or treatment chemicals are applied through the system.

Backflow prevention devices shall be provided on all microirrigation systems equipped for chemical injection.

Injectors (chemical, fertilizer or pesticides) and other automatic operating equipment shall be located and installed in accordance with manufacturer's recommendations and include integrated back flow prevention protection.

Chemigation shall be accomplished in the minimum length of time needed to deliver the chemicals and flush the pipelines. Application amounts shall be limited to minimum amount necessary, and rate shall not exceed maximum rate recommended by chemical label.

Proper maintenance and water treatment shall be followed to prevent clogging based upon dripper and water quality characteristics.

Irrigation water supply tests shall be used to plan for addressing or avoiding chemical reactions with injected chemicals to prevent precipitate or biological plugging.

Additional Criteria Applicable to Establishing Desired Vegetation

System capacity. The system shall have design capacity adequate to provide supplemental water at a rate that will insure survival and establishment of planned vegetation for a period of at least 3 years. The system shall have the capacity to apply the specified amount of water to the design area

within the net operation period.

Gross application volume per plant shall be determined using field application efficiency consistent with the type of microirrigation system planned. If a need is indicated by water test results, applications shall include adequate water for leaching to maintain a steady state salt balance.

Microirrigation systems installed solely to deliver supplemental water for establishment of windbreaks or riparian vegetation shall be designed to deliver a minimum of eight gallons per tree or shrub per week to assist in the establishment process. Design net application volumes per plant are dependent on the species of tree or shrub and the age (first, second, or third year).

Drip lateral lines installed on the ground surface shall be placed along the plant row(s) in a serpentine pattern to allow for expansion and contraction of the line while keeping the emitter close to the tree or shrub. Above ground drip line shall be pinned or anchored to prevent the line from being dislodged or moved away from the trees or shrubs.

Windbreaks shall be planned, designed, and installed according to the requirements of NRCS Conservation Practice Standard, Windbreak-Shelterbelt Establishment (380).

When lateral emitter spacing or capacities vary with each row, the laterals must be designed separately.

Operation and maintenance items specific to vegetation establishment are included in NEH, Part 652, National Irrigation Guide, Chapter 6.

Additional Criteria Applicable to Reduce Energy Use

Provide analysis to demonstrate reduction of energy use from practice implementation.

Reduction of energy use is calculated as average annual or seasonal energy reduction compared to previous operating conditions.

CONSIDERATIONS

In the absence of local experience field application efficiency (E) of 90% should used to estimate system capacity.

In arid climates with subsurface systems natural precipitation and/or stored soil water is sometimes inadequate to provide crop germination. Special provisions should be made for germination (i.e. portable sprinklers), or the microirrigation system should apply water at a rate sufficient to adequately wet the soil to germinate seeds or establish transplants. The depth of subsurface systems on annual crops should be limited by the ability of the system to germinate seeds, unless other provisions are made for this function.

Potential rodent damage should be considered when selecting materials and deciding on above or below ground system installation.

Chemigation may or may not be required at the same time the plant requires irrigation, which may affect the economics of chemigation. Weather conditions should be considered before applying chemicals. Pest or nutrient management planning should address the timing and rate of chemical applications.

Field shape and slope often dictate the most economical lateral direction. Laying laterals down slope can allow for longer lateral run lengths and/or lateral size reduction. Uneven topography may require use of pressure compensating emitters.

For terrain slopes steeper than 5%, lateral lines should be laid along the field contour and pressure-compensating emitters specified or pressure control devices used along downslope submains at lateral inlets.

Economic assessments of alternative designs should include equipment and installation as well as operating costs.

Longer, less frequent irrigations of windbreaks during establishment are recommended to encourage deeper root development that increases drought tolerance.

Media filters should be followed by secondary screen filters or a rinse cycle valve to prevent carryover of contaminants following the backwashing process.

Chemicals should not be applied if rainfall is imminent.

Installation and operation of microirrigation systems have the potential to save energy as a result of reduced seasonal irrigation application, and in some situations reduced operating pressures.

PLANS AND SPECIFICATIONS

Plans and specifications for the microirrigation system shall be in keeping with this standard and shall describe the requirements for properly installing the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

A site specific operation and maintenance (O&M) plan shall be developed and reviewed with the landowner/operator. The O&M plan shall provide specific instructions for operating and maintaining the system to ensure that it functions properly, including reference to periodic inspections and the prompt repair or replacement of damaged components. Operation and Maintenance Plan should include but is not limited to:

- Install flow meter and monitor water application.
- Clean or backflush filters when needed.
- Flush lateral lines at least annually.
- Check applicator discharge often; replace applicators as necessary.
- Check operating pressures often; a pressure drop (or rise) may indicate problems.
- Check pressure gauges to ensure proper operation; repair/replace damaged gauges.
- Inject chemicals as required to prevent precipitate buildup and algae growth.
- Check chemical injection equipment regularly to ensure it is operating properly.
- Check and assure proper operation of backflow protection devices.

REFERENCES

USDA-NRCS, National Engineering Handbook, Part 623, Chapter 7, Trickle Irrigation.

USDA-NRCS, National Engineering Handbook, Part 652, National Irrigation Guide.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

MULCHING

(Ac.)

CODE 484

DEFINITION

Applying plant residues or other suitable materials produced off site, to the land surface.

PURPOSE

This practice supports one or more of the following purposes:

- Conserve soil moisture – Resource concern (INSUFFICIENT WATER –Inefficient moisture management).
- Reduce energy use associated with irrigation – Resource concern (INEFFICIENT ENERGY USE – Farming/ranching practices and field operations and INSUFFICIENT WATER – Inefficient moisture management).
- Provide erosion control – Resource concern (SOIL EROSION– Excessive bank erosion from streams shorelines or water conveyance channels, and/or SOIL EROSION – Concentrated flow erosion, and/or SOIL EROSION - Sheet, rill, & wind erosion).
- Facilitate the establishment of vegetative cover – Resource concern (DEGRADED PLANT CONDITION – Undesirable plant productivity and health).
- Improve soil health – Resource concern (SOIL QUALITY DEGRADATION –Organic matter depletion).
- Reduce airborne particulates – Resource concern (AIR QUALITY IMPACTS - Emissions of Particulate Matter - PM - and PM Precursors).

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where mulches are needed. This practice may be used alone or in combination with other practices.

CRITERIA

General Criteria Applicable to All Purposes

The selection of mulching materials will depend primarily on the purpose(s) for the mulch application site conditions and the material's availability. Mulch materials shall consist of natural and/or artificial materials that are of sufficient dimension (depth or thickness) and durability to achieve the intended purpose for the required time period.

Prior to mulching, the soil surface shall be prepared in order to achieve the desired purpose.

The mulch material shall be evenly applied and, if necessary, anchored to the soil. Tackifiers, emulsions, pinning, netting, crimping or other acceptable methods of anchoring will be used if needed to hold the mulch in place for specified periods.

In cases where excessive furrow erosion may occur due to concentrated flows from plastic mulches, appropriate measures will be taken to protect the furrows.

As a minimum, manufactured mulches shall be applied according to the manufacturer's specifications.

Mulch material needs to be of a quality to meet the intended purpose.

Additional Criteria to Conserve Soil Moisture and/or Reduce Energy Use Associated with Irrigation

Mulch materials applied to the soil surface shall provide at least 60 percent surface cover to reduce potential evaporation.

Additional Criteria to Provide Erosion Control and to Reduce Airborne Particulates

When mulching with cereal grain straw or grass hay, apply at a rate to achieve a minimum 70 percent ground cover. Mulch rate shall be determined using current erosion prediction technology to reach the soil conservation objective.

When mulching with wood products such as wood chips, bark, or shavings or other wood materials, apply a minimum 2-inch thickness comprised of particles that remain in place during heavy rainfall and or strong wind events.

When mulching with gravel or other inorganic material apply a minimum 2 inch thickness and shall consist of pieces 0.75 to 2 inches in diameter.

Additional Criteria to Establish Vegetative Cover

Mulch shall be applied at a rate that achieves a minimum of 70 percent ground cover to provide protection from erosion and runoff and yet allow adequate light and air penetration to the seedbed to ensure proper germination and emergence.

Additional Criteria to Improve Soil Health

Use plant-based mulching materials of suitable quantity and quality to add organic matter, provide food and shelter for soil biota, and protect the soil surface from raindrop impact and crusting, while allowing for adequate soil aeration.

Apply mulch materials with a carbon to nitrogen ratio (C:N) less than 30 to 1 so that soil nitrogen is not immobilized by soil biota. Do not apply mulch with C:N less than 20:1 to an area of designed flow in watercourses.

An evaluation of the system using the current approved soil conditioning index (SCI) procedure results in zero or higher.

CONSIDERATIONS

Evaluate the effects of mulching on evaporation, infiltration, and runoff. Mulch material may affect microbial activity in the soil surface, increase infiltration, and decrease runoff, erosion, and evaporation. The temperature of the surface runoff may also be lowered.

Mulch material used to conserve soil moisture should be applied prior to moisture loss. Prior to mulching, ensure soil under shallow rooted crops is moist, as these crops require a constant supply of moisture.

Mulch materials with a high water holding capacity and/or high impermeability to water droplets may adversely affect the water needs of plants.

Fine textured mulches (e.g. rice hulls) which allow less oxygen penetration than coarser materials should be no thicker than 2 inches.

Avoid excessively thick or tightly packed mulches that can result in soggy, anaerobic conditions at the soil surface during wet weather; or prevent rainfall or overhead irrigation from reaching the soil during times of moisture deficit

Organic materials with C:N ratios of less than 20:1 will release nitrate-nitrogen which could cause water quality impairments.

Finely-divided plant residues (e.g., sawdust) and those rich in soluble carbohydrates (e.g., fresh green-chopped sorghum-sudangrass, corn, or other grasses) that have a C:N ratio greater than 30 can tie up soil N and necessitate supplemental N applications on crops. Coarser materials such as grain straw and chipped brush usually do not reduce crop-available soil N levels unless and until they are incorporated into the soil by tillage or cultivation.

Mulching may also provide habitat for beneficial insect and provide pest suppression.

Use mulch of sufficient ground cover, and suitable thickness and texture to provide habitat for ground beetles, spiders, and other predators of weed seeds and crop pests. Select crops to be mulched, mulching materials, and rates of application that do not contribute to pest problems. Avoid excessively thick or tightly-packed mulches, which can interfere with the movement of ground beetles and other

beneficial organisms, and may increase the incidence of crop pests and diseases.

During the period when weed seed predation is desired and predators are most active, avoid pesticide applications or pesticide exposures that could adversely affect weed seed consumers.

Low permeability mulches (e.g. Plastic) may increase concentrated flow and erosion on un-mulched areas.

Light-reflecting mulches such as white or aluminized plastic film or bright straw can repel some pests.

Select mulching materials and methods that are compatible with the crop and site. Consider potential beneficial or detrimental effects of mulching materials on the biotic community surrounding the crop, including beneficial soil micro- and macro-organisms, as well as plant pathogens and plant pests. These effects are specific to site, mulch, and crop, and may include enhanced soil microbial activity, increased or reduced levels of crop diseases, and toxic (allelopathic) activity against the crop, weeds, or other beneficial or pest organisms.

Keep mulch 3 to 6 inches away from plant stems and crowns to prevent disease and pest problems. Additional weed control may be needed around the plant base area.

Deep mulch provides nesting habitat for ground-burrowing rodents that can chew extensively on tree trunks and/or tree roots. Light mulch applied after the first cold weather may prevent rodents from nesting.

Some mulch material may adversely affect aquatic environments through changes in water chemistry or as waterborne debris. Consider placing mulch in locations that minimizes these risks.

Consider potential effects of soil physical and chemical properties. Refer to soil survey data as a preliminary planning tool for assessment of areas. Consult the Web Soil Survey at: http://websoilsurvey.nrcs.usda.gov/app/ to obtain Soil Properties and Qualities information.

For all organic or transitioning to organic operations, follow all National Organic Program (NOP) rules.

PLANS AND SPECIFICATIONS

Specifications shall be prepared for each site and purpose and recorded in the approved implementation requirements documentation.

Documentation shall include:

- Purpose of the Mulch
- Type of mulch material used
- The percent cover and/or thickness of mulch material
- Timing of application
- Site preparation
- Listing of netting, tackifiers, or method of anchoring, and
- Operation and maintenance.

OPERATION AND MAINTENANCE

Mulched areas will be periodically inspected, and mulch shall be reinstalled or repaired as needed to accomplish the intended purpose.

Evaluate the effectiveness of the mulch (application, amount of cover provided, durability, etc.) and adjust the management or type of mulch to better meet the intended purpose(s).

Removal or incorporation of mulch materials shall be consistent with the intended purpose and site conditions.

Operation of equipment near and on the site shall not compromise the intended purpose of the mulch.

Prevent or repair any fire damage to the mulch material.

Properly collect and dispose of artificial mulch material after intended use.

Monitor and control undesirable weeds in mulched areas.

REFERENCES

Agriculture and Agri-Food Canada. 2000. Plastic mulches for commercial vegetable production. Canada-Saskatchewan Irrigation Diversification Centre. Outlook, Saskatchewan.

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, Coordinators. 1997. Predicting soil erosion by water: A guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE). U.S.

Department of Agriculture, Agriculture Handbook No. 703.

Shaffer, M.J., and W.E. Larson (ed.). 1987. NTRM, a soil-crop simulation model for nitrogen, tillage and crop residue management. USDA Conserv. Res. Rep. 34-1. USDA-ARS.

Toy, T.J., and G.R. Foster. (Ed.) 1998. Guidelines for the use of the Revised Universal Soil Loss Equation (RUSLE) Version 1.06 on mined lands, construction sites, and reclaimed lands. USDI, OSMR.

USDA, NRCS. 2011. National Agronomy Manual. 190-V, 4th Ed. Washington, D.C.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

TREE/SHRUB ESTABLISHMENT

(Ac.)

CODE 612

DEFINITION

Establishing woody plants by planting seedlings or cuttings, direct seeding, or natural regeneration.

PURPOSE

Establish woody plants for:

- forest products such as timber, pulpwood, etc.
- wildlife habitat
- long-term erosion control and improvement of water quality
- treating waste
- storing carbon in biomass
- reduce energy use
- develop renewable energy systems
- improving or restoring natural diversity
- enhancing aesthetics.

CONDITIONS WHERE PRACTICE APPLIES

Tree/shrub establishment can be applied on any appropriately prepared site where woody plants can be grown.

Utilize other practice standards for specialized tree/shrub establishment situations, e.g., Riparian Forest Buffer (391), Alley Cropping (311), Windbreak/Shelterbelt Establishment, 380; Critical Area Planting (342), Hedgerow Planting (422).

CRITERIA

General Criteria Applicable to All Purposes

Composition of species will be adapted to site conditions and suitable for the planned purpose(s).

No plants on the Federal or state noxious weeds list shall be planted.

Planting or seeding rates will be adequate to accomplish the planned purpose for the site.

Planting dates, and care in handling and planting of the seed, cuttings or seedlings will ensure that planted materials have an acceptable rate of survival.

Only viable, high-quality and adapted planting stock or seed will be used.

A precondition for tree/shrub establishment is appropriately prepared sites. Refer to practice standard Tree/Shrub Site Preparation (490).

Adequate seed sources or advanced reproduction needs to be present or provided for when using natural regeneration to establish a stand.

Selection of planting technique and timing will be appropriate for the site and soil conditions.

The acceptability and timing of coppice regeneration shall be based on species, age and diameter.

The planting will be protected from plant and animal pests and fire. Refer to standard Integrated Pest Management (595) to assist with site-specific strategies for pest prevention, pest avoidance, pest monitoring, and pest suppression.

Each site will be evaluated to determine if mulching, supplemental water or other cultural treatments (e.g., tree protection devices, shade

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

cards, brush mats) will be needed to assure adequate survival and growth.

Additional Criteria for Treating Waste

Species used to treat waste shall have fast growth characteristics, extensive root systems, high nutrient uptake capacity and tolerance of the planned effluent.

Additional Criteria for Improving or Restoring Natural Diversity

Composition of species selected for planting or those favored for natural regeneration will be native to the site and create a successional stage or state that can progress to the potential natural plant community.

Additional Criteria for Storing Carbon in Biomass

The species and plant communities that attain biomass more quickly will sequester carbon faster. The rate of carbon sequestration is enhanced as trees and/or shrubs mature and soil organic matter increases. Select plants that have higher rates of growth and potential for carbon sequestration in biomass and are adapted to the site. Plant species at the appropriate stocking rate for the site.

Additional Criteria for Developing Renewable Energy Systems

Select plants that can provide adequate kinds and amounts of plant biomass to supply identified bioenergy needs.

Intensity and frequency of energy biomass removals will be managed to prevent long-term negative impacts on the system.

The harvesting of energy biomass shall be accomplished in a manner that will not compromise the other intended purpose(s) and functions.

Additional Criteria to Reduce Energy Use

Orient trees to shade a building to reduce summer energy usage. The first priority is placement on the building's west side where the greatest daily heat gain occurs. The second priority is the east side.

Select plants with a potential height growth that will be taller than the structure or facility being protected.

Use proper plant densities to optimize the shade produced and meet energy reduction needs.

Trees planted within 30 to 50 ft of the building generally provide effective shade to windows and walls depending on tree height potential.

Keep trees at least 10 ft or further from the structure depending on mature crown spread, to avoid damage to foundations or restrict maintenance access to windows and walls.

CONSIDERATIONS

Priority should be given to plant materials that have been selected and tested in tree/shrub improvement programs. All plant materials should comply with minimum standards such as those as established by the American Nursery and Landscape Association, Forest Service, or state-approved nursery.

Plans for landscape and beautification plantings should consider foliage color, season and color of flowering, and mature plant height.

Consider using diverse species combinations which best meet locally native wildlife and pollinator needs.

Consider the invasive potential when selecting plant species.

Tree/shrub arrangement and spacing should allow for and anticipate the need for future access lanes for purposes of stand management.

Residual chemical carryover should be evaluated prior to planting and alter species selection and/or timing of planting/seeding.

When underplanting, trees should be planted sufficiently in advance of overstory removal to ensure full establishment.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

Access by vehicles or equipment during or after tree/shrub establishment shall be controlled to protect new plants and minimize erosion, compaction and other site impacts. Refer to the standard Access Control (472).

The trees and shrubs will be inspected periodically and protected from adverse impacts including insects, diseases or competing vegetation, fire and damage from livestock or wildlife.

If needed, competing vegetation will be controlled until the woody plants are established. Noxious weeds will be controlled. Refer to standard Integrated Pest Management (595).

Replanting will be required when survival is inadequate.

Supplemental water will be provided as needed.

Periodic applications of nutrients may be needed to maintain plant vigor. If nutrients are applied, refer to Nutrient Management (590).

After trees and/or shrubs are established, refer to the standards Forest Stand Improvement (666) and Tree/Shrub Pruning (660) for subsequent management

REFERENCES

McPherson, E. Gregory; Simpson, James R.; Perper, Paula J.; Maco, Scott E.; Gardner, Shelley L.; Cozad, Shauna K.; Xiao, Qingfu 2006. Midwest community tree guide: benefits, costs, and strategic planting. USDA Forest Service General Technical Report PSW-GTR-199, p. 1-99.

Talbert, Cheryl. 2008. Achieving establishment success the first time. Tree Planters Notes, Vol. 52 No. 2 pages 31-37.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

VEGETATIVE BARRIER

(Ft.)

CODE 601

DEFINITION

Permanent strips of stiff, dense vegetation established along the general contour of slopes or across concentrated flow areas.

PURPOSE

- Reduce sheet and rill erosion.
- Reduce ephemeral gully erosion.
- Manage water flow.
- Stabilize steep slopes.
- Trap sediment.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where sheet and rill and/or concentrated flow erosion are resource concerns.

This practice is not well-suited to soils that are shallow to rock or other restrictive layers and where tillage is used on the cropped strips. The "benching" process that occurs on slopes where barriers are installed (tillage erosion moves soil from the upper part of the cropped strip, which then accumulates in the lower part of the cropped strip) can expose soil material unfavorable for crop growth.

CRITERIA

General Criteria Applicable to All Purposes

Physical Characteristics of Plants.

Stiffness Index. Vegetative barriers will be planted to vegetation having the minimum Vegetation Stiffness Index (VSI) designated in Table 1 measured at a point 6 inches above the ground.

Table 1. Stem Diameter and Minimum Stem Density Values for Vegetation Stiffness Index (VSI) Values of 0.05 and 0.10.

	Concentrated Flow Areas	Other Purposes
Stem Diameter (Inch)	Stem Density Per Square Foot @VSI=0.1	Stem Density Per Square Foot @VSI=0.05
0.10	1000	500
0.15	200	100
0.20	60	30
0.25	30	15
0.50	20	10
=/>1.00	1.0	1.0

Density. Gaps between plants will be no greater than 3 inches at the end of the first growing season.

Species Selection. Species must be adapted to local soil and climate conditions, be easily established, long-lived, and manageable.

Select species which exhibit characteristics that are required for adequate function such as: emergence though several inches of sediment or resuming growth from buried stem nodes; rhizomatous or stoloniferous growth habit; and stems that remain intact and erect year round.

Vegetation in the barrier will be tolerant to herbicides used in the cropped field.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

Do not establish any plant that is on the Federal or State noxious weed list.

Establishment. Barriers may be established vegetatively or from seed.

Seeding dates, depths and rates will be appropriate for the species selected and the conditions of the site. Seeds will be placed to insure good seed-to-soil contact.

Barriers established vegetatively will be planted at a density to insure a functional barrier as quickly as possible (usually two growing season). For most herbaceous species, this will require a spacing in the row of no more than 6 inches for bare-root seedlings, cuttings, sod chunks, plugs, rhizomes, or divisions consisting of no less than 5 viable stems. Suckering shrubs or herbaceous species established from 6-inch (gallon) potted material will be established at a spacing in the row of no more than 12 inches.

Site preparation must be sufficient to ensure seed germination or proper rooting conditions for vegetated material establishment. Plants will be placed to insure good root-to-soil contact and packed after planting.

Use appropriate site stabilization measures, such as erosion control blankets, silt barriers or mulches, during the barrier establishment period.

Barrier Width. Barrier widths will be the larger of 3 feet wide or 0.75 times the design vertical interval. Broadcast or drilled seed will be sown in a strip at least 3 feet wide. Seed sown with a row planter will be seeded in a minimum of 2 rows.

Additional Criteria for Reducing Sheet and Rill Erosion

Gradient. Gradients along the barrier will be no less than 0.2 percent and no greater than 1.0 percent except where the vegetative barrier crosses concentrated flow areas. Gradients entering a concentrated flow area may be up to 1.5 percent for 100 feet in order to get better row alignment.

All tillage and equipment operations in the interval between barriers will be parallel to the vegetative barrier.

A berm must exist at the upslope edge of the barrier and/or a channel must exist immediately upslope of the barrier to divert water along the vegetative barrier. Minimum berm height/channel depth will be 3 inches. Water flowing along a vegetative barrier berm/channel must be delivered to a stable outlet.

Spacing. Horizontal spacing between the vegetative barriers will be determined using the lesser of:

1. the horizontal distance between barriers when the vertical interval is 6 feet, or
2. the RUSLE2 "L" that achieves the allowable soil loss for the field, considering the planned practices in the conservation management system.

Crop strip width will be planned in multiples of widths of planting, tillage, spraying and harvest equipment. This spacing may be adjusted up to 10 percent between the barriers.

Vegetation. The vegetation will be of species to provide the designated minimum stem density with the designated stem diameter and have a minimum VSI of 0.05. See Table 1 for guidance.

Additional Criteria for Reducing Concentrated Flow Erosion

Alignment. Vegetative barriers may be installed across concentrated flow areas perpendicular to the direction of water flow.

Width and Length. Vegetative barriers for this purpose will consist of a minimum of 2 rows. Vegetative barrier length will vary depending on the topography. Each strip will be long enough to ensure that the ends of the strip are at least 1.5 feet higher than the center of the concentrated flow area (see Figure 1). When the concentrated flow area has a pre-existing headcut, place one row of a barrier at the bottom of the headcut and the other row at the top.

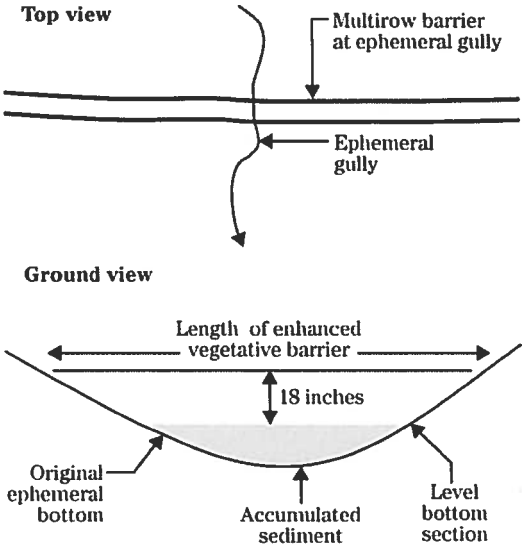


Figure 1. Barriers in concentrated flow areas must extend far enough up the hillslope to avoid bypass around the ends during peak flows.

Spacing. Spacing between the vegetative barriers will be based on the vertical interval of 1.5 feet for conditions where no tillage is performed between the barriers and 3 feet for all other conditions where sediment deposition and bench development is anticipated.

Crop strip width will be in multiples of widths of planting, tillage, spraying, and harvesting equipment. Adjustments of ±10 percent in the width of the crop strip are allowed to accommodate equipment operations.

Minimum Level Bottom Section Length. The minimum level bottom section length (in feet) shall be numerically equal to the peak discharge [in cubic feet per second (cfs)] for a 2-year 24-hour design storm from the total watershed upslope of the lowest barrier. This equates to a specific discharge of 1 cfs/ft of vegetative barrier. Level bottom section is defined as the bottom width of a trapezoidal waterway. This will be shaped during construction or formed by sediment deposition. (See Figure 1) Use methods in Chapter 2 of the Engineering Field Handbook to estimate peak discharge for local soil, climate and management conditions.

If the channel does not have a level bottom section, design the barriers so that the peak discharge through the barriers for a 2-year, 24-hour storm does not exceed allowable velocities for the soil, vegetation, and slope conditions as determined using Chapter 7 of the Engineering Field Handbook.

Vegetation. Establish species that will provide the designated minimum stem density with the designated stem diameter and have a VSI of 0.10. See Table 1 for guidance.

Additional Criteria for Managing Water Flow

Gradient. Barriers will have a minimum grade of 0.2 percent and a maximum grade of 1.0 percent, except where the vegetative barrier crosses a concentrated flow area. Gradients entering a concentrated flow area may be up to 1.5 percent for 100 feet in order to get better row alignment.

Minimum berm height/channel depth along the upper edge of the barrier will be 3 inches

Water flowing along the barrier must be delivered to a stable outlet.

Width and Length. Vegetative barriers may consist of 1 or 2 rows. Vegetative barriers may be wider to adjust for planter and/or sprayer width, or for improved contour alignment. Vegetative barrier length will vary depending on the topography. Each strip will be long enough to ensure that the ends of the strip are at least 1.5 feet higher than the center of the concentrated flow area (see Figure 1).

Spacing. Horizontal spacing between barriers shall be the lesser of:

- the horizontal distance between barriers with a vertical interval of four feet, or
- the RUSLE2 "L" that achieves the allowable soil loss for the field, considering the planned practices in the conservation management system.

For barriers intended to retard and spread run-off, the maximum vertical interval will be 1 foot.

Crop strip width will be planned in multiples of widths of planting, tillage, spraying and harvest equipment. This spacing may be adjusted up to 10 percent between the barriers.

Maximum Watershed. The total watershed in a vegetative barrier system will be the smaller of the size that will:

a) provide runoff to impound 1 foot of water upslope of the lowest barrier in the system, or

b) generate the maximum allowable velocity on bare soil for the soil texture in the concentrated flow area as determined in Chapter 7 in the Engineering Field Handbook.

Vegetation. Establish species that will provide the designated minimum stem density with the designated stem diameter and have a VSI of 0.05 for areas diverting runoff and VSI of 0.1 for areas retarding and ponding runoff. See Table 1 for guidance.

Additional Criteria for Stabilizing Steep Slopes

No concentrated flow channels may exist on slopes where vegetative barriers are used for this purpose. Any concentrated flows must be dispersed.

Barrier Row Grade. The maximum grade of barrier rows shall not exceed:

- one-half of the up-and-down hill slope percent used for conservation planning, or
- 2 percent,

whichever is less.

Spacing. The maximum vertical interval for this purpose is:

- 6 feet when barriers are designed so that runoff water flows along the barrier and not through it (i.e. functions as a terrace);
- 4 feet when overland flow occurs between barriers.

Vegetation. The vegetation will be deep-rooted species that establish easily and grow rapidly.

The vegetation stiffness shall provide the designated minimum stem density with the designated stem diameter and have a VSI of 0.05 based on Table 1.

Additional Criteria for Trapping Sediment at the Bottom of Fields and/or the Ends of Furrows

Alignment. Barriers will be aligned as close to perpendicular as possible to flow coming off of fields or out of the ends of furrows.

Width. Vegetative barriers for this purpose will be a minimum of 3 feet wide.

CONSIDERATIONS

General Considerations

Management practices such as Conservation Crop Rotation (code 328) and the residue and tillage management practices (codes 329, 345 and 346) must be considered in designing the conservation management system on cropland.

Practices such as water and sediment control basins, subsurface drainage, and underground outlets may be needed to adequately handle surface and subsurface water.

This practice may improve the efficiency of other practices such as stripcropping, filter strips, riparian forest buffers, grassed waterways, diversions and terraces.

On tilled fields, consider soil profiles that have sufficient depth to retain productivity where benches will develop as soil is moved down gradient by tillage. Soil upslope of barriers will gradually build up while soil will be removed down slope of the barrier. The effect of this movement should be considered with respect to soil depth, subsoil characteristics and response to amendments.

Established vegetative barriers systems can pond water above the barriers. Subsurface drains may need to be installed across the slope parallel to the barrier, or through the ponded areas above barriers that are installed across concentrated flow areas.

Increasing the minimum width of the barrier and choosing species with greater above- and below-ground biomass will increase the potential for carbon sequestration.

Considerations to Enhance the Functioning of Other Practices

Filter Strips. Vegetative barriers incorporated into the upslope portion of filter strips will increase filter strip longevity by promoting sediment deposition above the filter strip.

Field Borders. Vegetative barriers incorporated into the upslope portion of field borders at the bottom of slopes will increase

field border longevity by promoting sediment deposition above the field border.

Riparian Forest Buffers. Vegetative barriers can reduce sediment delivery to riparian buffers when located just upslope of the buffer. Shading effects on vegetative barrier growth should be considered in selecting species.

PLANS AND SPECIFICATIONS

Plans and specifications will include:

1. Field map with location of vegetative barriers.
2. Width of crop strip.
3. Vegetative barrier and crop strip orientation.
4. Width of barrier.
5. Vegetative species and cultivar.
6. Establishment date, establishment method, seeding rate (when seeded) or spacing of vegetative planting stock
7. Site stabilization, if needed to ensure establishment.

OPERATION AND MAINTENANCE

The following actions will be carried out to insure that this practice functions as intended. These actions include normal activities in the application and use of the practice and repair and maintenance of the practice.

1. Establishment failures will be replanted or reseeded immediately; short gaps in seeded barriers may be reestablished more effectively and immediately with transplanted plant material.
2. Mowing of herbaceous barriers may be used as a management practice to encourage the development of a dense stand and prevent shading of crops in adjacent fields. Mow at a 15-inch stem height, or the recommended height for the species, whichever is taller.
3. Mow barriers in concentrated flow areas during their dormant period to avoid reducing the average stem diameter and thus lowering the VSI.
4. Barriers may be burned, if the species used will tolerate fire. Carry out burns just prior to the spring regrowth period, while the vegetation is dormant.

   All burns will be conducted in accordance with a smoke management plan.
5. Control any plant on the Federal or State noxious weed list. Control other weeds as necessary to ensure a dense stand within the barrier.
6. Crop tillage and planting operations will be parallel with the vegetative barrier.
7. Pest control in adjacent fields will be performed with techniques and pesticides that will not damage the vegetative barrier.
8. Washouts or rills that develop will be filled and replanted immediately. Short gaps in established barriers will be reestablished with transplanted plant material.
9. Vegetative barriers will not be used as a field road or turn row. Vegetative barriers in concentrated flow areas will not be crossed with machinery.
10. Vegetative barriers will not be crossed with water furrow plows or similar implements to cut drainage ditches to allow the passage of surface and subsurface water. If necessary, water will be drained with underground outlets installed up gradient of the barrier

REFERENCES

Dabney, S.M., Z. Liu, M. Lane, J. Douglas, J. Zhu and D. C. Flanagan. 1999. Landscape benching from tillage erosion between grass hedges. Soil Tillage Res. 51:219-231.

Dewald, C., J. Henry, S. Bruckerhoff, J. Ritchie, D. Shepard, J. Douglas, and D. Wolfe. 1996. Guidelines for the establishment of warm season grass hedge for erosion control. J. Soil Water Conserv. 51(1):16-20.

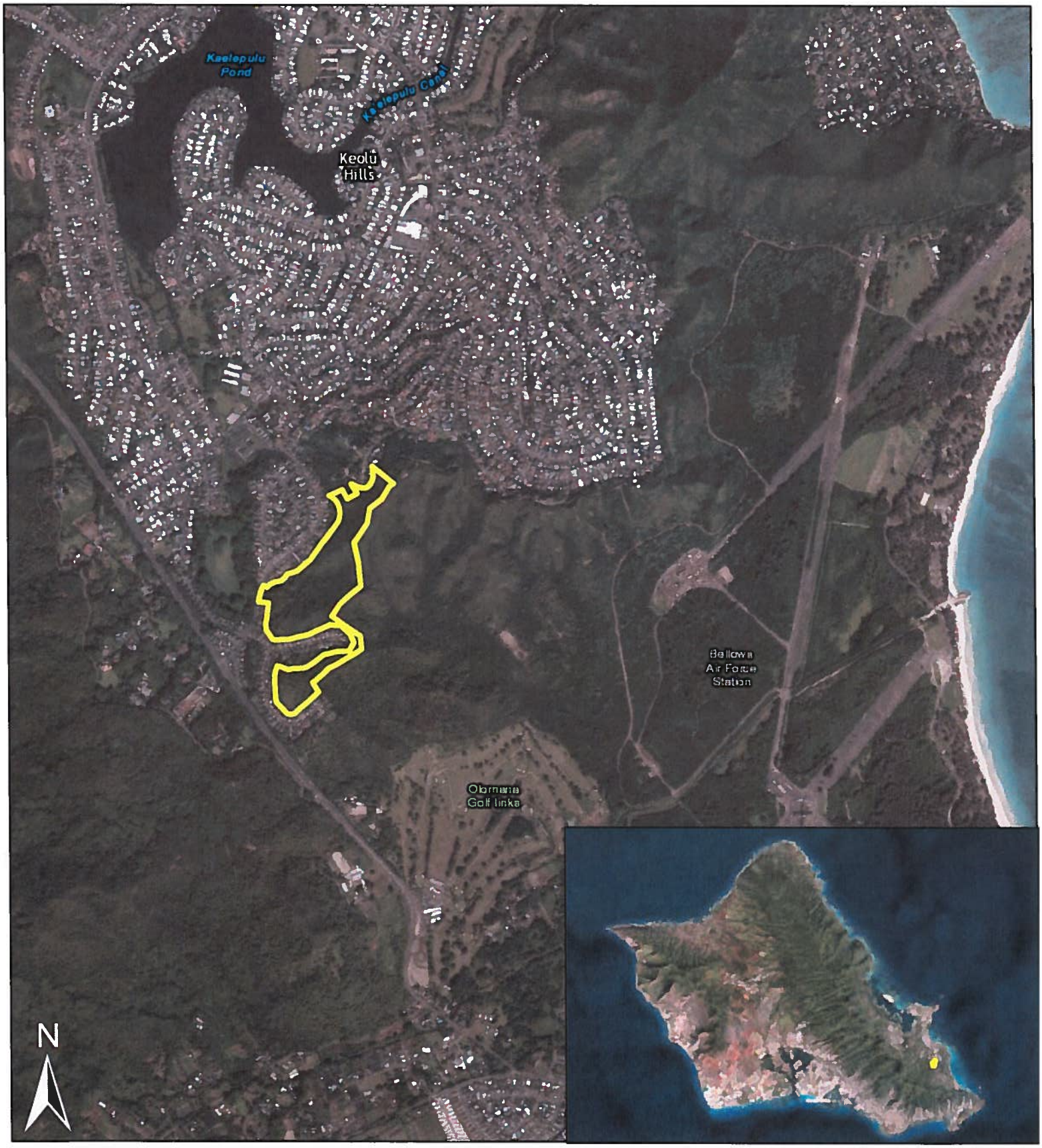
Douglas, J.L., and C.E. Mason. 1996. An alternative erosion control practice for cropland. Jamie L. Whitten Plant Materials Center Progress Report. 12(7).

Dunn, G.H., and S.M. Dabney. 1996. Modulus of elasticity and moment of inertia of grass hedge stems. Trans. ASAE 39(3):947-952.

Customer: MDHE LLC. / Dawn Horn
District: Windward O'ahu SWCD
TMK: 4-2-004-001
Approximate Area: ~37 acres

1711 Kanapuu Drive
Location Map

Agency: O'ahu RC&D
Assisted by: S. Mock, J. Brokish
Date: May 2016



0 1,000 2,000 4,000 Feet

0 287.5 575 1,150 Meters

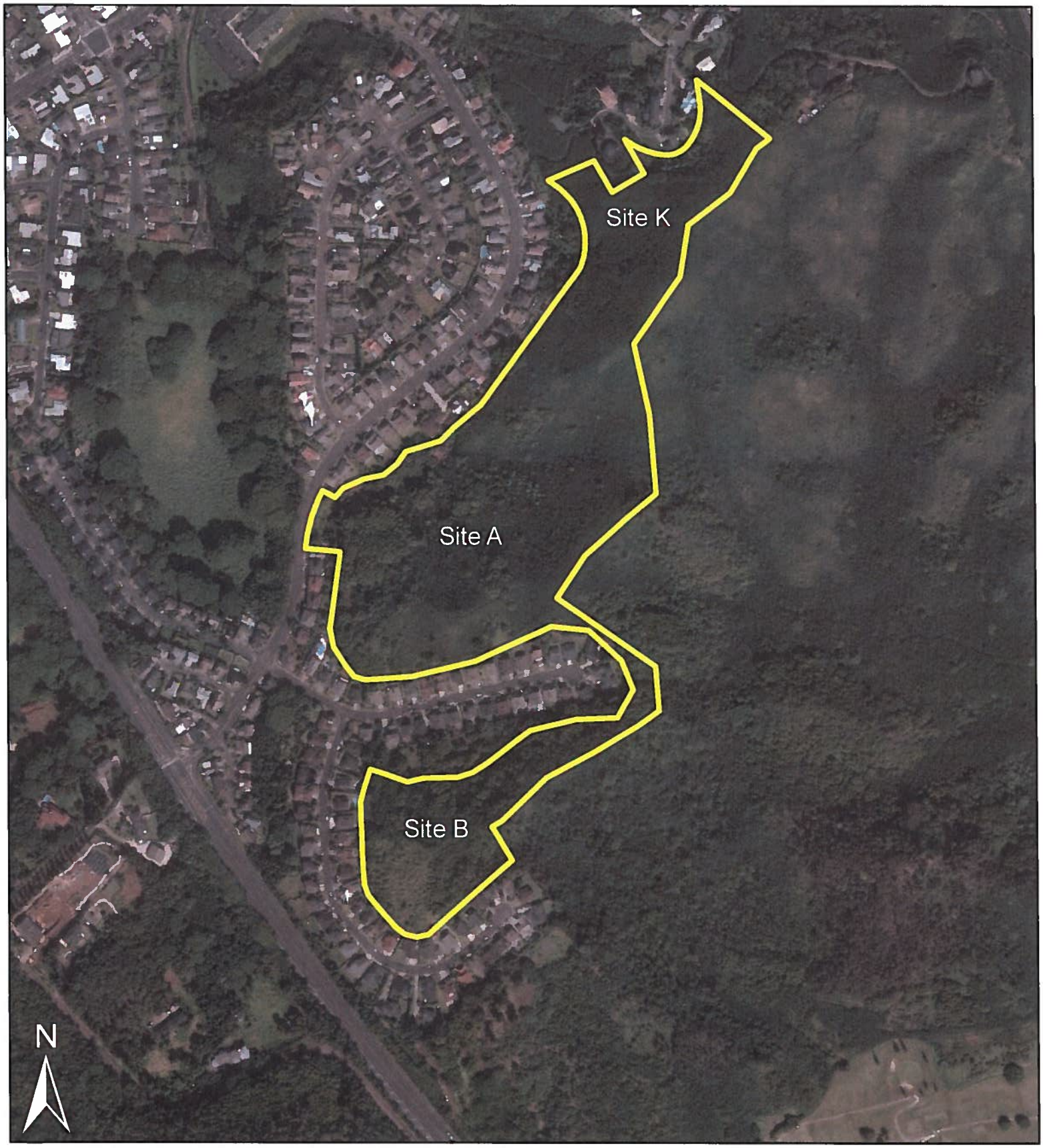
Legend

Property Boundary

Customer: MDHE LLC. / Dawn Horn
District: Windward O'ahu SWCD
TMK: 4-2-004-001
Approximate Area: ~37 acres

1711 Kanapuu Drive
Location Map

Agency: O'ahu RC&D
Assisted by: S. Mock, J. Brokish
Date: May 2016



0 290 580 1,160 Feet

0 85 170 340 Meters

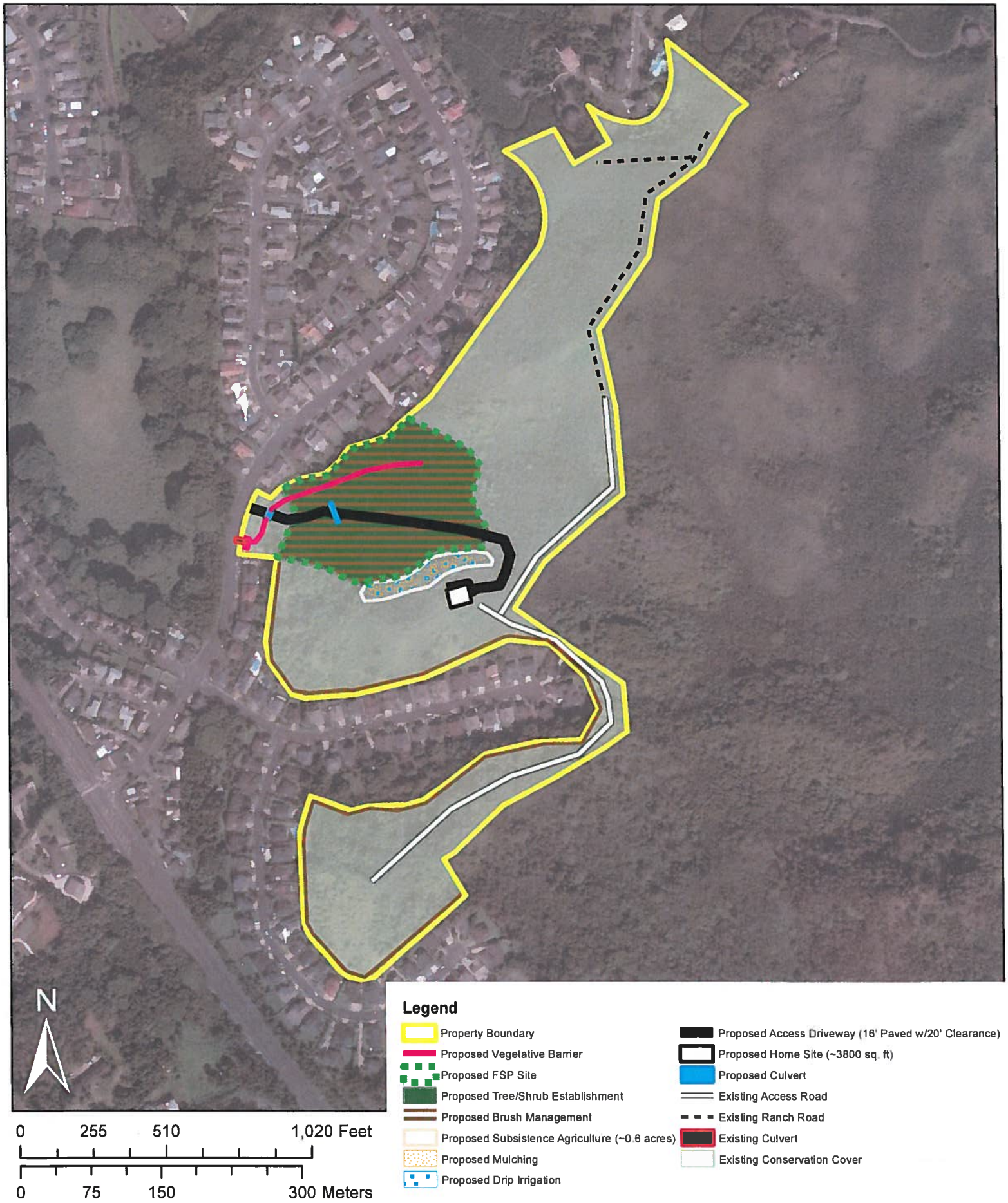
Legend

Property Boundary

Customer: MDHE LLC. / Dawn Horn
District: Windward O'ahu SWCD
TMK: 4-2-004-001
Approximate Area: ~37 acres

1711 Kanapuu Drive
Conservation Practices Map

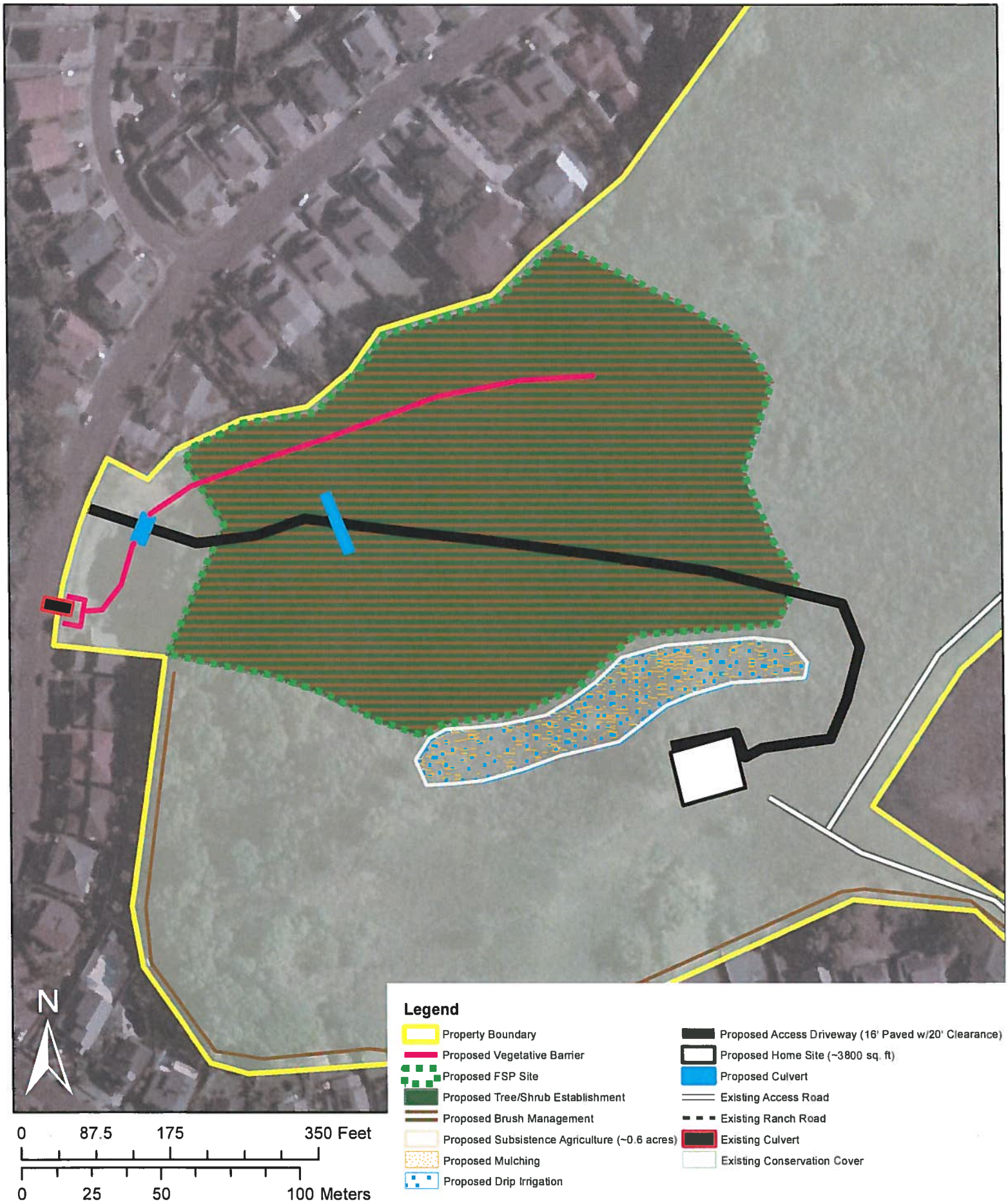
Agency: O'ahu RC&D
Assisted by: S. Mock,
J. Brokish
Date: Amended July 2016



Customer: MDHE LLC. / Dawn Horn
District: Windward O'ahu SWCD
TMK: 4-2-004-001
Approximate Area: ~37 acres

1711 Kanapuu Drive
Conservation Practices Map-Magnified

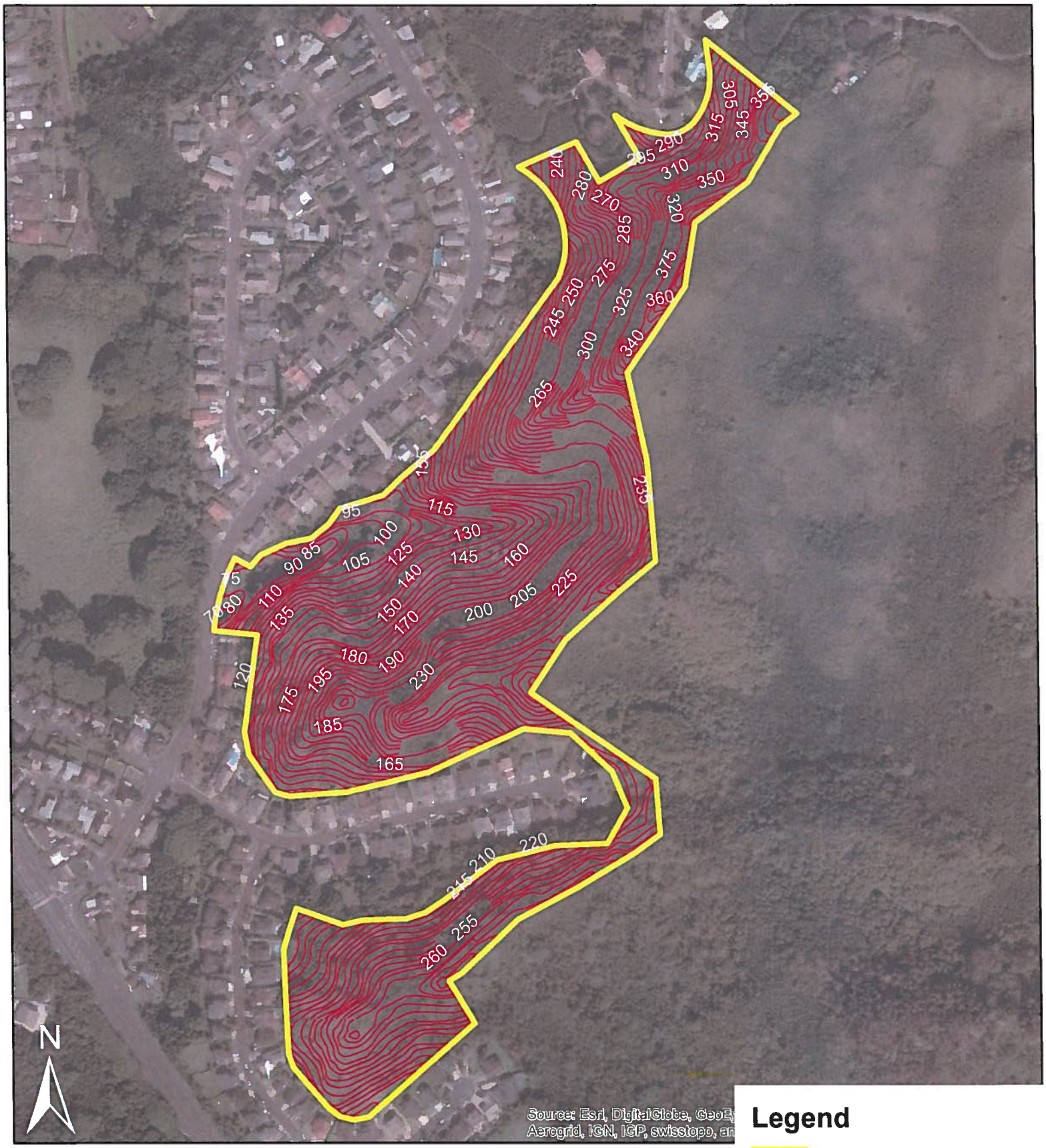
Agency: O'ahu RC&D
Assisted by: S. Mock, J. Brokish
Date: Amended July 2016



Customer: MDHE LLC. / Dawn Horn
District: Windward O'ahu SWCD
TMK: 4-2-004-001
Approximate Area: ~37 acres

1711 Kanapuu Drive
Elevation Map (5ft Contours)

Agency: O'ahu RC&D
Assisted by: S. Mock, J. Brokish
Date: May 2016



Legend

- Property Boundary
- Elevation Contours (5ft)

0 237.5 475 950 Feet

0 65 130 260 Meters

Customer: MDHE LLC. / Dawn Horn
District: Windward O'ahu SWCD
TMK: 4-2-004-001
Approximate Area: ~37 acres

1711 Kanapuu Drive
Annual Precipitation Map (Inches)

Agency: O'ahu RC&D
Assisted by: S. Mock, J. Brokish
Date: May 2016

Legend

Annual Precipitation (Inches)

Property Boundary

0 2,250 4,500 9,000 Feet

0 650 1,300 2,600 Meters

Customer: MDHE LLC. / Dawn Horn
District: Windward O'ahu SWCD
TMK: 4-2-004-001
Approximate Area: ~37 acres

1711 Kanapuu Drive
Soil Types Map

Agency: O'ahu RC&D
Assisted by: S. Mock, J. Brokish
Date: May 2016

Customer: MDHE LLC. / Dawn Horn
District: Windward O'ahu SWCD
TMK: 4-2-004-001
Approximate Area: ~37 acres

1711 Kanapuu Drive
Critical & Endangered Species Habitat Map

Agency: O'ahu RC&D
Assisted by: S. Mock, J. Brokish
Date: May 2016

Legend

- Property Boundary
- Critical & Threatened Species Habitat

0 2,000 4,000 8,000 Feet

0 550 1,100 2,200 Meters

This plan consists of general guidelines which were developed from Natural Resources Conservation Service conservation planning directives, standards, and specifications. These can be accessed at:http://efotg.sc.egov.usda.gov.

To ensure compliance with NRCS standards, guidance from a qualified engineer is recommended for the installation of structural practices, e.g., diversions, waterways and sediment basins.

CERTIFICATION

I. MDHE LLC. (Dawn Horn) has been fully involved in the planning process and agrees to the practices listed in this plan.

II. MDHE LLC. (Dawn Horn) will implement the practices listed in the plan and accepts the responsibilities of:

a) ensuring the practices meet or exceed current NRCS specifications,
b) complying with applicable federal, state, or county regulations and policies, and
c) acquiring any additional permit or approval that may be required before implementing a practice.

7/21/2016

MDHE LLC./Dawn Horn (Managing Member) — Date

Owner and Operator

O'ahu Resource Conservation & Development Council

7/21/16

Jean Brokish — Date

Executive Director

Planner

7/21/16

Stephanie Mock — Date

Conservation Specialist

O'ahu RC&D

Windward O'ahu Soil and Water Conservation District

21 JULY, 2016

RICHARD S. TOWNE — Date

WWOSWCD Director/CHAIR

Appendix B

Natural Resources Survey

Natural resources survey for the parcel at 1711 Kanapuu Drive (TMK: 4-2-004:001) in Kailua, Oʻahu

February 4, 2014 *AECOS* No. 1361

Eric Guinther and Reginald David[1]
AECOS, Inc.
45-939 Kamehameha Hwy, Suite 104
Kāneʻohe, Hawaiʻi 96744
Phone: (808) 234-7770 Fax: (808) 234-7775 Email: guinther@aecos.com

Introduction

This report[2] presents results from biological resource surveys undertaken on a 36.893-ac parcel in Kailua, windward Oʻahu (Fig. 1) and owned by MDHE, LLC. The primary purpose of the surveys is to determine if any sensitive biological resources occur on the property that must be considered in developing plans for a single residential dwelling and appurtenances (including a driveway and solar PV array).

The subject property at 1711 Kanapuu Drive (TMK: 4-2-004:001) has an irregular shape, fitting between the developed parcels of Kailua Bluffs (neighborhood), house lots along Kanapuu Drive, Kahako Street, and Kahako Place, and the ridgeline that separates Kailua from Waimanalo. This ridge is a continuous feature from the eastern flank of Olomanu to Keolu Hills *mauka* of Lanikai. The subject parcel rises steeply to the ridge line, which lies mostly at elevations between 280 ft and 360 ft above sea level (ASL). The east face of this ridge is part of Bellows Air Force Station. The subject property includes only one small valley of any consequence, but includes three lateral ridges in addition to the main ridge forming the east side. There are no streams or wetlands on the property. The small valley is a gulch, the bottom of which is

[1] Rana Biological Consulting, Inc., Kailua-Kona, Hawaiʻi.
[2] This report has been prepared for Group70, and will become part of the administrative record for environmental entitlements.

lacking definable bed and banks that would typify a dry (intermittent or ephemeral) stream.

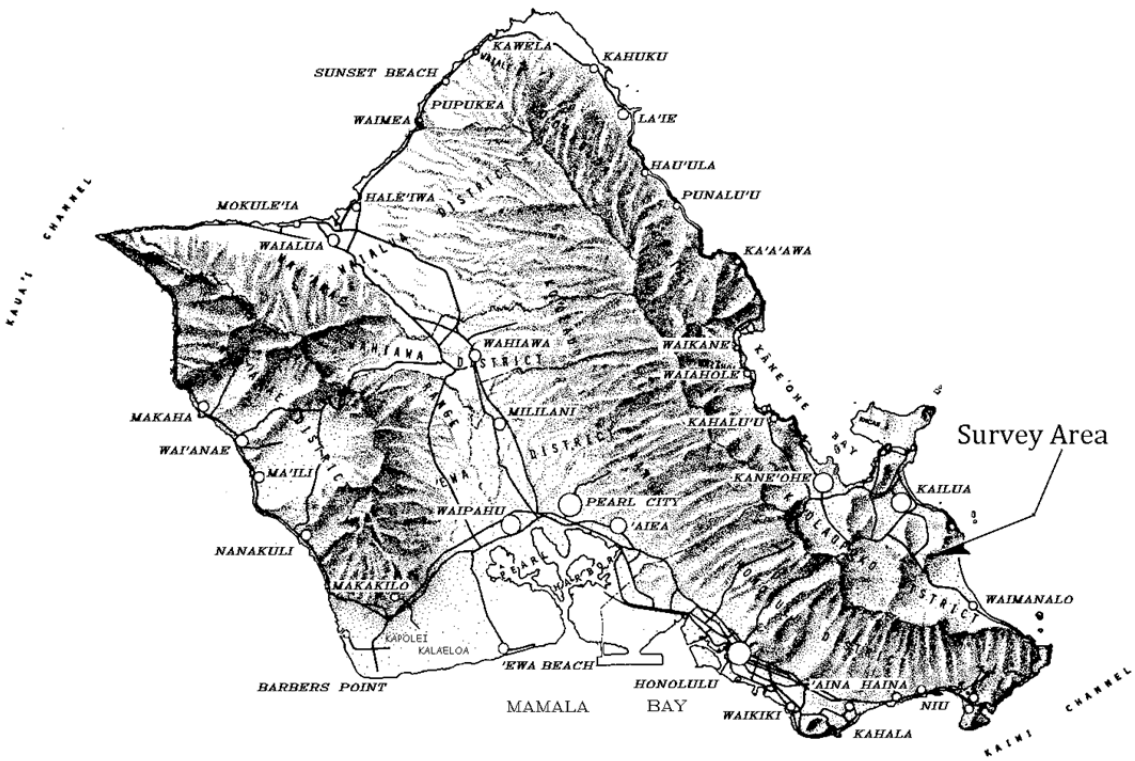


Figure 1. Location of 1711 Kanapuu Drive parcel on the Island of O'ahu.

Methods

Botanical Survey

Botanical surveys were conducted by Eric Guinther on November 6, 7, and 21, 2013. The surveys entailed traversing much of the property on foot with emphasis on the ridgeline, gulch bottoms, and parts close to adjacent, developed lots. Most plant species were identified as they were encountered and qualitative abundance determined as the survey progressed. A handheld GNSS unit (Trimble GeoXH) was used to record progress of the survey (survey track) as well as feature locations. In some areas, owing to uncertainty of the exact property boundary, all weeds and plantings made by neighbors on the subject property were not necessarily included in the listing.

Plants not immediately identified in the field were photographed and/or a piece "collected" for identification in the laboratory. Plant names follow *Manual of the Flowering Plants of Hawai'i* (1999) for native and naturalized flowering plants, *A Tropical Garden Flora* (2005) for crop and ornamental plants, and *Hawaii's Ferns and Fern Allies* (2003) for ferns and fern allies. More recent name changes for naturalized plants follow Imada (2012).

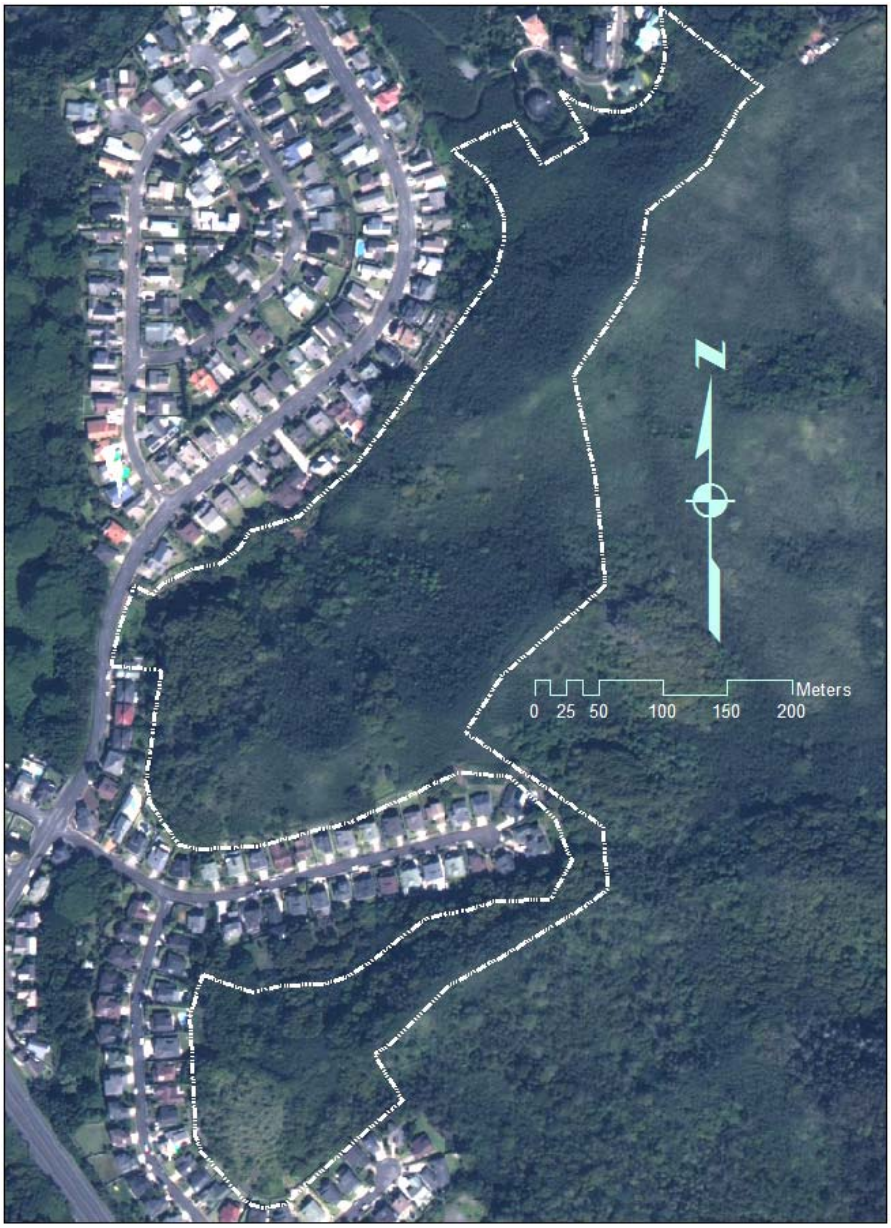


Figure 2. Satellite image of parcel at 1711 Kanapuu Drive outlined in white.

Vertebrates Survey

Avian Survey

Five avian point count stations were sited approximately 200 m (650 ft) apart along the length of the property on November 7, 2013. A single, eight-minute avian point count was made at each count station. Field observations were made with the aid of Leica 8 X 42 binoculars and by listening for vocalizations. The point counts were conducted between 8:20 am and 10:15 am, the daily peak of bird activity.

When not conducting point counts, the zoologist searched the remainder of the property for species and habitats not detected during the point counts. Weather conditions were good with unlimited visibility and winds of between one and four kilometers per hour.

Mammalian Survey

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

Results

Vegetation

The vegetation across much of the parcel is fairly uniform: Guinea grass (*Urochloa maxima*) and *koa haole* (*Leucaena leucocephala*) form a scrub growth that covers most of the land (Fig. 3). *Koa haole* plants becoming notably larger downslope and into the valley part. Many of the larger *koa haole* trees on the slopes have grown nearly parallel to the ground, possibly toppled (but continuing to grow) by a strong wind event in the distant past. A mixture of other shrubs and herbs (see Flora section) occur in the *koa haole*/Guinea grass association. And, there are patches of trees, such as ironwood (*Casuarina equisetifolia*) and Formosan koa (*Acacia confusa*) on parts of the ridges. Forested slopes occur along the western ends of the lateral ridges and the

northwest face of the southern lateral ridge, above developed houselots bordering the parcel.

Figure 3. View of subject parcel looking north from the southernmost ridge. Property includes lateral ridge behind houses and extends to beyond the peak in the center of the picture. Scrub growth with scattered trees dominates the property.

Flora

Although the majority of the property is dominated by a few species of trees, shrubs, and grasses, the flora listing (Table 1) is much "enhanced" by plantings made by adjacent land owners. In a number of locations, adjacent property owners have encroached on the subject property, planting a variety of landscape species and clearing the natural vegetation in some areas.

In all, 86 taxa of vascular plants were recorded during the botanical survey. Table 1 is divided into two parts: Table 1a lists those vascular plant species that are not native to the Hawaiian Islands. Table 1b lists those species native to the

Table 1. Flora for the property at TMK: 4-2-004:001, Kailua, O'ahu.

Table 1a. Non-native (ornamentals and naturalized) plants

Family Species	Common name	Status	Abundance	Notes
FERNS AND FERN ALLIES				
BLECHNACEAE				
Blechnum appendiculatum Willd.	---	Nat	U	
SCHIZAEACEAE				
Lygodium japonicum (Thunb.) Sw.	Japanese climbing fern	Nat	R	
FLOWERING PLANTS				
DICOTYLEDONS				
ACANTHACEAE				
Asystasia gangetica (L.) T. Anderson	Chinese violet	Nat	A	
Barleria repens C. Nees	pink ruellia	Orn	U	
ANACARDIACEAE				
Schinus terebinthifolius Raddi	Christmas berry	Nat	O	
APOCYNACEAE				
Plumeria rubra L.	plumeria	Orn	R	<1>
ASCLEPIADACEAE				
Stapelia gigantea N.E. Brown	giant toad plant	Nat	U	
ASTERACEAE (COMPOSITAE)				
Bidens alba (L.) DC.	beggartick	Nat	R	
Bidens cyanapiifolia Kunth	---	Nat	U1	
Sphagneticola trilobata (L.) Pruski	wedelia	Nat	R3	<1>
BIGNONIACEAE				
Spathodea campanulata P. Beauv.	African tulip tree	Nat	R	
BORAGINACEAE				
Carmona retusa (Vahl) Masamune	Fukien tea	Nat	A	
CACTACEAE				
Cereus sp.	---	Orn	R	<1>
Opuntia cochenillifera (L.) P. Mill.	cochineal cactus	Nat	R	<1>
Opuntia ficus-indica (L.) Mill.	*pānini*	Nat	R	
CASUARINACEAE				
Casuarina equisetifolia L.	ironwood	Nat	R1	
CARICACEAE				
Carica papaya L.	papaya	Nat	R	<1>
CLUSIACEAE				
Clusia rosea Jacq.	autograph tree	Nat	R	
COMBRETACEAE				
Terminalia catappa L.	tropical almond	Nat	R	<1>

Table 1a (continued).

Family Species	Common name	Status	Abundance	Notes
CUCURBITACEAE				
Coccinia grandis (L.) Voigt	scarlet-fruited gourd	Nat	R	
Momordica charantia L.	wild bitter melon	Nat	R	
EUPHORBIACEAE				
Codiaeum variegatum (L.) Blume	croton	Orn	R	<1>
Euphorbia hirta L.	garden spurge	Nat	U3	<1>
Euphorbia lactea Haworth	milk-stripped euphorbia	Orn	R	<1>
Phyllanthus debilis Klein ex Willd.	niuri	Nat	U3	<1>
FABACEAE				
Acacia confuse Merr.	Formosa *koa*	Nat	C	
Acacia farnesiana (L.) Willd.	*klu*	Nat	U	
Albizia saman F. Muell.	monkeypod	Nat	R	<1>
Canavalia cathartica Thours	*maunaloa* vine	Nat	U	<2>
Chamaecrista nictitans (L.) Moench	partridge pea	Nat	U1	
Desmodium incanum DC.	Spanish clover	Nat	U	
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat	AA	
Mimosa pudica L.	sensitive plant	Nat	R	
Neonotonia wightii (Wight & Arnott) Lackey	glycine vine	Nat	U3	<2>
Pithecellobium dulce (Roxb.) Benth.	*'opiuma*	Nat	R	
Senna surattensis (N.L. Burm.) H. Irwin & Barneby	scrambled egg plant, *kolomana*	Nat	U	
LAMIACEAE				
Hyptis pectinata (L.) Poit.	comb hyptis	Nat	O3	
MALVACEAE				
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	Nat	U	
MELIACEAE				
Swietenia mahagoni (L.) N. Jacq.	Cuban mahagony	Nat	R	
MORACEAE				
Ficus carica L.	common fig	Orn	R	<1>
MORINGACEAE				
Moringa oleifera Lam.	horseradish tree	Orn	R	<1>
MYRTACEAE				
Psidium guajava L.	common guava	Nat	U	<1>
Syzygium cuminii (L.) Skeels	Java plum	Nat	O	
OCHNACEAE				
Ochna thomasiana Engler & Gilg	Mickey Mouse plant	Nat	U	
OLEACEAE				
Jasminum fluminense Vell.	Brazilian jasmine	Nat	C	
PASSIFLORACEAE				
Passiflora edulis Sims	passion fruit vine	Nat	R	
Passiflora suberosa L.	*huehue haole*	Nat	O	

Table 1a (continued).

Family Species	Common name	Status	Abundance	Notes
PHYTOLACCACEAE				
Rivina humilis L.	coral berry	Nat	C	
PLANTAGINACEAE				
Plantago major L.	common plantain	Nat	R2	
PORTULACEAE				
Portulaca oleracea L.	pigweed	Nat	R	
PROTEACEAE				
Macadamia cf. *integrifolia* Maiden & Betche	mac nut	Orn	R	<1> <2>
RUTACEAE				
Murraya paniculata (L.) W. Jack	mock orange	Nat	O	
SANTALACEAE				
Santalum album L.	white sandalwood	Nat	R	<2>
SAPINDACEAE				
Filicium decipiens (Wight & Arnott) Thwaites ex J.D. Hook.	fern tree	Nat	R	<1>
SAPOTACEAE				
Chrysophyllum oliviforme L.	satinleaf	Nat	O	
Sideroxylon persimile (W. Hemsley) T. D. Penn.	bumelia	Nat	C	<2>
SOLANACEAE				
Solanum seaforthianum Andr.	---	Nat	R	
VERBINACEAE				
Citharexylum caudatum L.	fiddlewood	Nat	R	
Lantana camara L.	*lākana*, lantana	Nat	O	
MONOCOTYLEDONS				
AGAVACEAE				
Agave sisalana Perrine	sisal, *malina*	Nat	R	<1>
Agave sp.	---	Orn	R	<1>
Cordyline fruticosa (L.) A. Chev.	*ti* horticultural variety	Orn	R	<1>
Dracaena marginata Lam. 'Tricolor'	money tree cultivar	Orn	R	<1>
Dracaena sanderiana M.T. Masters	sanderiana	Orn	R	<1>
ALOEACEAE		Orn	R	<1>
Aloë vera (L.) N.L. Burm.	aloe	Nat	R	<1>
ARECACEAE				
Veitchia merrillii (Beccari) H. E. Moore	Manila palm	Orn	R	<1>
LILIACEAE				
Asparagus densiflorus (Kunth) Jessop	asparagus "fern"	Nat	U	
Asparagus plumosus J.G. Baker	climbing asparagus "fern"	Nat	U3	
POACEAE (GRAMINEAE)				
Arundo donax L.	giant reed	Nat	R	<1>
Bambusa multiplex (Lour.) J.A. & J.H. Schultes	hedge bamboo	Orn	R	<2>

Table 1a (continued).

Family Species	Common name	Status	Abundance	Notes
POACEAE (continued)				
Chloris barbata (L.) Sw.	swollen fingergrass	Nat	U3	<1>
Digitaria insularis (L.) Mez ex Ekman	sourgrass	Nat	C3	
Diplachne fusca uninervia (J. Presl.) P.M. Peterson & N. Snow	sprangletop	Nat	R2	<1>
Echinochloa crus-galli (L.) P. Beauv.	barnyard grass	Nat	R1	<1>
Otatea acuminata (Munro) C.E. Smith	weeping bamboo	Orn	R	<1>
Urochloa maxima (Jacq.) R.D. Webster	Guinea grass	Nat	AA	
Urochloa mutica (Forssk.) Nguyen	California grass	Nat	U3	

Table 1b. Native (and early Polynesian introduced) Plants

Family Species	Common name	Status	Abundance	Notes
FLOWERING PLANTS				
DICOTYLEDONS				
BORAGINACEAE				
Cordia subcordata Lam.	*kou*	Pol	R	<1>
SAPINDACEAE				
Dodonaea viscosa N. Jacq.	*'a'ali'i*	**Ind**	R	
MALVACEAE				
Waltheria indica L.	*'uhaloa*	**Ind**	O	
OXALIDACEAE				
Oxalis corniculata L.	yellow wood sorrel, *'ihi'ai*	Pol	U	<1>
ROSACEAE				
Osteomeles anthyllidifolia (Sm.) Lindl.	*'ulei*	**Ind**	U1	
MONOCOTYLEDONS				
AGAVACEAE				
Cordyline fruticosa (L.) A. Chev.	*ki*, ti	Pol	R	<1>
ARECACEAE				
Cocos nucifera L.	*niu*, coconut	Pol	R	
MUSACEAE				
Musa sp. hybrid	*mai'a*, banana	Pol	R1	<1>

Legend to Table 1

Status = distributional status

End = endemic; native to Hawai'i and found naturally nowhere else.

Ind = indigenous; native to Hawai'i, 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 = ornamental; cultivated or landscape plants not known to have naturalized in the wild in Hawai'i.

Pol = an early Polynesian introduction (so-called "canoe plant").

Table 1 (continued).

Abundance = occurrence ratings for plants on property in November 2013.

R – Rare -	only one or two plants seen.
U - Uncommon -	several to a dozen plants observed.
O - Occasional -	found regularly, but not abundant anywhere.
C - Common -	considered an important part of the vegetation and observed numerous times.
A - Abundant -	found in large numbers; may be locally dominant.
AA - Abundant -	very abundant and dominant; defining vegetation type.

Numbers (as in R3) offset occurrence ratings (1 – several plants; 2 – many plants; 3 – abundant in a limited area) in cases where distribution across the survey area may be limited, but individuals seen are more than indicated by the occurrence rating alone.

Notes:

<1> Generally associated with gardening/landscaping areas encroaching into the subject property.
<2> Plant lacking flowers or fruit; identification uncertain.

Hawaiian Islands, and species that are considered early Polynesian introductions or "canoe plants". Plant species in Table 1a characterize the flora, but are of no special interest or concern from a conservation perspective. Species in Table 1b are 9% of the total and represent the small native component of the flora at this location. Note <1> shows that 33 (or 38%) of the plant species identified are plantings made as a part of the landscaping of neighboring parcels (Fig. 4). Half of the native and early Polynesian species (Table 1b) are included in these landscape plants.

Avian Survey

A total of 142 individual birds of 14 species, representing 11 separate families, were recorded during station counts (Table 2). All of the species detected are alien to the Hawaiian Islands (that is, no native birds were observed). Three species: Red-vented Bulbul (*Pycnonotus cafer*), Java Sparrow (*Padda oryzivora*), and House Finch (*Haemorhous mexicanus*), accounted for slightly more than 59% of the total number of individual birds recorded. Red-vented Bulbuls were the most frequently recorded species, accounting for 23% of the individual birds recorded during the course of this survey (Table 2).

Mammalian Survey

Two terrestrial mammalian species were detected during the course of this survey. Several dogs (*Canis familiaris*) were heard barking from houses below the site. Scat, tracks, and sign of feral pig (*Sus scrofa*) were encountered at a number of locations within the site, but mostly in the area of the proposed house site and the trail connecting the site with the main (east) ridgeline trail.

Figure 4. View along the western property line showing encroachment of landscaping from neighborhood on left.

Discussion

Botanical Resources

The status column in Table 1 indicates native vs. non-native species (natives and early Polynesian introductions are separated out into Table 1b). Only native plants (indigenous or endemic species) would have any potential conservation value in this location. In all, Table 1b lists 8 species (9%), but only three of these are truly natives, the other 5 are early Polynesian introductions. None of the species listed in Table 1b are rare, and most are relatively common across O'ahu. A floristic composition of 3% natives (8% if Polynesian introductions included) is typical for lowland O'ahu. Considering number of plants, the natives account for far less than 3% of the vegetation biomass. The vast majority of the plants now growing on the property are introduced, naturalized species and, along the western side, various ornamentals.

Table 2. Avian species detected during point counts on the property at TMK: 4-2-004:001 in Kailua, November 2013.

Common Name	Scientific Name	ST	RA
	COLUMBIFORMES		
	COLUMBIDAE – Pigeons & Doves		
Spotted Dove	*Streptopelia chinensis*	A	0.60
Zebra Dove	*Geopelia striata*	A	1.00
	PASSERIFORMES		
	PYCNONOTIDAE – Bulbuls		
Red-vented Bulbul	*Pycnonotus cafer*	A	6.40
	ZOSTEROPIDAE – White-eyes		
Japanese White-eye	*Zosterops japonicus*	A	3.20
	TIMALIIDAE - Babblers		
Chinese Hwamei	*Garrulax canorus*	A	0.40
Red-billed Leiothrix	*Leiothrix lutea*	A	0.40
	TURDIDAE - Thrushes		
White-rumped Shama	*Copsychus malabaricus*	A	0.60
	STURNIDAE – Starlings		
Common Myna	*Acridotheres tristis*	A	1.00
	EMBERIZIDAE – Emberizids		
Saffron Finch	*Sicalis flaveola*	A	0.80
	CARDINALIDAE – Cardinals Saltators & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	0.80
	FRINGILLIDAE – Fringilline and Carduleline Finches & Allies		
	Carduelinae – Carduline Finches		
House Finch	*Haemorhous mexicanus*	A	4.20
	PASSERIDAE - Old World Sparrows		
House Sparrow	*Passer domesticus*	A	0.60
	ESTRILDIDAE – Estrildid Finches		
	Estrildinae – Estrildine Finches		
Common Waxbill	*Estrilda astrild*	A	2.80
Java Sparrow	*Padda oryzivora*	A	6.20

Legend to Table 2

ST Status

A Alien – Introduced to the Hawaiian Islands by humans

RA Relative Abundance - Number of birds detected divided by the number of count stations (5)

Avian Resources

The findings of the avian survey are consistent with the location and with the highly disturbed nature of habitats present on the property. During the course

of our survey, 14 avian species were detected, all alien to the Hawaiian Islands. The density and diversity of birds was greatest in the lower elevations around the gardens and the small, central valley, not surprising as this is an area with the most diverse and densest vegetation on the site.

Although no seabirds were detected during the course of this survey, low numbers of several seabird species potentially overfly the site on occasion. The primary cause of mortality in resident seabirds is thought to be predation by alien mammalian species at the nesting colonies (USFWS, 1983; Simons and Hodges, 1998; Ainley et al., 2001). Collision with man-made structures is considered to be the second-most cause of mortality in locally nesting seabird species in Hawai'i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds may collide with man-made structures and, if not killed outright, can be easy prey for feral mammals (Hadley, 1961; Telfer, 1979; Sincock, 1981; Reed et al., 1985; Telfer et al., 1987; Cooper and Day, 1998; Podolsky et al., 1998; Ainley et al., 2001; Hue et al., 2001; Day et al., 2003). There are no known nesting colonies of any of the O'ahu resident seabird species on, or within close proximity of the subject property.

There currently are no suitable habitats on the property that could support native avian species. Modifications of the site may provide open grassy areas that could be utilized by indigenous shorebirds. It is unlikely the site will ever support any endemic native birds.

Mammalian Resources

The findings of the mammalian survey are consistent with the location of the site and the highly disturbed habitats present on the property. Although no rodents were detected during the course of our survey, it is likely that the four established alien Muridae found on O'ahu—roof rat (*Rattus r. rattus*), brown rat (*Rattus norvegicus*), European house mouse (*Mus musculus domesticus*), and possibly black rat (*Rattus exulans hawaiiensis*)—use various resources in the general project area on a seasonal basis. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependent on them.

No Hawaiian hoary bats were detected during the course of this survey. A small possibility exists that bats may occasionally use resources within the lower, more densely treed parts of the site.

Protected Species, Jurisdictional Waters, and Critical Habitats

No species proposed for listing or listed under the federal endangered species act of 1973, as amended or the State of Hawai'i's (H.R.S. 195D) were recorded during the course of this survey (DLNR, 1998; USFWS; 2005a, 2005b, 2013).

The property lacks flowing or standing water. The valley bottom is dry and shows minimal evidence of effects from flowing water other than narrow erosion channels incised less than 0.5 m to perhaps 1 m (mostly 1 to 2 ft) in a very few locations.

Much of the property is within the General (G) subzone of the state Conservation District. "General" is the least restrictive of the four levels of conservation subzones; the specific purpose being "to designate open space where specific conservation uses may not be defined, but where urban use would be premature" (DLNR, 1994).

There is no federally delineated Critical Habitat present on or near the property (USFWS, 2012). Any development on the property will not result in an impact to federally designated Critical Habitat. There is no equivalent statute under state law.

Recommendations

To avoid adverse impacts on night-flying sea birds, lights associated with construction activities should be shielded, and if large flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground. Exterior house lighting should be shielded to reduce the potential for interactions between nocturnally flying seabirds and man-made structures.

References

Ainley, D. G, R. Podolsky, L. Deforest, G. Spencer, and N. Nur. 2001. The Status and Population Trends of the Newell's Shearwater on Kaua'i: Insights from Modeling, *In*: Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna.* Cooper's Ornithological Society, Allen Press, Lawrence, Kansas. Studies in Avian Biology No. 22: 108-123.

American Ornithologist's Union. 1998. *Check-list of North American Birds*. 7th edition. AOU. Washington D.C. 829pp.

_____. 2000. Forty-second supplement to the American Ornithologist's Union *Check-list of North American Birds*. *Auk,* 117: 847-858.

Banks, R. C., C. Cicero, J. L. Dunn, A. W. Kratter, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2002. Forty-third supplement to the American Ornithologist's Union *Check-list of North American Birds*. *The Auk*, 119: 897-906.

_____ , _____, _____, _____, _____, _____, _____, and _____. 2003 Forty-fourth supplement to the American Ornithologist's Union *Check-list of North American Birds*. *The Auk*, 120: 923-931.

_____ , _____, _____, _____, _____, _____, _____, and _____. 2004 Forty-fifth supplement to the American Ornithologist's Union *Check-list of North American Birds*. *The Auk*, 121: 985-995.

_____ , _____, _____, _____, _____, _____, _____, and _____. 2005 Forty-sixth supplement to the American Ornithologist's Union *Check-list of North American Birds*. *The Auk*, 122: 1031-1031.

_____ , _____, _____, _____, _____, _____, _____, and _____. 2006 Forty-seventh supplement to the American Ornithologist's Union *Check-list of North American Birds*. *The Auk,* 123: 926-936.

_____, C. R. Terry Chesser, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2007. Forty-eighth supplement to the American Ornithologist Union *Check-list of North American Birds*. *The Auk*, 124: 1109-1115.

_____, _____, _____, _____, _____, _____, _____, _____, _____, _____, and K. Winker. 2008. Forty-ninth supplement to the American Ornithologist Union *Check-list of North American Birds*. *The Auk*, 125: 758-768.

Chesser, R. T., R. C. Banks, F. K. Barker, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, D. F. Stotz, and K. Winker. 2009. Fiftieth supplement to the American Ornithologist Union *Check-list of North American Birds*. *The Auk,* 126: 1-10.

_____, _____, _____, _____, _____, _____, _____, _____, _____, _____, _____, and _____. 2010. Fifty-first supplement to the American Ornithologist

Union, *Check-list of North American Birds*. *The Auk*, 127: 726-744.

Chesser, R. T., R. C. Banks, F. K. Barker, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, D. F. Stotz, and K. Winker2011. Fifty-second supplement to the American Ornithologist Union, *Check-list of North American Birds*. *The Auk*, 128: 600-613.

. _____, _____, _____, _____, _____, _____, _____, _____, _____, _____, _____, and _____. 2012. Fifty-third supplement to the American Ornithologist Union, *Check-list of North American Birds*. *The Auk*, 129: 573-588.

_____, _____, _____, _____, _____, _____, _____, _____, _____, _____, _____, and _____. 2013. Fifty-fourth supplement to the American Ornithologist Union, *Check-list of North American Birds*. *The Auk*, 130: 558-571.

Cooper, B. A., and R. H. Day. 1998. Summer Behavior and Mortality of Dark-rumped Petrels and Newell's Shearwaters at Power Lines on Kauai. *Colonial Waterbirds*, 21(1): 11-19.

Day, R. H., B. Cooper, and T. C. Telfer. 2003. Decline of Townsend's (Newell's Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii. *The Auk*, 120: 669-679.

Department of Land and Natural Resources (DLNR). 1994. Hawaii Administrative Rules. Title 13. Department of Land and Natural Resources. Subtitle 1 Administration Chapter 5 Conservation District. 42 pp.

_____. 1998. Indigenous Wildlife, Endangered and Threatened Wildlife and Plants, and Introduced Wild Birds. Department of Land and Natural Resources. State of Hawaii. Administrative Rule §13-134-1 through §13-134-10, dated March 02, 1998.

Hadley, T. H. 1961. Shearwater calamity on Kauai. *Elepaio*, 21: 60.

Hue, D., C. Glidden, J. Lippert, L. Schnell, J. MacIvor and J. Meisler. 2001. Habitat use and limiting factors in a population of Hawaiian Dark-rumped Petrels on Mauna Loa, Hawai'i. Pp. 234-242, *in*: Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna.* Studies in Avian Biology No. 22. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas.

Imada, Clyde T. 2012. Hawaiian Native and Naturalized Vascular Plants Checklist (December 2012 update). Bishop Museum Tech. Rept. 60. 380 pp.

Palmer, D. D. 2003. *Hawai`i's ferns and fern allies*. University of Hawaii Press, Honolulu. 324 pp.

Podolsky, R., D. G. Ainley, G. Spencer, L. de Forest, and N. Nur. 1998. Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kaua'i. *Colonial Waterbirds,* 21: 20-34.

Reed, J. R., J. L Sincock, and J. P. Hailman 1985. Light Attraction in Endangered Procellariform Birds: Reduction by Shielding Upward Radiation. *Auk*, 102: 377-383.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (*Pterodroma phaeopygia*). *In:* A. Poole and F. Gill (editors). *The Birds of North America, No. 345*. The Academy of Natural Sciences, Philadelphia, PA. and the American Ornithologists Union, Washington, D.C.

Sincock, J. L. 1981. Saving the Newell 's Shearwater. Pages 76-78 in Proceedings of the Hawaii Forestry and Wildlife Conference, 2-4 October 1980. Department of Land and Natural Resources State of Hawaii, Honolulu.

Staples, G. W. and D. R. Herbst. 2005. *A Tropical Garden Flora. Plants Cultivated in the Hawaiian Islands and other Tropical Places*. Bishop Museum, Honolulu. 908 pp.

Telfer, T. C. 1979. Successful Newell's Shearwater Salvage on Kauai. *'Elepaio*, 39: 71

_____, J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian seabirds to lights: Conservation efforts and effects of moon phase. *Wildlife Society Bulletin*, 15: 406-413.

U.S. Fish & Wildlife Service (USFWS). 1983. Hawaiian Dark-Rumped Petrel & Newell's Mano Shearwater Recovery Plan. USFWS, Portland, Oregon. February 1983.

_____. 2005a. 50 CFR 17. Endangered and Threatened Wildlife and Plants; Review of Species that are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petition; Annual

Description of Progress on Listing Actions. *Federal Register*, 70 No. 90 (Wednesday, May 11, 2005): 24870-24934.

U.S. Fish & Wildlife Service (USFWS). 2005b. Endangered and Threatened Wildlife and Plants. 50CFR 17:11 and 17:12 (Tuesday, November 1, 2005).

_____. 2012. Endangered and Threatened Wildlife and Plants; Endangered status for 23 species on Oahu and Designation of Critical Habitat for 124 species. Final Rule. *Federal Regi*ster, 77(181; Tuesday, September 18, 2012): 57648-57862.

_____. 2013. USFWS Threatened and Endangered Species System (TESS), online at URL: http://ecos.fws.gov/tess_public/StartTESS.do

Wagner, W. L., D. R Herbst, and S. H. Sohmer. 1990. *Manual of the Flowering Plants of Hawai'i*. University of Hawaii Press, Honolulu, Hawaii 1854 pp.

_____ and _____. 1999. *Supplement to the Manual of the flowering plants of Hawai'i*, pp. 1855-1918. *In:* Wagner, W.L., D.R. Herbst, and S.H. Sohmer, Manual of the flowering plants of Hawai'i. Revised edition. 2 vols. University of Hawaii Press and B.P. Bishop Museum.

Wilson, D.E., and D. M. Reeder, (Editors), 2005. *Mammal species of the world: a taxonomic and geographic reference.* 3rd edition. 2 vols. John Hopkins University Press. Baltimore, Maryland. 2142 pp.

Appendix C

Preliminary Engineering Report

PRELIMINARY ENGINEERING REPORT

FOR

1711 Kanapu‘u Drive

TMK: (1) 4-2-004:001
Kailua, O‘ahu, Hawai‘i

December 2017

OWNER:

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1.0 Introduction

The purpose of this report is to describe the preliminary engineering design for development of a single-family home at 1711 Kanapuʻu Drive, Kailua, Oʻahu, by MDHE, LLC (Owner). This report evaluates the existing site conditions and defines requirements for roadway, water, wastewater, and drainage utilities, along with other site improvements.

2.0 Proposed Project

2.1 Location

The project site is located in Kailua, on the island of Oʻahu in the State of Hawaiʻi. The site lies within the traditional moku of Kailua and the ahupuaʻa of Koʻolaupoko, and is bounded by the Kailua Bluffs, formerly Kaopa Subdivision (Kanapuʻu Drive, Kahako Place, and Kahako Street), to the South and the West, a water storage tank and residence in the Keolu Summit development at the end of Aunauna St. to the North, and two State conservation land areas zoned as P-1 to the East. The proposed single-family home will occupy a maximum developable are of 5,000 square feet which is 0.3% of the 37-acre parcel (TMK: (1) 4-2-004:001). Refer to Figure 1, Location Map and Figure 2, Project Area Map.

2.2 Project Location

The proposed project is to construct a single family residential dwelling with supporting property elements, including an improved access driveway to meet emergency access codes. The landowner also proposes to convert the existing non-native dominated vegetation in a 6-acre area to native plants under a Management Plan approved by the Forest Stewardship Program of the State of Hawaiʻi Division of Forestry and Wildlife. A garden plot of approximately 0.5 acres will be established to grow food for the family's use.

3.0 Existing Conditions

3.1 Access

The property has street frontage along Kanapuʻu Drive and has been given an address of 1711. Kanapuʻu Drive is owned and maintained by the City and County of Honolulu (CCH). It is a two-way, two-lane, asphalt paved roadway, 40-foot wide from curb to curb.

Current vehicular access to the property requires 4-wheel drive along a rudimentary jeep road established prior to current ownership; there is no existing driveway apron.

3.2 Water System

The City and County of Honolulu Board of Water Supply (BWS) operates two water systems (water mains), for two different pressure zones, along Kanapuʻu Drive. The existing 8-inch main is on the Windward 272 system, and the existing 12-inch main is on the Kailua Heights 390 system. BWS would determine which system could best serve the property at the time of permit issuance.

3.3 Wastewater System

There is an existing 8-inch sewer main along Kanapu‘u Drive which would be used to service the property. However, there is no existing sewer lateral. The main is owned, operated, and maintained by the CCH. An application for sewer connection to the parcel was approved by CCH.

3.4 Drainage

The project area lies within a 21.7-acre drainage area that flows to a 54-inch culvert below Kanapu‘u Drive, which is owned and maintained by CCH. The balance of the property (13.9 acres) is not affected by the project and overland flows either to the north toward Aunaunu Street or south to a drainage system along Kahako Street. See Figure 3, Existing Runoff Map which shows the project area’s drainage basin and existing drain ditches that convey runoff to the 54-inch culvert located under Kanapu‘u Drive.

The 54-inch culvert inlet capacity is 128.8 cfs based on the EDP Hawaii Inc. Drainage Report for Kaopa Subdivision Unit 4 Phases VI-B and VII (1990). The Kaopa Drain Report, updated May 27, 1988, shows drainage boundaries applicable to this project. Refer to Figure 3, Runoff Map.

Calculations for runoff from the site under the 10-year recurrence interval, 1-hour duration total 93.7 cubic feet per second (cfs). Runoff from the site for the higher 50-year recurrence interval, 1-hour duration totals 125.0 cfs. Figure 3 shows the areas that attribute to the flow calculations: Ditch-1 (6.2 acres), Ditch-2 (1.6 acres), and the balance (13.9 acres) attributes to overland sheet flow.

According to the Flood Insurance Rate Map (FIRM) 15003C0380H (11/05/2014), the site is located in Flood Zone X, which includes areas determined to be outside the 0.2% annual chance of floodplain. Refer to Figure 5, Flood Map.

Existing Drainage Calculations:

Reference:

“Storm Drainage Standards,” August 2017, City & County of Honolulu, DPP.

“Drainage Report for Kaopa Subdivision Unit 4-Phases VI-B and VII”, May 1990, EDP Hawaii Inc.
Q=CIA

Existing Conditions for Project’s Drainage Basin:
The project’s drainage basin is 21.7 acres as stated in the drainage section, above. The 54-inch culvert that collects runoff from the project’s drainage basin has an inlet capacity of 128.8 cfs as shown above.

Existing Project Area Calculations:

Runoff Coefficient, C (From Table 1):
C = 0.6 (Band 2; steep forested and steep grass meadows)

Time of Concentration, Tc (From Plate 5):
Representative flow path length, L = 1,890 feet
Average Slope along path length, s = (370’-70’)/1,890’ = 15.9%
Tc = 9 minutes

10-Year Rainfall Intensity, i (From Plate 1; Tm=10 year) = 3.0 inches/hour
Correction Factor, CF (from Plate 4) = 2.4
Corrected Rainfall Intensity, I = CF x i = 3.0 x 2.4 = 7.2 inches/hour

50-Year Rainfall Intensity, i (From Plate 2; Tm=50 year) = 4.0 inches/hour
Correction Factor, CF (from Plate 4) = 2.4
Corrected Rainfall Intensity, I = CF x i = 4.0 x 2.4 = 9.6 inches/hour

Area of Project Area Basin, A = 21.7 acres
Q = C x I x A
Q_{10} = 0.6 x 7.2 x 21.7 = 93.7 cubic feet per second (cfs)
Q_{50} = 0.6 x 9.6 x 21.7 = 125.0 cfs

4.0 Proposed Infrastructure Improvements

4.1 Access

Existing vehicular access to the site will be facilitated by a proposed apron located along Kanapu‘u Drive. The concrete apron will be 24 feet wide.

An access road will be routed along the hillside, rising nearly 150 feet in elevation along the approximate 1,220 linear foot length to the dwelling. Preliminary design of the access road considered City and County of Honolulu Fire Department (HFD) access requirements, including 20-foot clear width with a 16-foot wide travel way, and truck turnaround near the home. The final design will require approval by the HFD Plans Division.

4.2 Water System

Based on the BWS’s “Water System Standards, 2002,” the project will require an average daily demand of about 500 gallons per day (gpd) based on the single-family residence, the meter is anticipated to be no bigger than 1-inch. The water system will be sized according to the Uniform Plumbing Code (UPC), 1997. See water demand calculations, following:

Water Demand Calculations

Per the City and County of Honolulu, Department of Water Supply, *Water System Standards*, dated 2002.

Single family units = 1 units

Consumption Guidelines:
Single family Residential = 500 gallons/unit

Average Daily Demand (ADD) =
Single family Residential = 500 gallons/unit x 1 units = 500 gallons

Maximum Daily Demand (1.5 x ADD) = 1.5 x 500 gpd = 750 gallons/day (gpd)

Maximum Fire Flow (*Single family with sprinklers) = 500 gallons/minute (gpm)

*Per the City and County of Honolulu Fire Code, a single-family dwelling unit with fire sprinklers installed shall have a fire flow requirement that is half of the required flow stated.

The standard fire flow required for the dwelling, which is anticipated to be fire sprinklered, is 500 gpm for a 1-hour period. This will use a proposed 4-inch detector check (DC) meter for fire flow, with a 6-inch fire water line that will service a privately owned on-site fire hydrant. The fire water line will continue from the hydrant and service the fire sprinklers for the dwelling unit. Refer to water demand calculations above.

The layout of the domestic and fire water lines shall be determined during the design stage of the project. For preliminary design purposes, the domestic and fire waterlines were assumed to follow the access driveway. See Figure 4 - Site and Utility

4.3 Wastewater System

Based on the City’s “Wastewater System Standards,” the dwelling will generate an average daily flow of about 320 gpd of wastewater. See wastewater demand calculations below:

Wastewater Demand Calculations

Per the City and County of Honolulu, Design Standards of the Department of Wastewater Management, Volume 1, dated July 1993.

Residential homes for the project = 1 home
Wastewater contribution for the home = 80 gallons/day/capita
Occupancy = 4 capita/home
Contribution = (1 home) x (80 gallons/day/capita) x (4 capita/home)
= 320 gallons/day (gpd)

The dwelling will be serviced by a new 6-inch sewer lateral which will connect to the existing 8-inch main along Kanapu‘u Drive.

The layout of the sewer lateral shall be determined during the design stage of the project. For preliminary design purposes, the sewer line is assumed to follow the access driveway. See Figure 4 Site and Utility Plan.

4.4 Grading

Grading will be required to create a level pad for the dwelling and for the access driveway. The dwelling’s pad elevation for the lower level is anticipated to be at 244-feet mean sea level (msl).

The access road is anticipated to include excavation or embankment where needed. Retaining walls of up to 3-feet in height are proposed where needed to reduce the footprint of disturbed area along the access road.

The overall proposed grading is approximately 4,700 cubic yards (cy) of excavation and 7,300 cy of fill, having a net fill of approximately 2,600 cubic yards (this earthwork quantity does not account for subgrade requirements that is usually recommended by a geotechnical engineer). The table below shows earthwork quantities in the Urban District and Conservation District.

	Cut (cy)	Fill (cy)	Net (cy)	Net (cut/fill)
Urban District	30	1,700	1,670	Fill
Conservation District	4,670	5,600	930	Fill
Overall	4,700	7,300	2,600	Fill

Use of short retaining walls will reduce the estimated grading area. Refer to Figure 6 Conceptual Grading and Drainage Plan.

Erosion control Best Management Practices (BMP) will comply with the State, County and Federal regulations during all phases of construction. A National Pollutant Discharge Elimination System (NPDES) general permit coverage authorizing discharges of storm water associated with construction activities will be required for the project from the State Department of Health, Environmental Management Division, Clean Water Branch.

4.5 Drainage

The proposed project will be designed to minimize any adverse effect on the basic drainage pattern of the area. To the extent possible, basic drainage ways will not be altered nor will the extent of the land tributary to each drainageway be changed.

The project will result in an increase of storm drainage runoff of approximately 2.8%. This increase is not considered excessive and will be accommodated by existing gullies. No changes are anticipated to the existing drainageways.

Drainage will remain as overland flow throughout the site. Runoff from the dwelling unit will be collected from roof downspouts which will discharge to rain gardens or planter boxes. There will be drainage culverts located along the access road to allow overland flow to follow natural drainage patterns.

Based on a 10-year and 50-year recurrence interval, 1-hour duration rainfall, the post-construction runoff for the project is approximately 95.3 cfs and 127.1 cfs respectively. The proposed flow conditions do not exceed the inlet capacity of the culvert in Kanapu‘u Drive (128.8 cfs).

Proposed Conditions for Project’s Drainage Basin:

Project Area Peak Flow Calculations at the existing 54-inch Culvert:
Runoff Coefficient, C (From Table 1):

Basin Area Description	C-Value	Area (ac)	% of Basin Area
Existing	0.60	21.7	100%
Proposed Pervious	6.0	21.1	97.2%
Proposed Impervious	0.95	0.6	2.8%
Total		21.7	100%

Therefore, a weighted C-Value for the 21.7 acres = 97.2% x .6 + 2.8% x 0.95 = 0.61

Since the most hydraulically remote portion of the project basin and flow path in the basin to 54-inch culvert is unaffected by the project, the Time of Concentration, and therefore, the rainfall intensities remain the same as the pre-project condition.

Tc = 9 min
I_{10} = 6.9 inches/hour
I_{50} = 8.8 inches/hour.

Area of Project Area Basin, A = 21.7 acres

Q = C x I x A

Q_{10} = 0.61 x 7.2 x 21.7 = 95.3 cfs
Q_{50} = 0.61 x 9.6 x 21.7 = 127.1 cfs

Proposed Access Road Culvert Peak Flow Calculations:
Drainage culverts are proposed to be located along the access road near stations 0+90 and 3+65 to allow overland flow to follow natural drainage patterns. At station 0+90, two (2) side-by-side HDPE corrugated drainage culverts, each with a diameter of 36”, will convey its proposed sub-basin’s flow of approximately 89.6 cfs. At station 3+65, an HDPE

corrugated drainage culvert, with a diameter of 24", will convey its proposed sub-basin's flow of approximately 12.4 cfs. See drainage calculations below:

Proposed Conditions for 2- 36" Culverts (Access Road, STA 0+90) Drainage Basin:

STA 0+90 Q_{10} (Project Area) + Q (Ditch-1) = 69.5 + 20.1 = 89.6 cfs
STA 0+90 Q_{50} (Project Area) + Q (Ditch-1) = 92.72 + 20.1 = 112.8 cfs

Proposed Conditions for 24" Culvert (Access Road, STA 3+65) Drainage Basin:

Runoff Coefficient, C (From Table 1):
C = 0.6 (Band 2; steep forested and steep grass meadows)

Time of Concentration, Tc (From Plate 5):
Representative flow path length, L = 420 feet
Average Slope along path length, s = 36 %
Tc = 5 minutes

10-Year Rainfall Intensity, i (From Plate 1; Tm=10 year) = 3.0 inches/hour
Correction Factor, CF (from Plate 4) = 2.75
Corrected Rainfall Intensity, I = CF x i = 3.0 x 2.75 = 8.2

50-Year Rainfall Intensity, i (From Plate 2; Tm=50 year) = 4.0 inches/hour
Correction Factor, CF (from Plate 4) = 2.75
Corrected Rainfall Intensity, I = CF x i = 4.0 x 2.75 = 11.0

Area of Basin, A = 2.5 acres

Q_{10} = 0.6 x 8.25 x 2.5 = 12.4 cfs
Q_{50} = 0.6 x 11 x 2.5 = 16.5 cfs

The project has a disturbed area greater than 1 acre (Figure 6). According to the Administrative Rules, Title 20, Chapter 3, "Rules Relating to Water Quality," the project is classified as a Priority A project (disturbed area greater than 1 acre). The project is required to provide Best Management Practices (BMPs) that will meet the criteria for Priority A projects under the standards for storm water quality. The selection and design of the BMPs will occur during the design stage.

5.0 Conclusion

The proposed improvements for this project will be designed in accordance with the applicable rules and regulations of the City and County of Honolulu. Future utilities will provide adequate potable and fire water, wastewater conveyance, and storm drainage management for the project. Based on the foregoing study, the existing utility infrastructure has capacity to service the proposed improvements for this project.

6.0 References

City and County of Honolulu, *Design Standards* of the Department of Wastewater Management, Volume 1, dated July 1993.

City and County of Honolulu, Department of Planning and Permitting, *Storm Drainage Standards,* dated August 2017.

City and County of Honolulu, Administrative Rules, Title 20, Department of Planning and Permitting, Chapter 3, *Rules Relating to Water Quality,* adopted August 16, 2016.

City and County of Honolulu, Department of Water Supply, *Water System Standards*, dated 2002.

City and County of Honolulu, Fire Code of the City and County of Honolulu, Revised Ordinances of Honolulu, Chapter 20.

EDP Hawaii Inc., Drainage Report for Kaopa Subdivision Unit 4-Phases VI-B and VII, dated May 1990.

Figure 1: Location Map

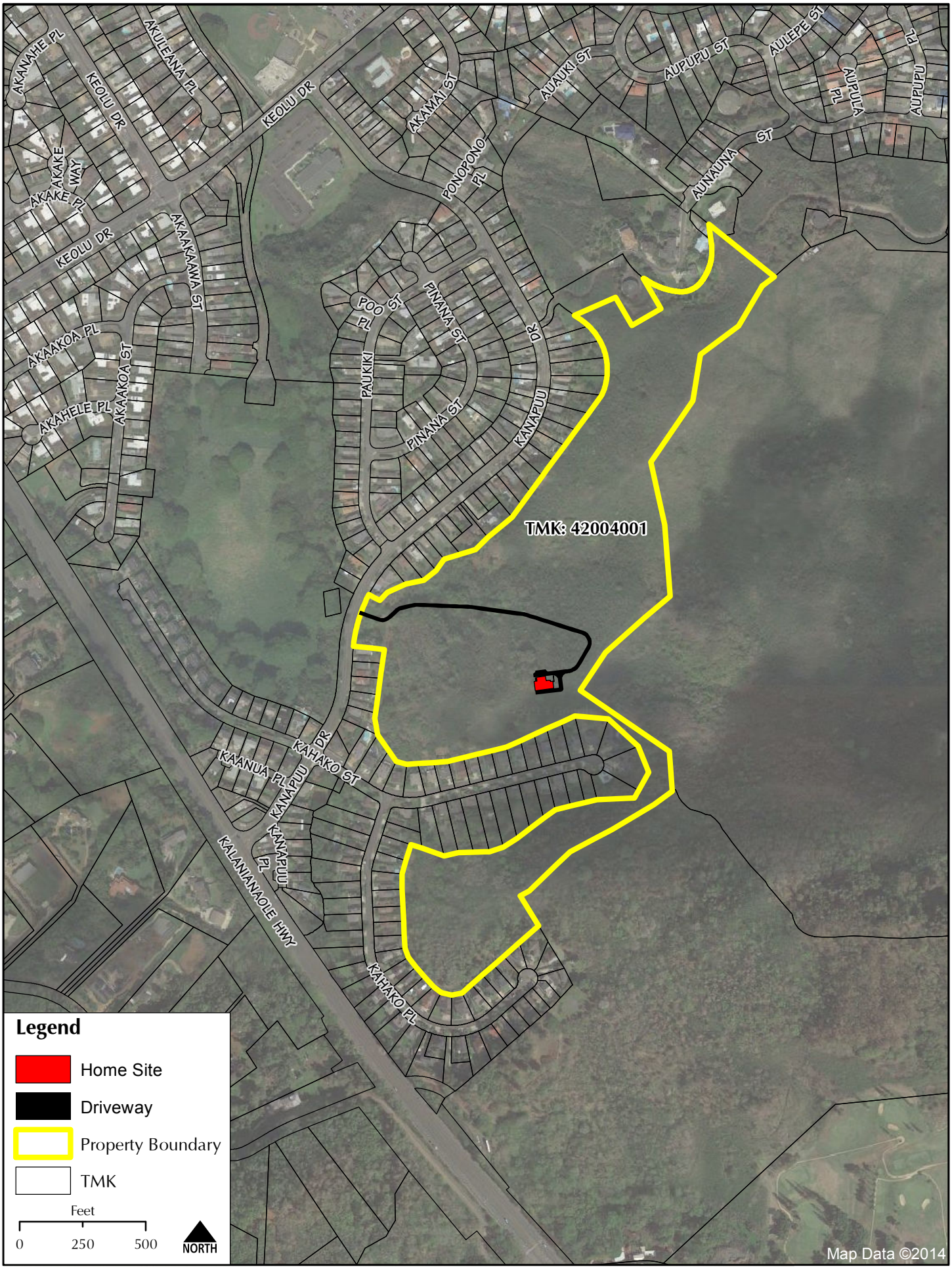
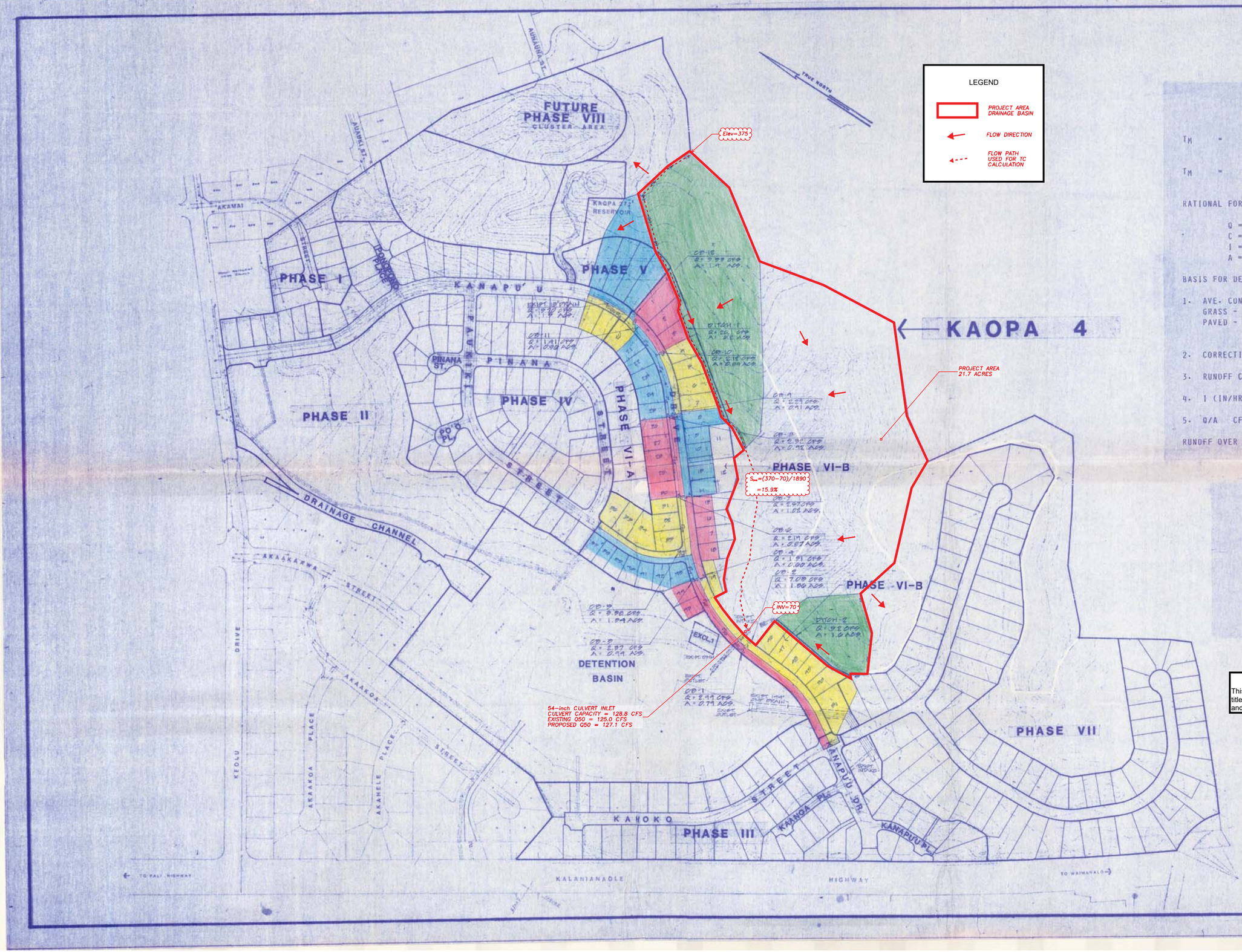


Figure 2: TMK MAP

UPDATED
APRIL 22, 1987
OCTOBER 15, 1987
MAY 27, 1988



HYDROLOGIC FACTORS

T_M = 10 YRS
ONE HR RAINFALL = 2.0 IN/HR

T_M = 50 YRS
ONE HR RAINFALL = 3.0 IN/HR

RATIONAL FORMULA: Q = CIA

Q = RUNOFF (CFS)
C = RUNOFF COEFFICIENT
I = RAINFALL INTENSITY (IN/HR)
A = AREA (ACRES)

BASIS FOR DESIGN OVER DEVELOPED AREAS

		T_C	TM_{10}	TM_{50}
1.	AVE. CONDITION			
	GRASS - 110' @ 1%	15 MIN		
	PAVED - 250' @ 10%	3 MIN		
		18 MIN		
2.	CORRECTION FACTOR		1.8	1.8
3.	RUNOFF COEFFICIENT		0.7	0.7
4.	I (IN/HR)		2.0	3.0
5.	Q/A CFS/AC		2.52	3.78

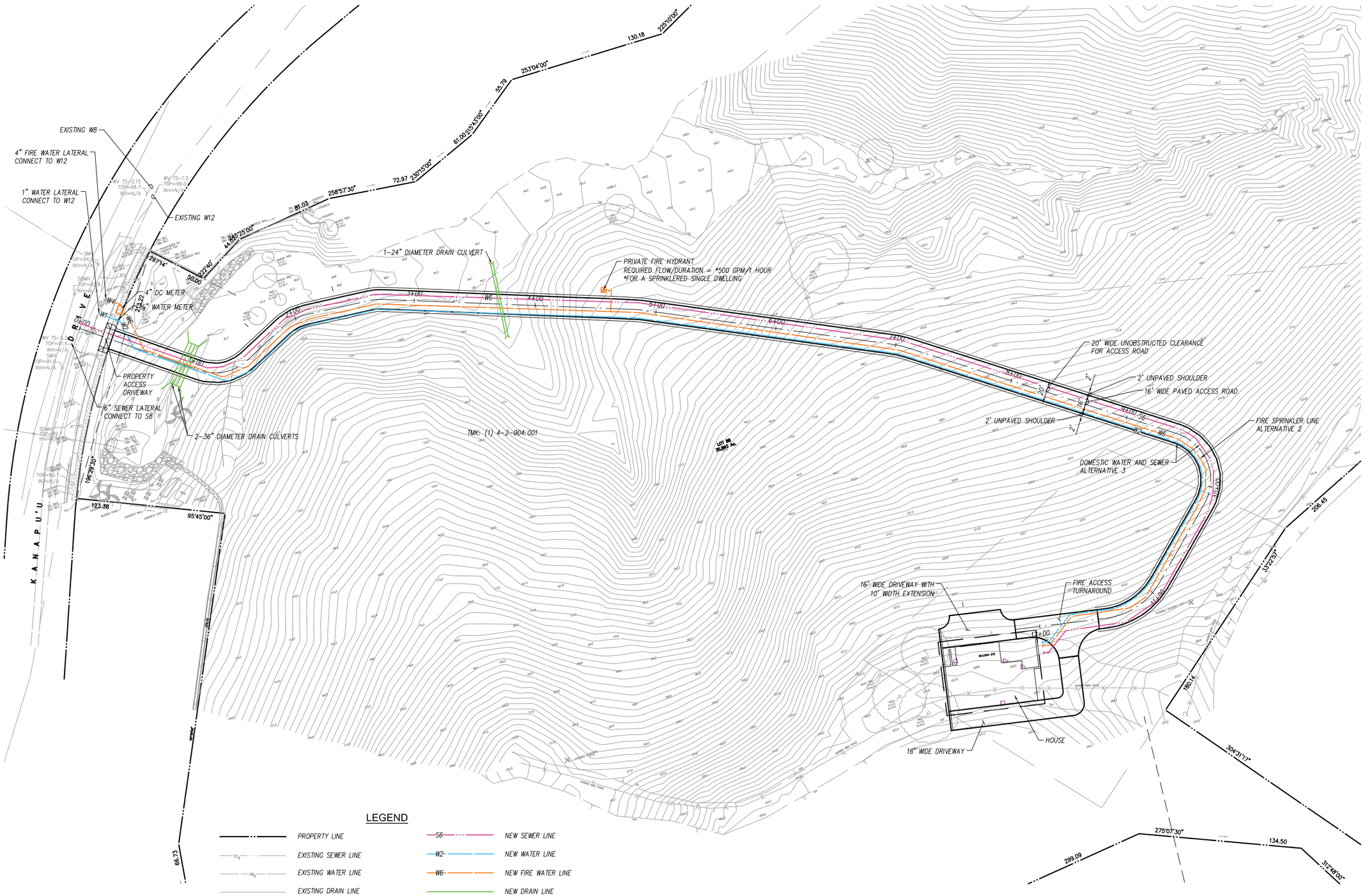
RUNOFF OVER UNDEVELOPED AREAS DETERMINED ON CASE BY CASE BASIS.

	DITCH-1	DITCH-2
L (FT)	500	340
S (FT/FT)	0.30	0.28
T_C (PLATE 4)		
DENSE GRASS (MIN)	17	17
CF	1.8	1.8
I50 (IN/HR)	3.0	3.0
R	0.6	0.6
A (AC)	6.2	1.6
Q50 (CFS)	20.1	5.2

FIGURE 3 - RUNOFF MAP
This map is modified from the "Runoff Map" for the drainage report titled, "Drainage Report for Kaopa Subdivision Unit 4-Phases VI-B and VII, May 1990, EDP Hawaii Inc.

KAOPA 4 PHASE VI-B
RUNOFF MAP

KAOPA 4
PRELIMINARY DEVELOPMENT PLAN



925 BETHEL STREET, FIFTH FLOOR
HONOLULU, HI 96813-4398
808.523.5866
WWW.G70.DESIGN

CONCEPTUAL SITE AND UTILITY PLAN

CAD DRAWING: 213037-01 SITE AND UTILITY PLAN.DWG
SCALE: 1" = 40'
DATE: 5/13/2017
PROJECT #: 213037-01

FIGURE
4

FILE LOCATION: P:\Civil 3D Projects\C3D 213037-01 Kanapuu Drive CDUA_1 Preliminary Design\213037-01 SITE AND UTILITY PLAN.dwg

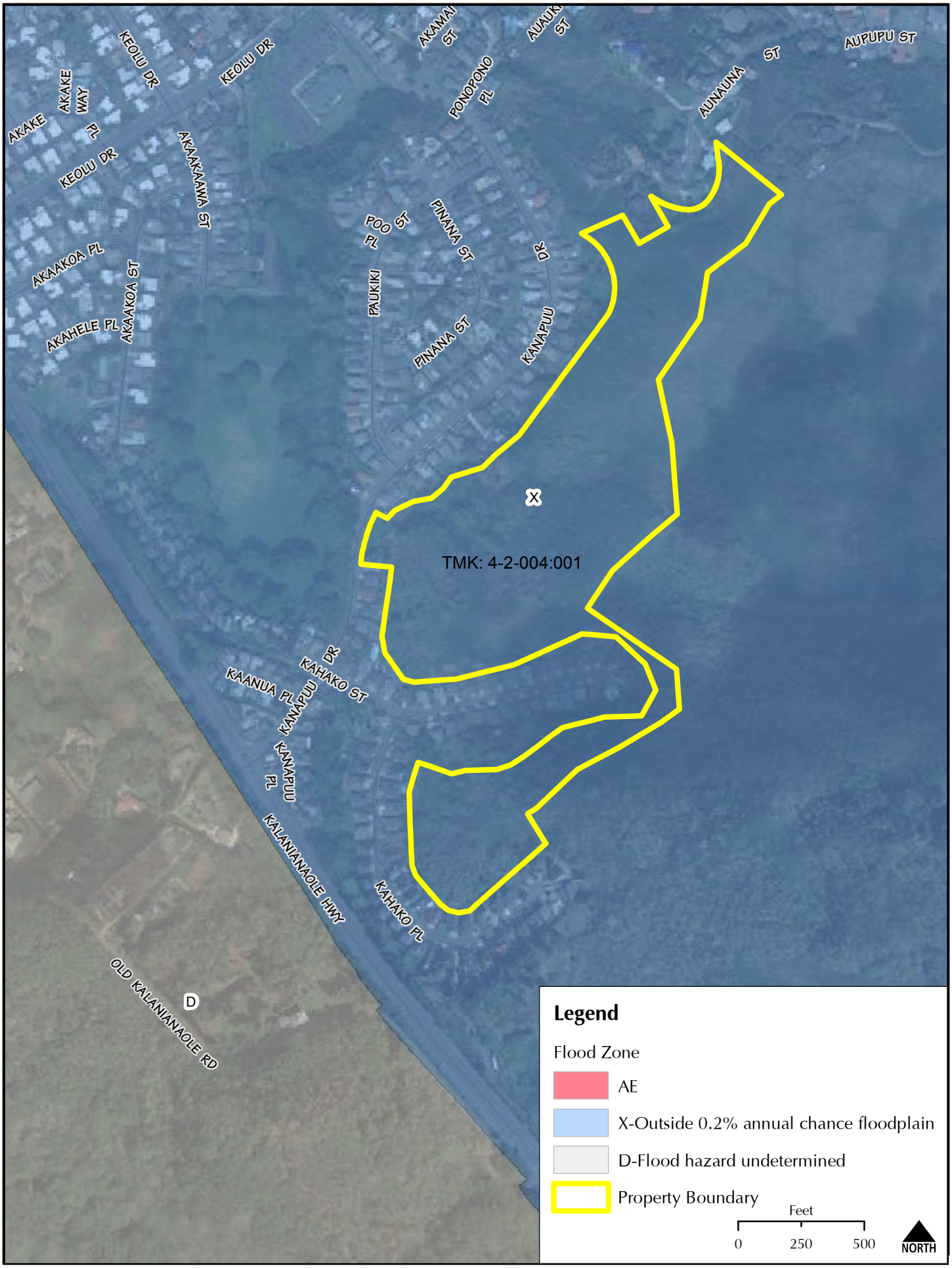
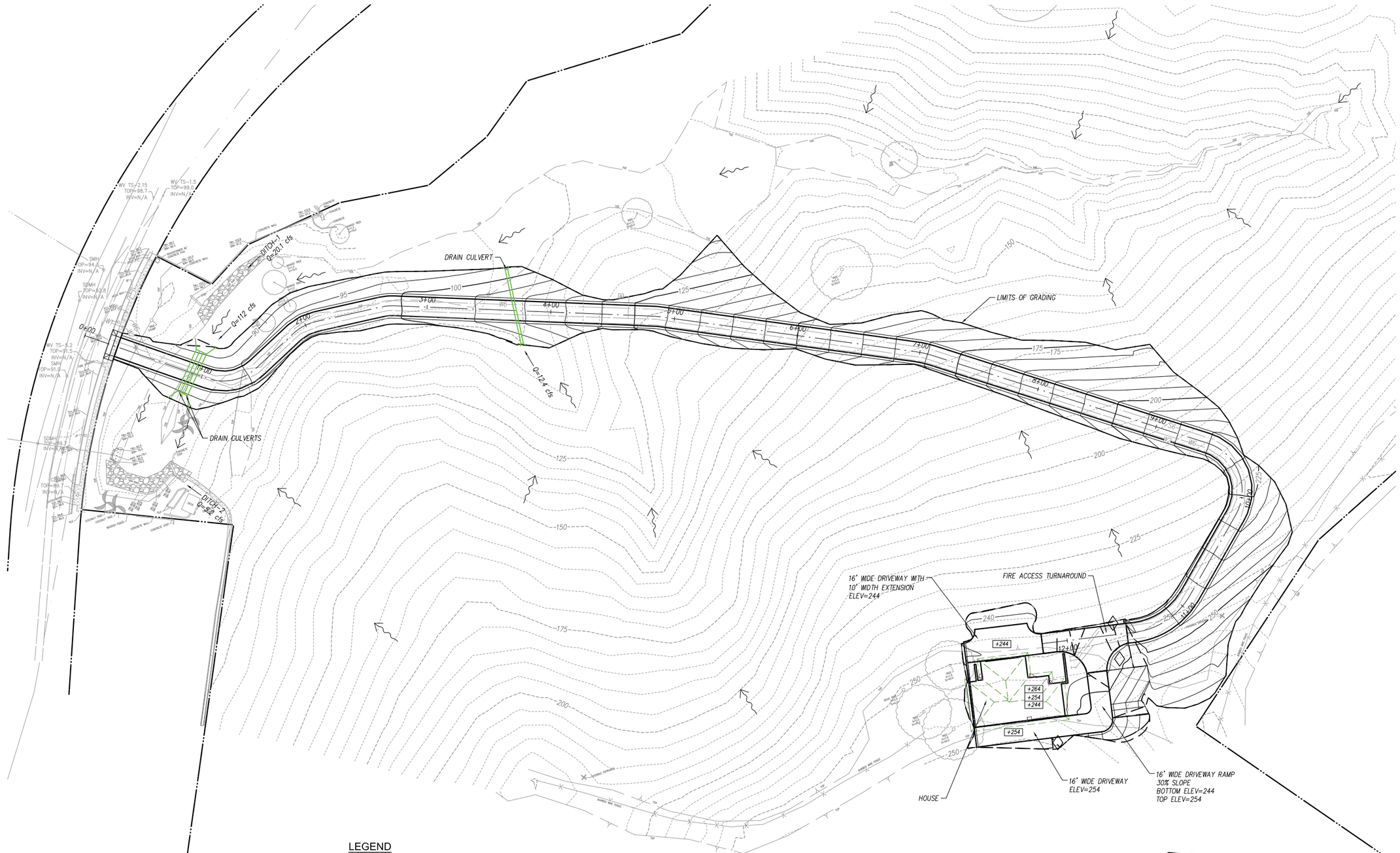


Figure 5: Flood Map



LEGEND

PROPERTY LINE	NEW SEWER LINE
EXISTING CONTOUR	NEW WATER LINE
PROPOSED CONTOUR	NEW FIRE WATER LINE
LIMITS OF GRADING/DISTURBED AREA	NEW DRAIN LINE
EXISTING DRAIN LINE	+244 DRIVEWAY FINISH FLOOR ELEVATION
FLOW DIRECTION	+264 HOUSE ROOF HEIGHT ELEVATION +254 HOUSE UPPER FINISH FLOOR ELEVATION +244 HOUSE LOWER FINISH FLOOR ELEVATION

EARTHWORK SUMMARY

EXCAVATION	= 4,700	CUBIC YARDS
EMBANKMENT	= 7,300	CUBIC YARDS
AREA TO BE GRADED	= 1.61	ACRES
AREA TO BE DISTURBED	= 1.62	ACRES

NOTE: QUANTITIES ARE FOR PERMITTING PURPOSES ONLY AND SHALL NOT BE INCLUDED IN BIDS.

SCALE FOR 22" X 34"

1" = 40' 40 20 0 40 80

925 BETHEL STREET, FIFTH FLOOR
HONOLULU, HI 96813-4398
808.523.5866
WWW.G70.DESIGN

CONCEPTUAL GRADING AND DRAINAGE PLAN

CAD DRAWING: 213037-01 GRADING PLAN.DWG
SCALE: 1" = 40'
DATE: 5/13/2017
PROJECT #: 213037-01

FIGURE 6

FILE LOCATION: P:\Civil 3D Projects\C3D 213037-01 Kanapuu Drive CDUA_1 Preliminary Design\213037-01 GRADING PLAN.dwg

Appendix D

Archaeological Literature Review

FINAL— Literature Review for 1711 Kanapuʻu Drive, Kailua Ahupuaʻa, Koʻolaupoko District, Island of Oʻahu, Hawaiʻi

TMK: (1) 4-2-004:001 (por.)

Prepared For:

G70
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813

December 2017

Keala Pono Archaeological Consulting, LLC ●PO Box 1645, Kāneʻohe, HI 96744 ● Phone 808.381.2361

FINAL—Literature Review for 1711 Kanapuʻu Drive, Kailua Ahupuaʻa, Koʻolaupoko District, Island of Oʻahu, Hawaiʻi

TMK: (1) 4-2-004:001 (por.)

Prepared For:

G70
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813

Prepared By:

Windy McElroy, PhD
and
Dietrix Duhaylonsod, BA

December 2017

Keala Pono Archaeological Consulting, LLC ● PO Box 1645, Kāneʻohe, HI 96744 ● Phone 808.381.2361

MANAGEMENT SUMMARY

Keala Pono Archaeological Consulting prepared a cultural and historical resources literature review for 1711 Kanapuʻu Drive in Kailua Ahupuaʻa, Koʻolaupoko District, on the island of Oʻahu, where a single-family home and access road are proposed. This work was designed to identify any historic properties that may be located on the parcel in anticipation of the proposed construction. The literature review consisted entirely of library and published research. No new archaeological fieldwork was conducted. A previous archaeological inventory survey did not identify any surface remains in the project area, therefore it is not expected that any pre- or post-contact surface architecture will be found there.

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INTRODUCTION

At the request of G70, Keala Pono Archaeological Consulting conducted a literature review for 1711 Kanapuʻu Drive in Kailua Ahupuaʻa, Koʻolaupoko District, on the island of Oʻahu, where a single-family home and access road are proposed. This work was designed to identify any historic properties that may be located on the parcel in anticipation of the proposed construction. It consisted entirely of a literature review, including archaeological studies on the parcel, with no archaeological fieldwork conducted.

The report begins with a description of the project area and a historical overview of land use and archaeology in the area. Results of the literature review are summarized, and recommendations are made in the final section. Hawaiian words and flora and fauna are defined in a glossary at the end of the document.

Project Location and Description

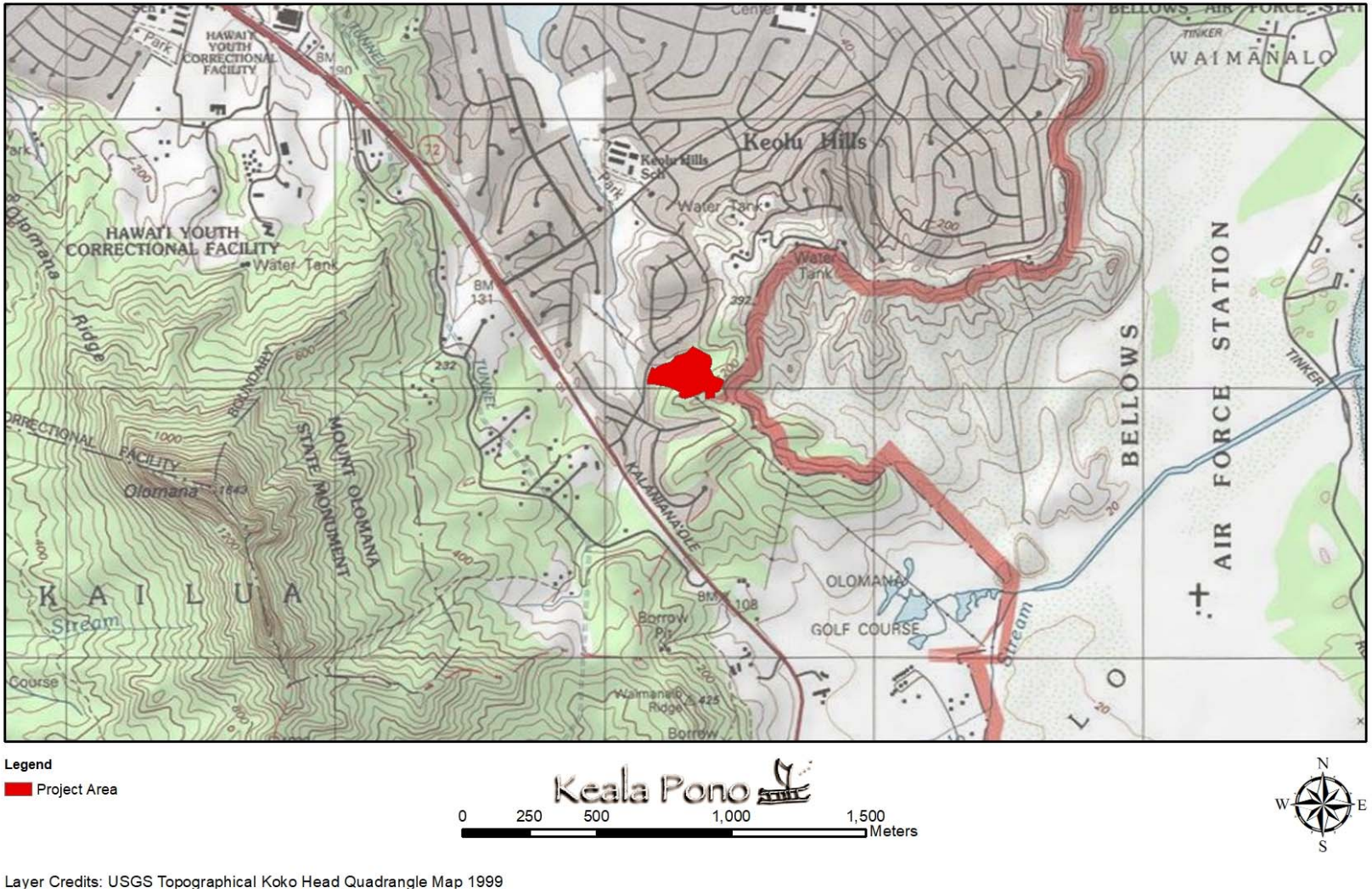
TMK: (1) 4-2-004:001 is a 36.89-acre parcel that lies within Kailua Ahupuaʻa, Koʻolaupoko District, on the windward side of Oʻahu (Figures 1 and 2). The property is located at 1711 Kanapuʻu Drive, the entrance of which is within the Kailua Bluffs Subdivision. Bellows Air Force Station (BAFS) and the Waimānalo Ahupuaʻa boundary are to the east; the Keolu Hills Subdivision lies to the north, and the Kailua Bluffs and Kaopa Subdivisions are to the west and south of the property. The property is owned by MDHE, LLC. An unimproved access road currently runs through the parcel, and the remainder of land within the property is undeveloped.

The proposed project aims to construct a single-family home on the parcel with an access road. With a vision of low-impact and sustainable systems, the home will include a rooftop photovoltaic (PV) system with battery storage backup. Additional uses of the parcel will include conservation and stewardship activities in a portion of the site, to reduce erosion, improve soil conditions, and to transform low-benefit, non-native dominated landscape into a native plant dominated lowland forest and shrub land. The access road will ascend from 1711 Kanapuʻu Drive, and has been designed in consultation with the Honolulu Fire Department Plans Review to ensure width and grade will accommodate emergency vehicles.

Approximately 8 acres of the 36.89-acre property are considered as the project area (Figure 3). This acreage includes two potential homesites (only one of which will be selected for construction), as well as the access road and planting areas. A previous archaeological inventory survey was conducted for the project (Dagher et al. 2014). Revisions were required by the State Historic Preservation Division (SHPD) (Log No. 2014.1898, Doc. No. 1409TR02). These revisions were made and the report was resubmitted (Dagher et al. 2015). Further information was requested by SHPD, to include a description of the scope of work, a map showing previous archaeological investigations in the area, and a map of the project area (Appendix). These items were provided to SHPD by G70 in 2017 and are also included herein.

Physical Environment

The project area is varied in topography, mostly situated on the rolling hills at the boundary of Kailua and Waimānalo. Elevation ranges from approximately 24–110 m (80–360 ft.) above mean sea level (amsl). An intermittent section of Kaʻelepulu Stream lies 35 m (115 ft.) west of the western boundary of the property. Kaʻelepulu Pond is 1,100 m (3,600 ft.) to the north, and the coastline of BAFS is 2,300 m (7,500 ft.) to the east. According to Foote et al. (1972), soils on the parcel are classified as part of the Lolekaa-Waikane association, which are deep, well-drained soils with a dominantly fine-textured subsoil, found on terraces, fans, and uplands. Specifically, soils are almost entirely Papaa clay 35–70% slopes (PYF), with a very small portion of the parcel on the west consisting of Alaeloa silty clay 15–35% slopes (AeE) (Figure 4). The project area receives approximately 105 cm (41 in.) of rainfall annually (Giambelluca et al. 2013), and vegetation is dominated by koa haole forest.



Layer Credits: USGS Topographical Koko Head Quadrangle Map 1999

Figure 1. Project area on a 1999 USGS Koko Head quadrangle.

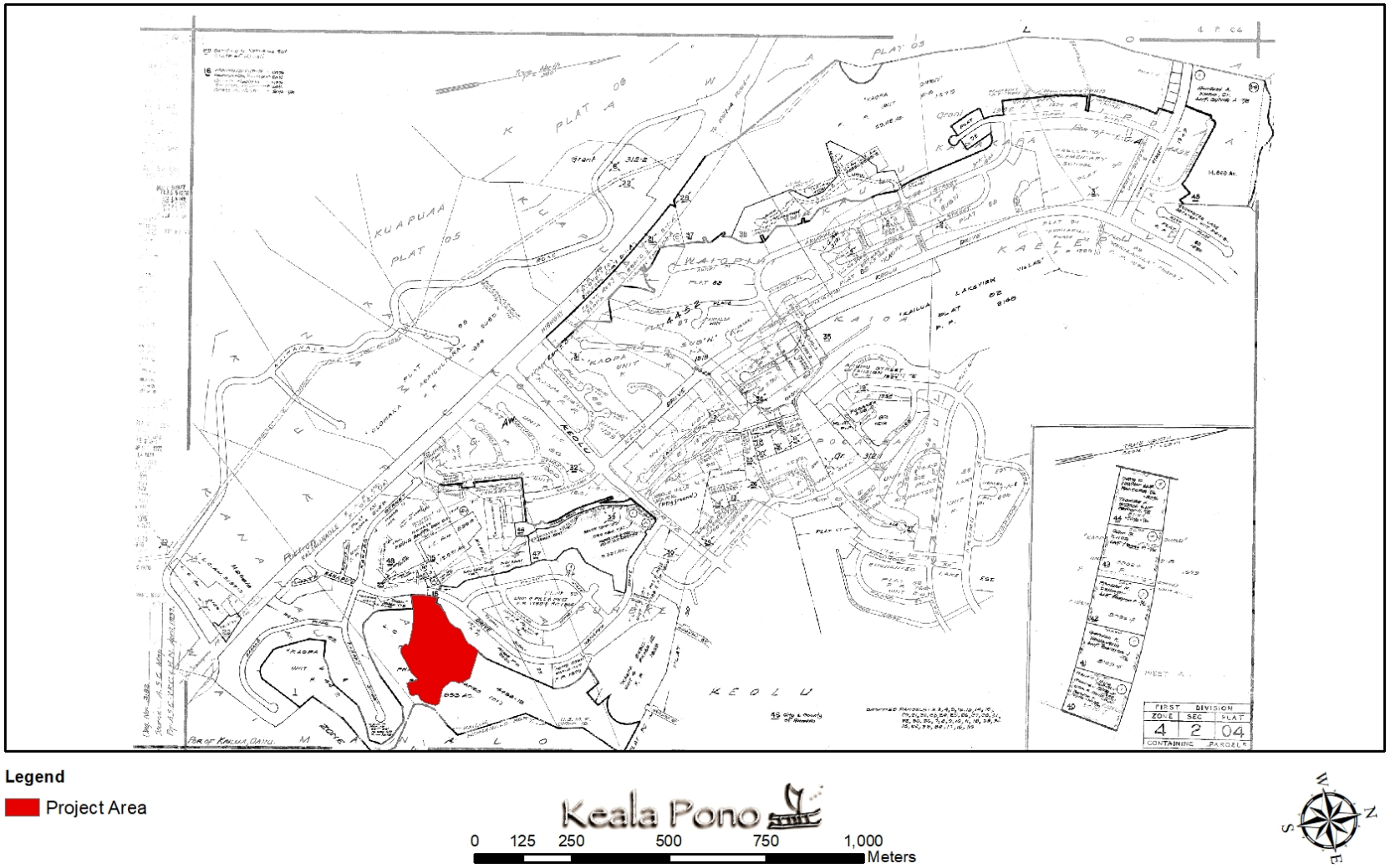


Figure 2. Project area shown on TMK plat (1) 4-2-004.

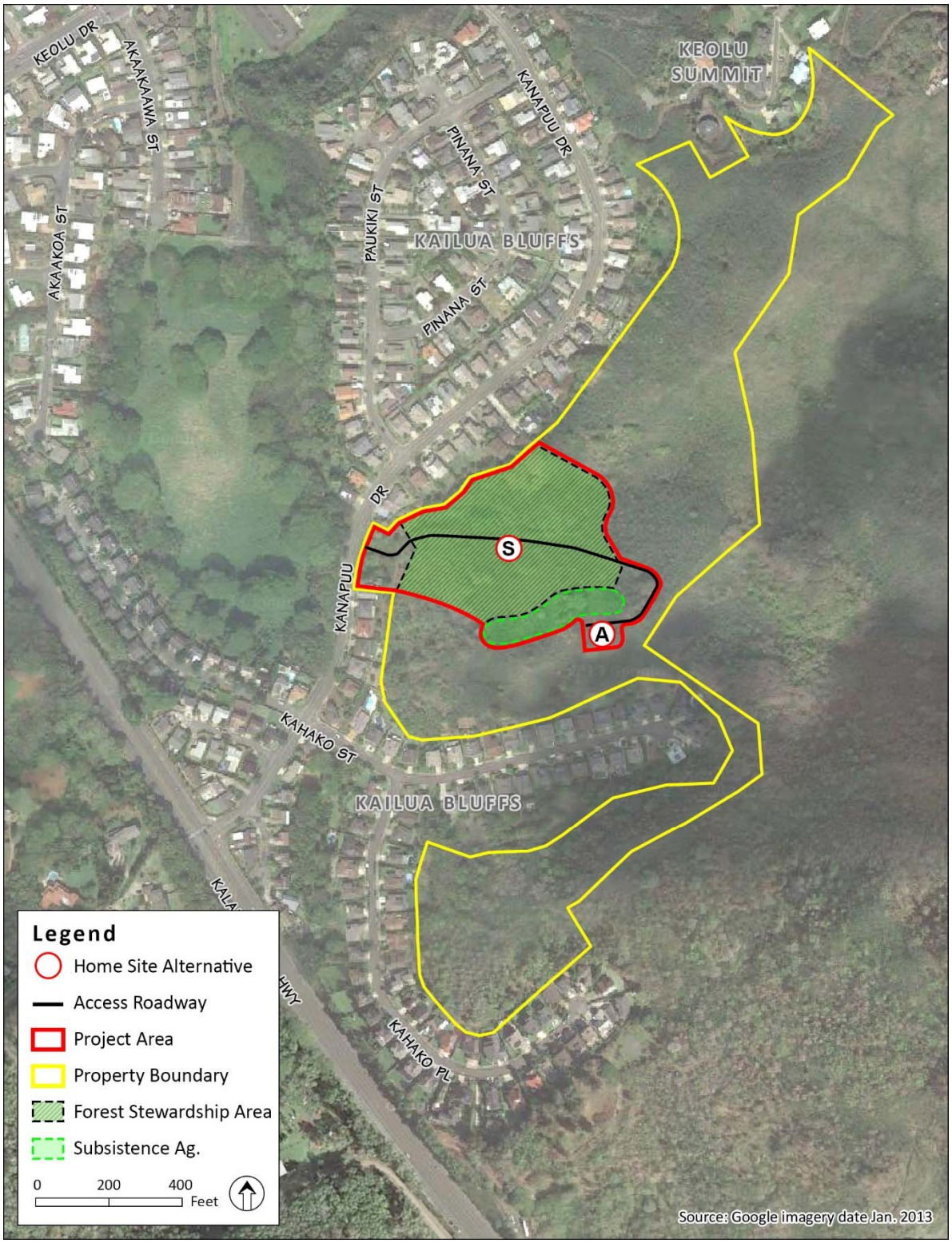


Figure 3. The project area within TMK: (1) 4-2-004:001 (courtesy of G70).

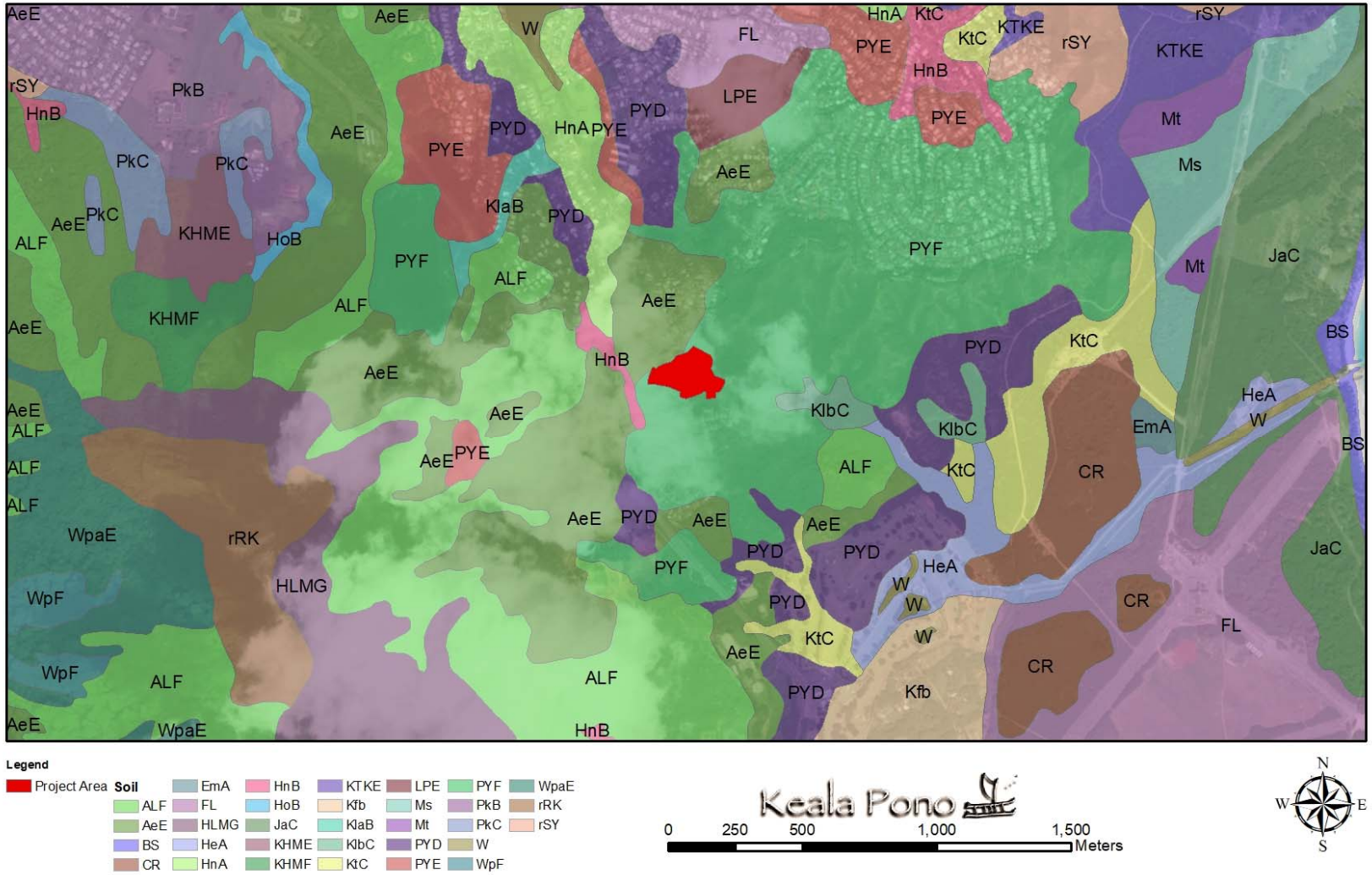


Figure 4. Soils in the vicinity of the project area. Data from Foote et al. (1972).

BACKGROUND

A brief historic review of Kailua is provided below, to offer a better holistic understanding of the use and occupation of the project area. In the attempt to record and preserve both the tangible (i.e., traditional and historic archaeological sites) and intangible (i.e., moʻolelo, ʻōlelo noʻeau) culture, this review assists in the discussion of anticipated finds. Research was conducted at the Hawaiʻi State Library, the University of Hawaiʻi at Mānoa libraries, the SHPD library, and online on the Office of Hawaiian Affairs website and the Waihona Aina, Huapala, and Ulukau databases. Archaeological reports and historical reference books were among the materials examined.

Kailua in the Pre-Contact Era

> Native traditions describe the formation (literally the birth) of the Hawaiian Islands and the presence of life on and around them, in the context of genealogical accounts… As this Hawaiian genealogical account continues, we find that these same god-beings, or creative forces of nature who gave birth to the islands, were also the parents of the first man (Hāloa), and from this ancestor, all Hawaiian people are descended. It was in this context of kinship, that the ancient Hawaiians addressed their environment. (Maly and Maly 2003)

The history of Kailua begins with the history of Oʻahu Island:

> Oʻahu is also a new name, given in memory of an ancestor of the people of Oʻahu. Lolo-imehani, Lalo-waia, and Lalo-oho-aniani were the ancient names of Oʻahu. Oʻahu was the child of Papa and Lua… and because Oʻahu was a good chief and the people lived harmoniously after the time of Wākea mā, Oʻahu's descendants gave the name of their good chief to the island --- Oʻahu-a-Lua. (Kamakau 1991:129)

Many of Oʻahu's great rulers over the centuries chose Kailua to be their seat of governance and/or their seat of residence. Among these were: ʻOlopana, who ruled in the 1200s; Kumuhonua, who ruled in the 1400s; Kākuhihewa, who ruled in the 1500s; and Kūaliʻi, who ruled from the late 1600s into the early 1700s (Hall 1998).

Of particular note to the current project area is the court, government houses, and one of the island residences of the great chief Kākuhihewa:

> Kākuhihewa maintained residences in ʻEwa, at Waikīkī, and at Kailua in Koʻolaupoko. At ʻĀlele in Kailua he built his "government house," Hale Aupuni. It was forty anana long and fifteen anana wide; Pāmoa was its name. All these were done here: storytelling, distribution of lands, recalling traditions of the ancestors, reciting of genealogies, practicing of battle skills, wielding of war clubs, thrusting of spears, observation of omens, study of land features, study of the stars, playing kōnane learning the mele of the ancestors and chiefs, running, learning to leap from cliffs, maika rolling, dart throwing, boxing, hand wrestling, sitting wrestling, shoulder wrestling, hand-to-hand fighting, all kinds of sports that strengthened the body, cultivating, and fishing. (Kamakau 1991:69)

Generations after Kākuhihewa's reign, his descendant, Chief Kūaliʻi also established his seat of government on the plain of ʻĀlele, and likewise was the more recent chief Peleiōhōlani, "a grandfather of Kamehameha I," drawn to the same area, choosing "'ĀIele as a favorite place, building himself a simple house there" (Kailua Historical Society 2009:195).

Place Names

There are other means, besides archival documentation, by which Hawai‘i’s history has been preserved. One often overlooked source of history is the information embedded in the Hawaiian landscape. Hawaiian place names “usually have understandable meanings, and the stories illustrating many of the place names are well known and appreciated… The place names provide a living and largely intelligible history” (Pukui et al. 1974:xii).

The current project area and the places around it are listed in “Place Names of Hawaii” along with the meanings of their names and/or other comments about the specific locales:

> ‘Ālele. Land area in the approximate center of Kailua, O‘ahu, formerly a plain called Kulao-‘Ālele, a sports area.
>
> Ka‘elepulu. Pond. (Former fishpond), stream… now called Enchanted Lake, Kailua, O‘ahu. Lit., the moist blackness.
>
> Kailua. Land division, bay, stream… Lit., two seas (probably currents).
>
> Ka‘iwa…Peak and ridge above Lanikai, O‘ahu, where frigate birds (‘iwa) are often seen.
>
> Kalaheo. Land section… (Today, commonly pronounced Kalaheo) Lit., the proud day.
>
> Kalapawai. Land division… Lit., the water ridge.
>
> Kalua-o-Pele. Crater, Waimānalo, O‘ahu. Lit., the pit of Pele.
>
> Ka‘ōhao. Old name for Lanikai… Lit., the tying (two women were tied together here with a loincloth after being beaten in a kōnane game).
>
> Kawai Nui. Swamp, fishpond… Lit., the big water.
>
> Keolu. Land section, subdivision, elementary school, drive, playground, Kailua, O‘ahu. [no translation given]
>
> Ko‘olau Poko. District, southern windward O‘ahu. Lit., short Ko‘olau.
>
> Lanikai. Section of Kailua, surfing beach… Development here began in 1924; the name was changed from Ka‘ōhao to Lanikai, in the belief that it meant ‘heavenly sea’ (Honolulu Advertiser, August 15, 1948). This is English word order; in Hawaiian the qualifier commonly follows the noun, hence Lanikai means ‘sea heaven, marine heaven’.
>
> Maunawili. Land sections… Lit., twisted mountain.
>
> Mōkapu. Peninsula, land division... Lit., taboo district (mō- is short for moku).
>
> Olomana. Peak (1,643 feet high), ridge, stream… named for a legendary giant who jumped from Kaua‘i to this peak. Lit., forked.
>
> Oneawa. Land division… Lit., milkfish sand. Oneawa was famous for great quantities of ‘ō‘io, and perhaps also awa fish (Sterling and Summers 5:246).
>
> Waimānalo. Land division, bay, beach… Lit., potable water.
>
> (Pukui et al. 1974:10, 61, 69, 70, 73, 75, 79, 85, 98, 99, 108, 117, 129, 149, 150, 153, 154, 170, 225)

Subsistence and Traditional Land Use

In early Hawaiian history, O‘ahu’s windward coast was noted for its “many attractive bays, beaches, and stream-watered lowlands and valleys all the way from Kailua to La‘ie” (Handy et al. 1991:268). Bays throughout Hawai‘i, such as the one at Kailua, “generally had a cluster of houses where the

families of fishermen lived" (Handy et al. 1991:287). But the added abundant resources of Kailua's perennial streams and thriving fishponds clearly promoted a regional population that was greater than that of other areas. The ahupuaʻa of Kailua, along with Kāneʻohe, "was rich in fishponds and tillable lands, [and it] was the seat of the ruling chiefs of Koʻolaupoko (Short Koʻolau) which was the southern portion of the windward coast" (Handy et al. 1991:272). Handy et al. further illustrate why the Kailua area was a choice place to live, citing not only the fishponds and streams but also the extensive wetlands which were converted into agricultural terraces:

> Undoubtedly further reasons for the attractiveness of Kailua as a place of residence for an aliʻi nui with his large entourage were the great natural fishponds, Kaʻelepulu and Kawainui, and the complex of artificial salt-water ponds that are between Kailua and Kaneʻohe in the Mokapu area: Halelou, Nuʻupia, and Kaluapuhi. In former times, Kailua must have been very rich agriculturally, having one of the most extensive continuous terrace areas on Oahu, extending inland one and a half miles from the margin of Kawainui Swamp. Terraces extended up into the various valleys that run back into the Koʻolau range. There were some terraces watered by springs and a small stream from Olomana mountain along the western slope of the ridge that lies southeast of Kawainui Swamp, and another system of terraces was east of the seaward end of the ridge, watered by the stream which joins Kawainui and Kaʻelepulu Ponds. There were also terraces north of the Kawainui Pond, and several terrace areas flanked Kaʻelepulu Pond at the base of the ridge to the eastward. (Handy et al. 1991:457)

From mountain to sea, the district of Kailua also had its fair share of religious structures to serve the needs of its burgeoning population. One of Kailua's temples was the heiau, Kanahau, which was characterized "as being the class devoted to increasing food (hoʻoulu ʻai)" (Handy et al. 1991:387). At least two temples were constructed and dedicated to human sacrifice: Pahukini Heiau on the Kapaʻa slopes, and Kawaewae Heiau on the ridge of Puʻu Papaʻa, both said to have been built by Chief ʻOlopana (Hall 1998). ʻOlopana is said to have built other temples in Kailua, including Holomakani Heiau near Kawainui, but "of the five heiau attributed to ʻOlopana, only two remain relatively intact… [both of which] were placed on the National Register in 1972" (Kelly and Nakamura 1981:3).

One more important thing to point out regarding the land use of Kailua during its pre-contact history is the locale of burials. Numerous pre-contact burials have been inadvertently discovered within the sandy areas of Kailua fronting its bay such as Oneawa, Kalāheo, Keahupuaʻanui, and Kawailoa. Likewise, pre-contact burials have been inadvertently discovered in the sandy area on the Waimānalo side of the Keolu Hills ridgeline. Note that these burials were most often found in sandy beach deposits, not the ridgeline where the project area is located.

Moʻolelo

As mentioned earlier, Hawaiian place names were connected to traditional stories through which the history of the places was preserved. These stories were referred to as "moʻolelo, a term embracing many kinds of recounted knowledge, including history, legend, and myth. It included stories of every kind, whether factual or fabulous, lyrical or prosaic. Moʻolelo were repositories of cultural insight and a foundation for understanding history and origins, often presented as allegories to interpret or illuminate contemporary life… Certainly many such [oral] accounts were lost in the sweep of time, especially with the decline of the Hawaiian population and native language" (Nogelmeier 2006:429–430). Still, many traditional stories managed to be recorded as Hawaiian society transitioned from an oral culture to a written one, and among those recorded were several versions of stories connected to the Kailua area.

Perhaps one of the most revealing aspects of the moʻolelo of Kailua is that they attribute many of the earliest construction works of the area, such as Ulupō Heiau (Sterling and Summers 1978) to the Menehune. According to Pammer and Hammatt (2014:15), "Kailua is one of the places where, following their arrival on Oʻahu from Kahiki, the Menehune (legendary race of small people) were assigned to live. These legendary workers are credited with the construction of numerous fishponds and religious structures." It can be debated, whether or not the Menehune were literally small people, and whether or not they were assigned to live in Kailua or decided to live there by their own free will, but what is more significant is that since they are of the earliest migrations to Hawaiʻi, the fact that they are credited with building many structures in Kailua suggests that Kailua, indeed, is one of the earlier places of Oʻahu to be settled in pre-history.

A relatively later migration to Kailua is chronicled by Kamakau. Perhaps this migration is thought to be after the Menehune because the names of the travelers and the name of their ship are still remembered:

> ʻO nā haole mua i ʻōlelo ʻia, ua hiki mai ma Koʻolau o Oʻahu, aia ma Kāneʻohe a me Kailua. I ka wā o ʻAuanini, ke aliʻi e noho ana ma Kapalawai [Kalapawai], ma Kailua, a ʻo Kaomealani ke aliʻi me Muaokalani, kāna wahine; e noho ana lāua ma Kaʻōpūloha i Kāneʻohe. Ua kū mai kekahi moku ma kai o Mōkapu, ʻo Ulupana ka inoa o ua moku lā; ʻo Mololana ke kāpena, a ʻo Mālaea ka wahine. A ʻo ka inoa o nā kānaka, ʻo ia hoʻi ʻo Olomana, ʻo Aniani a me Holokamakani; aia nō ko lākou mau inoa i kapa ʻia ma kekahi mau ʻāina a me nā puʻu kaulana. Na kēlā mau aliʻi i kapa i ko lākou mau inoa a hiki i kēia lā (Kamakau 1996:41).
>
> *The first foreigners, it is said, arrived at Koʻolau, Oʻahu, there at Kāneʻohe and Kailua, in the time of ʻAuanini, the chief who was living at Kapalawai [Kalapawai], at Kailua, and Chief Kaomealani with his wife Muaokalani, who were living at Kaʻōpūloha in Kāneʻohe. A ship anchored offshore of Mōkapu, Ulupana was the name of that ship; Mololana was the captain, and Mālaea was the wife. And the name of the people, they were Olomana, Aniani, and Holokamakani. Their names were indeed given to some lands and famous hills. Those were the chiefs who have given their names until today. [translation by D. Duhaylonsod]*

Several of the Kailua moʻolelo center on Kawainui. This implies the great significance of this resource to the history of the region. Like other fishponds, Kawainui was the home of a guardian spirit, also called a moʻo kiaʻi or akua moʻo. These guardian spirits looked after the well-being of the people ensuring that the land and/or sea would provide for the populace as long as the people remained good stewards. The guardian of Kawainui was a moʻo named Hauwahine, and Hauwahine's companion was the moʻo who dwelled near Kaʻelepulu Stream (Kelly and Nakamura 1981).

In addition to getting the benevolent help of their guardian spirits, the Kailua people also were assisted by the mythological tree, Mākālei. This tree came up from the sea, intending to go to Nuʻuanu. However, the shouting from the Menehune and other ʻeʻepa people caused Mākālei to fall near Kawainui. It became rooted there, and its magical powers attracted fish from the neighboring waters to the area (Kelly and Nakamura 1981).

So sustaining was the fishpond of Kawainui that even its mud was edible. The mud of Kawainui, or lepo ʻai ʻia, was purposely brought from Kahiki and put into the fishpond. According to a report by the Bishop Museum, a moʻolelo states that this mud even nourished Kamehameha and his warriors in more recent times:

> [The lepo ʻai ʻia mud] is found only there [at Kawainui]. When there was a shortage of taro in Kailua during the time Kamehameha and his warriors stayed there, the men of Kailua went to Kawainui Pond to get the edible mud. A strict kapu had to be imposed during diving for the mud. No one was allowed to utter a word at that time. If the kapu were broken, the ordinary mud in the pond would rise, cover the diver and drown him. (Kelly and Nakamura 1981:5)

Finally, one other moʻolelo that is pertinent to the current project area is the story connected to the Kaluaopele crater. This crater is situated on the Waimānalo side of the Keolu Hills ridgeline. The name of the crater means "The Pit of Pele," and it was said, "Pele dug here long ago and gave it up when she came to water. Much palolo clay was found here" (Sterling and Summers 1978:244).

Oli and Mele

The noteworthiness of specific locales in Hawaiian culture is further bolstered by their appearances in traditional chants. An oli refers to a chant that is done without any accompaniment of dance, while a mele refers to a chant that may or may not be accompanied by a dance. These expressions of folklore have not lost their merit in today's society. They continue to be referred to in contemporary discussions of Hawaiian history, identity, and values.

While there are numerous chants of old which give insight into the history and identity of Kailua, the chants shared here are contemporary ones composed in the traditional way. What is especially important about them is the reason they were composed. These chants are the product of the modern Hawaiian renaissance and how it has been manifested in renewed efforts to restore the traditional place-based stewardship of community resources. Kupuna Charles "Doc" Burrows explains how this movement has applied to Kailua:

> As community stewardship in Kailua has evolved, we have ultimately been drawn to the Kanaka Maoli customs and practices as a living guide to our work. Aloha ʻāina, love and respect the land, and mālama ʻāina, care for and protect the land and natural resources, have been embraced as core values underlying modern approaches to ecological restoration… Community involvement to protect the natural and cultural resources of the ahupuaʻa of Kailua began in the 1960s and early 1970s --- the Lani-Kailua Outdoor Circle stepped forward to spare Kawainui Marsh from becoming another shopping center… With the restoration of streams, taro pond fields, and diversified agriculture in Maunawili and Kahanaiki, Kailua can play a major role in much needed efforts to achieve greater sustainability and improved quality of life in our islands. Today, Kawainui/Hāmākua is recognized as a Ramsar wetland of international importance, a distinction shared with only twenty-seven other wetlands. (Kailua Historical Society 2009:266–267)

An oli komo and a pane were composed by Dr. Sam ʻOhukaniʻōhiʻa Gon III for community stewards doing restoration work in Kailua. The Oli Komo No Kawainui, or Entrance Chant for Kawainui, asks permission to enter the area, and the pane is the response that is chanted to answer the oli komo. Both of these chants refer to some of the natural and cultural features of Kailua. They are presented here in their entirety along with their translations as shared by the Kailua Historical Society (2009:266–267).

Oli Komo No Kawainui

KAHEA
Hāleʻaleʻa ka leo o ka ʻalae
He māpuna leo poloʻai i ka laʻi
He pule kānaenae i Ulupō
I ulu pono lā i Ulumawao

Kakali ka neke i ka nihi
I ka niʻo o ka wahinewai
Ke nihi ka hele nei, ē!
Ke nihi ka hele nei, ē!

CALL
Full is the voice of the ʻalae
A voice of invitation in the calm
A chant of request to Ulupō
That true inspiration reaches Ulumawao
The neke ferns await at the border
At the entrance of the woman-water
We proceed with due care now!
We proceed with due care now!

PANE
Māwehe ʻia ka neki i ka wai
E hōʻike i ka wai ʻānapanapa
Hōʻike pū nō ka manaʻo pono
E mai, hele mai, i Ulupō
E mai, hele mai, eia nō mākou

RESPONSE
The neki bulrushes part the water
Revealing the shimmering waters
Revealed along with your righteous intent
Approach, enter, at Ulupō
Approach, enter, here we are

ʻŌlelo Noʻeau

Like oli and mele, traditional proverbs and wise sayings, also known as ʻōlelo noʻeau, have been another means by which the history of Hawaiian locales have been recorded. In 1983, Mary Kawena Pukui published a volume of close to 3,000 ʻōlelo noʻeau that she collected throughout the islands. The introductory chapter of that book reminds us that if we could understand these proverbs and wise sayings well, then we would understand Hawaiʻi well (Pukui 1983).

Only three ʻōlelo noʻeau concerning Kailua are recorded in Pukui's compilation. Two of these are suggested to commemorate Kamehameha's visits to Kailua after taking control of Oʻahu. The third ʻōlelo noʻeau does not pertain to any particular historical person, but rather, it points out the hau trees which grow at Kailua and the characteristics of the rope which can be made from its bark. Here are the sayings as they appear in Pukui's publication (1983:60, 193, 230).

Hawaiʻi palu lāʻī.

Ti-leaf lickers of Hawaiʻi.

This saying originated after Kamehameha conquered the island of Oʻahu. The people of Kailua, Oʻahu, gave a great feast for him, not expecting him to bring such a crowd of people. The first to arrive ate up the meat, so the second group had to be content with licking and nibbling at the bits of meat that adhered to the ti leaves. In derision, the people of Oʻahu called them "ti-leaf lickers."

Kini Kailua, mano Kāneʻohe.

Forty thousand in Kailua, four thousand in Kāneʻohe.

> A great number. Said by a woman named Kawaiho‘olana whose grandson was ruthlessly murdered by someone from either Kailua or Kāne‘ohe. She declared that this many would perish by sorcery to avenge him. Another version credits Keohokauouli, a kahuna in the time of Kamehameha, for this saying. He suggested sorcery as a means of destroying the conqueror’s O‘ahu enemies.
>
> Mālama o ‘ike i ke kaula ‘ili hau o Kailua.
>
> *Take care lest you feel the hau-bark rope of Kailua.*
>
> Take care lest you get hurt. When braided into a rounded rope, hau bark is strong, and when used as a switch, it can be painful.

Kailua in the Historic Era

When the first Westerners arrived in the Hawaiian archipelago in 1778, the islands were not yet united under one sovereign. At that time, Kailua and the entire island of O‘ahu were under the rule of Chief Kahahana. In 1783, Chief Kahahana’s reign was ended with the invasion and victory of Chief Kahekili of Maui. This would forever be the end of O‘ahu’s independence as a separate island kingdom. When Chief Kahekili died in 1794, control of O‘ahu went to his son Kalanikūpule. The following year, Chief Kamehameha of Hawai’i Island invaded O‘ahu to engage Kalanikūpule in battle. Kamehameha overwhelmed Kalanikūpule’s warriors, effectively gaining control of all the islands from Hawai’i to O‘ahu. Eventually, Kamehameha would make a peaceful agreement with Chief Kaumuali‘i of Kaua‘i, bringing that island and Ni‘ihau into the fold and thereby uniting the Hawaiian archipelago under one rule (Kamakau 1996, Kanahele 1995).

Early Historical Accounts of Land Use in the Kailua Area

It is recorded that in 1778 James Cook became the first westerner to see the Hawaiian Islands. Following Cook, a wave of other western explorers landed on Hawai‘i’s shores. In 1779, William Bligh, the “sailing master of the HMS Resolution, and his fellow crewmembers, are the first Westerners to get a look at the shores and hills of Kailua ahupuaa” (Hall 1998:22). The midshipman George Gilbert remarked about the cultivation of the land and the relative lack of trees seen:

> The interior part is hilly, the shore low and exceeding(ly) well cultivated but very bare of wood. The Natives here don’t appear to be very numerous and as soon as we came near the land they ventured onboard, without any hesitation and were very friendly… and in the evening sailed from the island; which is called by the Natives Oowahoo. (Hall 1998:22)

Around the same time as the arrival of the first westerners to Hawai‘i, O‘ahu was experiencing major political changes. It was during this time, as mentioned above, that O‘ahu’s sovereignty ended with the invasion of the Maui chiefs, and the Maui rule was subsequently overcome by the invasion of the forces from Hawai‘i Island. Yet throughout this tumultuous period, Kailua remained an important seat of O‘ahu governance. Kailua retained its prominence after the invasion of Kahekili from Maui in 1783:

> In historic times Kahekili, the high chief of Maui, battled the O‘ahu chiefs and finally killed Kahahana, taking his place as high chief [of O‘ahu]… [Kahekili] chose… and settled in Kailua with several of his supporting chiefs. (Kelly and Nakamura 1981:6)

And a decade later, after the invasion of Kamehameha from Hawai‘i Island, Kailua again retained its significance as a place of rule. Kamehameha not only lived and ruled from there, but the new king himself also worked in the fishponds of Kailua as an encouragement to his chiefs and commoners to be productive and raise food:

> The last, and most notable, chief who had attachments to Kailua and to Kawainui was Kamehameha I. He conquered Oʻahu in 1795, and had the problem of feeding the members of his retinue, far away from their homes on the Island of Hawaiʻi. Kamehameha I encouraged the development of the natural resources of Oʻahu to provide his chiefs and followers with sufficient food… While he [Kamehameha] lived on Oahu he encouraged the chiefs and commoners to raise food and he went fishing and would work himself at carrying rock or timber. They all saw that he labored himself with his own hands. He worked at the fishponds at Kawainui, [and] Kaʻelepulu. (Kelly and Nakamura 1981:7)

When Kamehameha died in 1819, his windward lands were divided between his sons Liholiho and Kauikeaouli. Kailua Ahupuaʻa went to the younger son, Kauikeaouli, who would later become Kamehameha III (Hall 1998).

Missionaries in Kailua

A year after Kamehameha passed away, the first missionaries arrived in the islands, coming from the New England states of America. They could not have come at a more opportune time because the traditional religious kapu system in Hawaiʻi had just been abolished (Hall 1998). The missionaries quickly went about preaching their brand of Christianity and setting up schools for the natives. Some of the earliest detailed post-contact records of the Kailua area come from the missionaries and their school endeavors in the early 1800s:

> The earliest school records are those from the journal of Levi Chamberlain in 1826 and 1828. In 1826, Chamberlain visited Kailua… and gave the name of the teacher there as Kaui. There were 154 scholars listed for the Kailua school… The earliest government school records for Koʻolaupoko are dated 1847 (Hawaiian Kingdom, Department of Instruction), and cover the events for the year 1846. Two types of schools are listed for Kailua: Protestant and Catholic. The Protestants had three teachers that years and the Catholics, two. The teachers for the Protestant schools were Kauhi, Kaima, and Kapihenui, and for the Catholics, Kapukila and Kamakauwila. Each teacher was on a different pay rate that varied between $.10 and $.25 per day. The Protestant students numbered 78 for all three schools and for the Catholics there were 54 students. Out of these, only 50 Protestant and 22 Catholic school students were listed as able to read. Only 31 Protestant and 22 Catholic students were reported adequate in mathematics. The report for Kailua dated 1848, covering the year 1847, listed only two teachers for the Protestants --- Kaina and Keliʻiokapalapala, whose pay was $.25 and $.18 per day, respectively. Together their students numbered 103. The Catholics had only one school, with 30 students who were taught by Kalama at a pay rate of $.125 per day. Of the total of 33 students in Kailua, the record indicates that 101 were adequate in reading, 87 in mathematics, 84 in world history and 71 in writing. Sixty-five passed their geography studies and 40 their music requirements. The 1847 report was submitted by the kahukula (superintendent of schools for the district), W.E. Pii. A report dated August 1848 lists only one Protestant teacher and no Catholic teachers for Kailua. All 64 students were being taught by Kaina, and among them were 41 boys and 23 girls. The locations of the schools in this early period is not known. (Kelly and Nakamura 1981:8–9)

Kailua and the Changes in Land Tenure

In the mid-1800s, during the reign of Kamehameha III, the Hawaiian kingdom became increasingly exposed to outside influences, and the Hawaiian monarchy faced a crossroads of major change. "The Constitution of 1840 confirmed that only two offices could convey allodial title. These were the mōʻī and the kuhina nui. The Māhele was an instrument that began to settle the constitutionally granted vested rights of three groups in the dominium of the kingdom—mōʻī, aliʻi, and the makaʻāinana"

(Beamer 2014:143). However, the king felt the difficulty of governing a land where the influence of foreigners had been growing. Dr. David Keanu Sai describes this predicament:

> Kamehameha III's government stood upon the crumbling foundations of a feudal autocracy that could no longer handle the weight of geo-political and economic forces sweeping across the islands. Uniformity of law across the realm and the centralization of authority had become a necessity. Foreigners were the source of many of these difficulties. (Sai 2008:62)

Moffatt and Fitzpatrick (1995) state that "several legislative acts during the period 1845–1855 codified a sweeping transformation from the centuries-old Hawaiian traditions of royal land tenure to the western practice of private land ownership." Most prominent of these enactments was the Māhele of 1848 which was immediately followed by the Kuleana Act of 1850.

> The Mahele was an instrument that began to settle the undefined rights of three groups with vested rights in the dominion of the Kingdom --- the government, the chiefs, and the hoaʻāina. These needed to be settled because it had been codified in law through the Declaration of Rights and laws of 1839 and the Constitution of 1840, that the lands of the Kingdom were owned by these three groups… Following the Mahele, the only group with an undefined interest in all the lands of the Kingdom were the native tenants, and this would be later addressed in the Kuleana Act of 1850. (Beamer 2008:194,195)

Although the Māhele had specifically set aside lands for the King, the government, and the chiefs, this did not necessarily alienate the makaʻāinana from their land. On the contrary, access to the land was fostered through the reciprocal relationships which continued to exist between the commoners and the chiefs. Perhaps the chiefs were expected to better care for the commoners' rights than the commoners themselves who arguably might have been less knowledgeable of foreign land tenure systems. Indeed, the ahupuaʻa rights of the makaʻāinana were not extinguished with the advent of the Māhele, and Beamer points out that there are "numerous examples of hoaʻāina living on Government and Crown Lands Post-Mahele which indicate the government recognized their rights to do so" (Beamer 2008:274).

> Hoaʻāina who chose not to acquire allodial lands through the Kuleana Act continued to live on Government and Crown Lands as they had been doing as a class previously for generations. Since all titles were awarded, "subject to the rights of native tenants." The hoaʻāina possessed habitation and use rights over their lands. (Beamer 2008:274)

For those commoners who did seek their individual land titles, the process that they needed to follow consisted of filing a claim with the Land Commission; having their land claim surveyed; testifying in person on behalf of their claim; and submitting their final Land Commission Award to get a binding royal patent. However, in actuality, the vast majority of the native population never received any land commission awards recognizing their land holdings due to several reasons such as their unfamiliarity with the process, their distrust of the process, and/or their desire to cling to their traditional way of land tenure regardless of how they felt about the new system. In 1850, the king passed another law, this one allowing foreigners to buy land. This further hindered the process of natives securing lands for their families.

Hundreds of land claims up and down windward Oʻahu were awarded to commoners. In the Koʻolaupoko District, 199 awards were "granted in the Kailua and Waimanalo ahupuaʻa, each averaging roughly 10 acres" (Hall 1998:53). However, most of the windward Oʻahu lands went to Kamehameha III's queen, Kalama, and to several of the other high chiefs. Kailua in particular found Queen Kalama as its dominant landholder with 10,665 acres, followed by Princess Kamāmalu. Their land claims in Kailua are described as follows:

> Kamamalu submitted her claims for the ili of Kaelepulu and Keolu; while Kalama's claims included Kawainui and the ili of Mokapu, Oneawa, and Keahupuaanui. (Hall 1998:52)

Two Land Commission Awards (LCA) have been documented in the current project area. They are LCA 44 and LCA 4452, as noted in a previous survey of the subject property:

> Land Commission Awards (LCA) for Kailua documented garden areas clustered around all eighteen permanent and perennial streams and in areas of natural springs. Two LCA are located within the project area, located near an unnamed stream, and are identified as LCA 44:2 and LCA 4452:12 on TMK (1) 4-2-004. According to the Waihona ʻAina Database (2014), LCA 44 M.A. (Royal Patent 8262) consisted of one half of the ʻili of Kaula (204 acres) and includes a portion of the project area. Land Commission Award 44 was awarded to Kalaau and signed by Kamehameha III at the "Royal Palace on 2 February 1848."… Land Commission Award 4452 included 11,885 acres within the ahupuaʻa of Kailua awarded to Queen Kalama and also included a portion of the project area. As specified in LCA 4452, these lands were awarded to Queen Kalama as house lots. (Dagher et al. 2015:12, 14)

Kailua in the late-1800s: Large-scale Agriculture and the Cattle Industry

Following the Resident-Alien Act in 1850 which allowed foreigners to "purchase (for the first time) fee simple lands in the islands… title to much of the land, which had only recently been made available to Hawaiian alii and commoners, is lost forever as it is passed into the hands of the newly arrived" (Hall 1998:54). Further up the windward coast in locales such as Kāneʻohe and Kualoa, private companies, headed by newcomers to the islands, started to increase their land holdings and consolidated them into large-scale sugar operations, bringing in laborers from China and elsewhere to work in the sugarcane fields (Hall 1998). The cultivation of both sugarcane and of pineapple, which would come after the turn of the century, would be attempted in Kailua but neither would be productive. Within a decade, the Chinese laborers moved off of the Kāneʻohe plantations and started rice-farming operations in Kailua:

> Chinese cane laborers from the Kaneohe plantations have been permitted to begin establishing rice paddies in Kailua's Kaelepulu pond area and the Kawainui marshes… Wetland taro, which had been actively cultivated in the Kaelepulu and Kawainui marshes for nearly 500 years, will shortly be thoroughly displaced in the ponds and wetlands for the new cash crop. (Hall 1998:62)

Besides large-scale agricultural enterprises, Kailua also saw the imprint of the cattle industry. By the end of the 1800s, ranching operations found their foothold on the Kailua flatlands. J.P. Mendonca and C. Bolte partnered and approached the Kailua landowner D. Rice "to lease 15,000 acres of Kailua's central landholdings to raise Angus beef cattle… [their future company] will come to own practically all of Kailua, except for the lands held by the Bishop Estate" (Hall 1998:91).

An early map found for this region, dated 1899, shows the smaller divisions of land within the ahupuaʻa of Kailua (Figure 5). The current project area is located on this map within the subdivision labeled as Kaioa, which is between Kuapuaa on the west and Kanahau on the east. The map shows a dtich that crosses through what is now Kalanianaʻole Highway. Several tunnels are labeled along the ditch, beginning with Tunnel No. 1 in Kanahau and Tunnel No. 2 in Kuapuaa. Numerous LCA awards and land grants are shown on the map, although none are depicted near the project area.

Another historic map, dated 1900, also shows the traditional names of the many ʻili throughout the ahupuaʻa (Figure 6). In contrast to the 1899 map (see Figure 5), this depicts the project area as

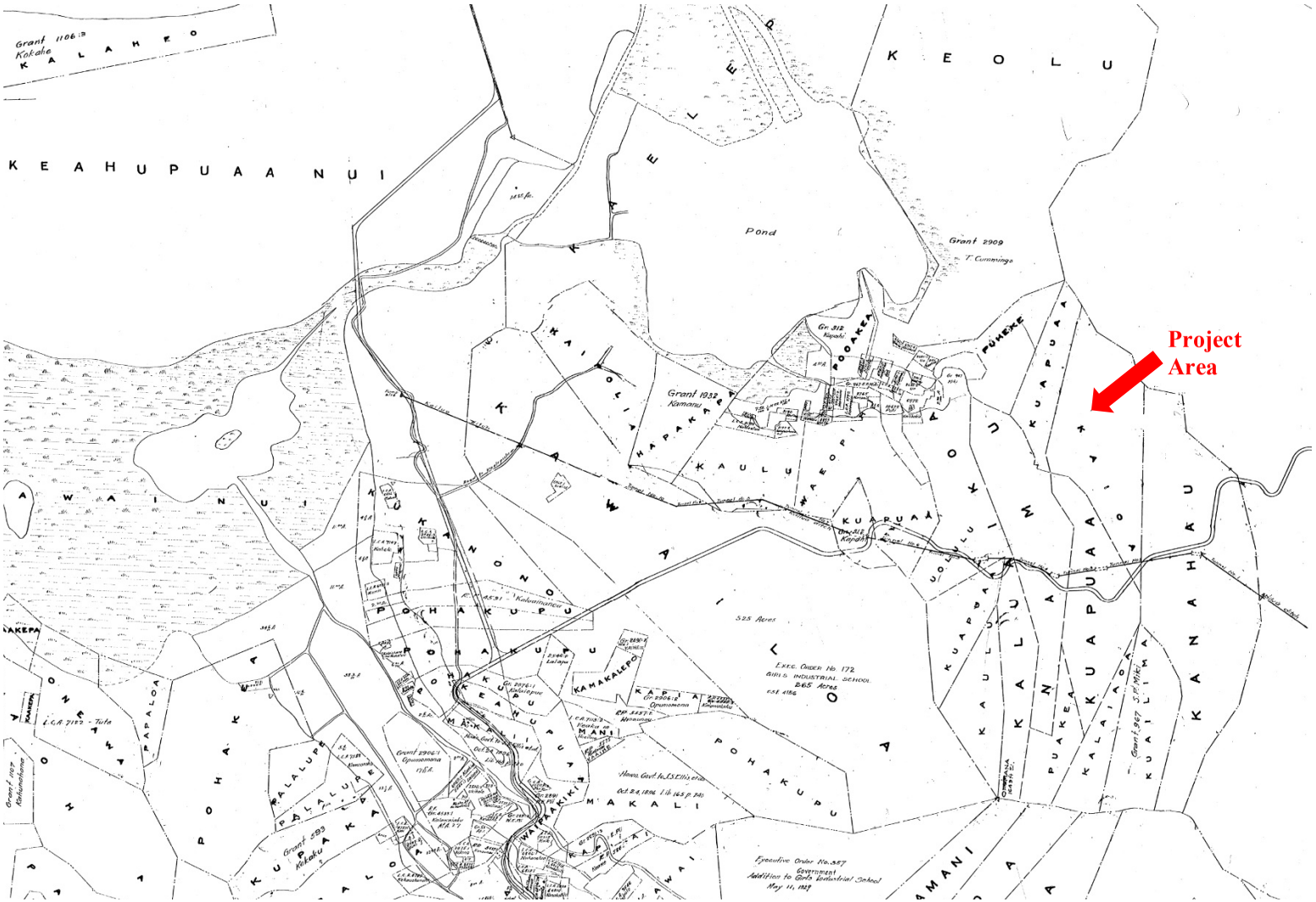


Figure 5. Portion of an early Kailua map (Wall 1899).

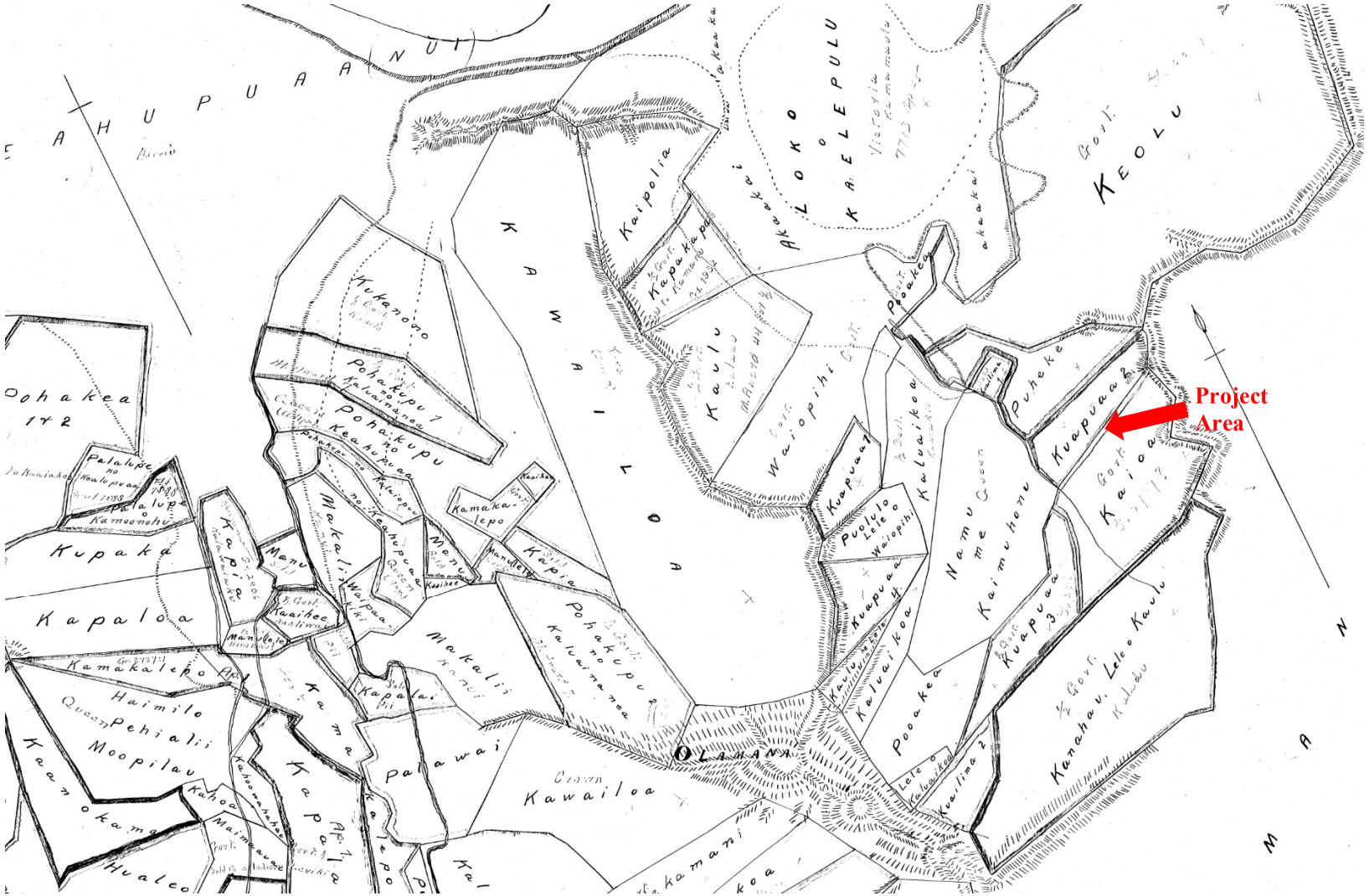


Figure 6. Portion of an early Kailua map (King 1900).

straddling the boundary of Kaioa and Kuapuaa. In addition, the discontiguous plots labeled as Kuapuaa are numbered, with the project area falling within Kuapuaa 2. Faint text on the map distinguishes the land owners, with several plots labeled as "Govt.," "Queen," or "Sold."

The 19th century ended with the overthrow of the Hawaiian monarchy and the subsequent annexation of the Hawaiian Islands by the United States of America. Thus Kailua saw great changes within that century. Its population was transformed from a native Hawaiian society under a monarchy to an increasingly multiethnic populace as a territory of the United States government. Its landscape reflected the changes, going from one primarily made up of kalo and other important native Hawaiian plants to one that added sugarcane, pineapple, rice, and the footprint of imported cattle brought by newcomers (Hall 1998).

Kailua in the 20th Century: Copra, Dairy Farming, and the Housing Market

In the first decade of the 20th century, the copra industry was also started in Kailua, beginning with the planting of 10,000 coconut trees in 1908 in "a large stretch of … grassy sand flats beyond the Kailua Bay shoreline (now Kalaheo and Oneawa Streets)" (Hall 1998:113). The next year, investors planted an additional 130,000 trees, many of which were imported from Samoa, and all of these coconut trees were "laid out on 320 acres behind the 4-mile stretch of Kailua's shoreline…The 140,000 plantings, each with a life span of 100 years, will shortly lend the area its name of Coconut Grove" (Hall 1998:113, 123).

Expanding out of the cattle ranching enterprises, Arthur Rice and Harold Castle established the earliest dairies in the coastal areas of Kailua. This occurred around 1910, with dairies located at today's Coconut Grove area, noted above (Kailua Historical Society 2009:182). Later, in the 1920s, the Campos family added their family dairy to the operations in Kailua, leasing land from Ka'elepulu and Olomana all the way to Bellows Beach in Waimānalo. "Initially, they trucked their raw milk to Meadow Gold (Dairymen's) in Honolulu for processing, but in the early 1950s the Campos, Moanalua, and Rico dairies united to form the Honolulu-based Foremost Dairy (Kailua Historical Society 2009:183).

Interestingly, as early as 1910 there was speculation of turning Kailua into a dream vacation destination of sorts. That year, "thirty-three 1-acre beachfront Kailua properties along Kalaheo Road are advertised in Honolulu for lease to those who wish to build summer cottages for their families on Kailua Bay's secluded 4-mile stretch of beach" (Hall 1998:117). In 1917, after the demand for coconut oil declined causing a decrease in copra profits, Arthur Rice of the Hawaiian Copra Company "plans to develop subdivision of 'tract housing' in the flat open coconut orchards… He initiates the first steps that, over time, will see Kailua become a year-round residential town… [and he] will become recognized as the founding father of what will develop as residential Kailua" (Hall 1998:123–124).

It should be noted that for a brief period during the World War II years, housing development, and also commercial ranching and agricultural operations, came to a standstill as military activities escalated throughout Kailua:

> Pharmacist Hughes recalled, "The 25th Division was stationed in Coconut Grove and put on the beach to protect Kailua from invasion. To residents, it looked like thousands of troops packed in among the thick, jungly palms in their tent encampments…American officers occupy the vacation homes of kamaaina along the shore, where they set up their command stations… Beach landings are rehearsed at Waimanalo and Kailua Bays and tactical moves conducted in the marsh environs… (Hall 1998:193, 197)

After the war, the large-scale development of housing in Kailua was renewed. Intense real estate development in Kailua occurred "in the early 1950s, in response to the improved Pali Highway and the anticipation that tunnels would be constructed through the Koʻolau range… Suburbanization accelerated the displacement of agriculture and ranching (Kailua Historical Society 2009:191–192).

Contemporary History

The 20th century saw a massive urbanization of Kailua as a whole. By the end of the century, much of the former agricultural and pasture lands were mostly converted to residences, and although some ranching and farming continued, it was a faint shadow of what it once was in the previous era. In the 1930s, there was a noted residential development in the Kalama Tract of Kailua. In the 1940s, the residential development picked up in the Bishop Tract area. And finally, the residential development around the current project area, that is, the Keolu Hills subdivision, was not initiated until the 1950s. (Kailua Historical Society 2009:218) As the number of homes in Kailua has increased over the years, so has the number of residents in Kailua.

> Kailua today is an ahupuaʻa of little agriculture and much urbanization. Some banana farms and small-scale truck farming can be seen from the highway when traveling between Kailua and Honolulu. The increase in urbanization has also meant the increase of population of Kailua, as follows: 1940 - 1,540 persons; 1950 – 7,740 persons; 1960 – 25,622 persons; 1970 – 33,783 persons. (Schmitt 1977:16 in Kelly and Nakamura 1981:66)

Kailua today, with its many neighborhoods and numerous parks, churches, schools, and businesses contributes greatly to the social fabric of modern Oʻahu. It has become a favorite destination for tourists, and its beaches have become internationally acclaimed attracting millions of vacationers from around the world.

Previous Archaeology

Numerous archaeological studies have been conducted in Kailua. The following discussion provides information on archaeological investigations that have been carried out in the vicinity of the project area, based on reports found in the SHPD library in Kapolei, Hawaiʻi (Figure 7 and Table 1). State Inventory of Historic Places (SIHP) numbers are prefixed by 50-80-11 unless otherwise noted.

In the 1930s J.G. McAllister conducted his famous island-wide survey of archaeological sites around Oʻahu. McAllister (1933) documented a total of nine heiau in the Kailua region: Pahukini, Holomakani, Ulupō, Hālaualolo, Kukapoki, Alāla, Kukuipilau, Kanahau, and Keikipuipui. Of those, only Kanahau Heiau (Site 379) is located in proximity to the current project area. Kanahau was situated upland and west of the project area and makai of Mount Olomana. The construction of Kalanianaʻole Highway destroyed a portion of this sacred place where Hiʻiaka stopped to eat taro tops on her way to Kauaʻi.

In 1984, archaeologist Bertell Davis wrote to the Hawaiʻi Land Use Commission recommending an archaeological survey be conducted before granting a special land use permit for land in the Keolu Hills area to the Lone Star Hawaii Properties, Inc. (Davis 1984). The area of study was adjacent to and partially overlapping the west side of the current project area. During a brief pedestrian survey, Davis noted several sites in and nearby his area of study. Among the sites noted were a 20th century cemetery, an agricultural site, and several terraces. Davis' comments were followed soon after by a letter from the Society for Hawaiian Archaeology (SHA) in which the SHA president echoed the recommendation for a thorough archaeological survey of the parcel (Spriggs 1984). It was recommended that no present or future request by Lone Star Hawaii Properties to use the Keolu Hills land be granted unless the company first conducts a complete archaeological survey of the area.

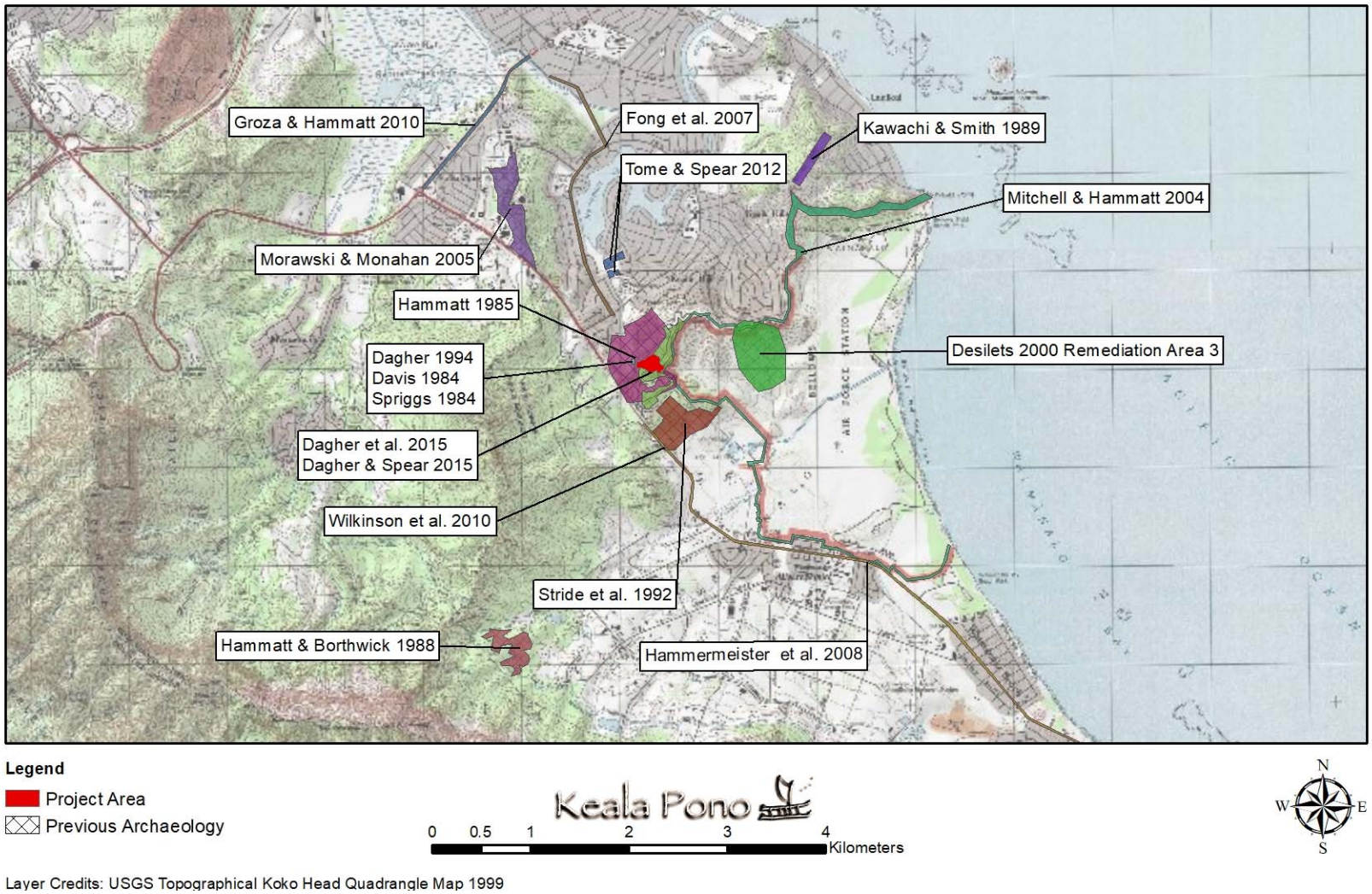


Figure 7. Previous archaeological research in the vicinity of the project area.

Table 1. Previous Archaeology in the Project Area Vicinity

Author & Year	Location	Study	Findings
McAllister 1933	Island-Wide	Survey	Recorded nine heiau in Kailua; the closest to the project area is Site 379, Kanahau Heiau.
Davis 1984	Keolu Hills	Survey	Noted a 20th century cemetery site, terraces, and an agricultural site.
Spriggs 1984	Keolu Hills	Recommendation Letter	Recommended a complete survey of Keolu Hills.
Hammatt 1985	Keolu Hills	Survey with Subsurface Testing	Recorded the cemetery site but dismissed other previously-identified sites as natural or modern.
Hammatt & Borthwick 1988	Waimanalo Agricultural Park	Reconnaissance Survey	Identified two sites: SIHP 4008, agricultural terraces; and 4409, a wall complex.
Kawachi & Smith 1989	Kaiwa Ridge	Field Inspection	Noted two WWII military bunkers.
Stride et al. 1992	Olomana Golf Course	Reconnaissance Survey	Identified SIHP 4524, a reservoir and irrigation ditches.
Dagher 1994	Keolu Hills	Letter Report	Assigned SIHP 4931 to the cemetery site first noted by Davis (1984).
Desilets 2000	BAFS, Lower Slopes of Keolu Hills	Archaeological Monitoring and Sampling	Identified two lithic scatters, together designated as SIHP 5799.
Mitchell & Hammatt 2004	Olomana Golf Course to Waimanalo Beach Park	Cultural Impact Assessment	Indicated that subsurface archaeological sites may be present.
Morawski & Monahan 2005	TMK: (1) 4-2-003	Archaeological Inventory Survey	Identified SIHP 6816, a lithic scatter; and 6817, a historic water control structure.
Fong et al. 2007	Kailua Reconstructed Sewer Project	Archaeological Monitoring	No findings.
Hammermeister et al. 2008	Dey Family Subdivision (Olomana Heights)	Archaeological Inventory Survey	Documented four sites: SIHP 6941, concrete foundations; 6942, water control features; 6943, a historic road berm; and 4042, a segment of a previously identified ditch system.
Groza & Hammatt 2010	Wana‘ao Rd./Keolu Dr.	Archaeological Monitoring	No findings.
Wilkinson et al. 2010	Kahako Pl. to the Olomana Golf Course	Archaeological Monitoring	No findings.
Tome & Spear 2012	Four parcels in Keolu	Archaeological Inventory Survey	No findings.
Dagher et al. 2015	Current Project Area	Archaeological Inventory Survey	No findings.
Dagher & Spear 2015	Current Project Area	Cultural Impact Assessment	Found that the proposed project would not impact any cultural sites or practices.

The following year, a report was submitted which presented the results of an archaeological survey and subsurface testing of Keolu Hills land, part of which included the area first surveyed by Davis (1984), as shown in Figure 8 (Hammatt 1985). It was determined that the previously identified archaeological sites were instead natural unmodified bedrock or recent bulldozed rock piles. No cultural materials of significance were identified during subsurface testing. The previously identified historic cemetery was documented consisting of two headstones; one was dated 1928, and the other was dated 1938. Following the wishes of the descendants, the report recorded the family's request to protect the graves from the impacts that any development might cause.

In 1988, an archaeological reconnaissance survey was conducted for Phase II of the Waimanalo Agricultural Park (Hammatt and Borthwick 1988). It was determined that although archival records indicated taro fields in the area, all traces of the taro fields had been erased due to large scale cultivation of sugarcane by the Waimanalo Sugar Company. However, two sites were identified just outside of the project area: the Waimanalo Agricultural Terraces Complex, SIHP 50-80-15-4008; and the Waimanalo Wall Complex, SIHP 50-80-15-4009 (Hammatt and Borthwick 1988).

In 1989, a field inspection of Kaiwa Ridge was conducted in response to a concerned citizen who suggested the presence of fishing shrines and burials on the ridge (Kawachi and Smith 1989). However, upon inspection, no shrines or burials were identified on the ridge. However, two military bunkers dating to the World War II era were documented.

In 1992, a reconnaissance survey was conducted over 56 acres associated with the proposed expansion of the Olomana Golf Course (Stride et al. 1992). The only archaeological features identified during this survey were the reservoir and parallel irrigation ditches associated with the Waimanalo Sugar Company. The site was designated SIHP 4524, and it was recommended for further documentation (Stride et al. 1992).

In 1994, a letter was submitted by the State Historic Preservation Division to help document the presence of six historic graves in the family cemetery first identified by Davis (1984) (Dagher 1994). The historic cemetery was designated as SIHP 50-80-15-4931 (Dagher 1994).

In 2004, a cultural impact assessment was conducted for construction activities connected to the proposed improvements to Kalaniana‘ole Highway between Waimānalo Beach Park and the Olomana Golf Course. It was determined that "the proposed project would have minimal or no impact on Hawaiian culture, its practices and traditions… however, the subsurface properties associated with former traditional Hawaiian activities… may be present" (Mitchell and Hammatt 2004:57).

In 2005, an archaeological inventory survey of 25 acres was conducted between Kalaniana‘ole Highway and Kailua High School (Morawski and Monahan 2005). Two archaeological sites were documented during the survey: a lithic scatter, SIHP 6816; and a historic water control structure, SIHP 6817 (Morawski and Monahan 2005).

In 2007, a report was completed which documented the archaeological monitoring of construction activities related to the Reconstructed Sewer Project along several roads in Kailua (Fong et al. 2007). No surface or subsurface archaeological features or materials were identified during the project.

In 2008, an archaeological inventory survey of approximately 63 acres was conducted for the Dey Family Subdivision Project (Hammermeister et al. 2008). Four archaeological sites were identified during the survey. These consisted of several concrete foundations, SIHP 6941; pre- and/or post-contact infrastructure related to agricultural/water control, SIHP 6942; a historic road berm, SIHP 6943; and a new segment of a previously documented ditch system, SIHP 4042 (Hammermeister et

al. 2008). All of the sites identified during this survey were recommended for the Hawai‘i Register of Historic Places except for the road berm.

In 2010, archaeological monitoring was conducted for construction activities related to the Wana‘ao Road/Keolu Drive Sewer Project (Groza and Hammatt 2010). No archaeological sites were identified during the monitoring. Also in 2010, archaeological monitoring was conducted for Phase I of the Kalaniana‘ole Improvement Project (Wilkinson et al. 2010). This consisted of work in the area between Kahako Place and the Olomana Golf Course. No archaeological sites were identified during the monitoring.

In 2012, an archaeological inventory survey was completed for four parcels in the Enchanted Lakes area of Kailua (Tome and Spear 2012). Although the survey yielded modern debris, no significant surface or subsurface archaeological features or materials were identified.

The Archaeology of Bellows Air Force Station

Bellows Air Force Station (BAFS), which lies directly to the west of the project area, has a long and complicated archaeological history. The following summary is from McElroy (2004:5–6):

> Archaeological and archival data from MCTAB [Marine Corps Training Area Bellows, the former name of BAFS] indicate a long-term Hawaiian occupation, with development of pondfield irrigation along the inland sections of Waimānalo Stream and habitation sites along the stream and the coast. Archaeological information indicates use of the interior beach ridges and swales with activities that included fire-making, cooking, lithic working, and burials. Most of this activity took place on a stable land surface with little stratigraphic development except along the stream and near the coast, where cultural deposits are relatively thick.
>
> Archaeological work indicates that there are remnants of a paleosol scattered across the entire plain. This surface existed on undulating beach ridges and swales that can be identified on pre-World War II topographic maps, and is probably the main occupational surface associated with Hawaiian use of the area. The paleosol is found today in a variety of situations determined primarily by the nature and extent of modern land alterations. It can be found wholly or partially exposed and deflated with traditional Hawaiian cultural materials on the surface; near the surface beneath graded material, roads, or runways; and deeply buried by fill materials in former swales.
>
> The Waimānalo coastal dunes were reported to contain many burials (Finsch 1879). These probably reflect a large settlement inland and south of MCTAB, rather than dense settlement along the coast of MCTAB…. Information on the known historic properties of MCTAB was compiled in the 1990s. Tuggle (1997) inventoried archaeological sites dating to the traditional Hawaiian and early historic periods. Surface structural remains from the historic period prior to 1950 were inventoried by Yoklavich and Leineweber (1997).

Because of the complexity of BAFS archaeology, archaeological sensitivity maps have been developed to predict the probability of encountering archaeological sites in the area (e.g., Eidsness 1993; Farrell and Spear 1997). The current project area lies just outside a zone of low probability on BAFS (Figure 9).

Most archaeological projects on BAFS have been conducted near the coast or along the runway areas. The closest BAFS project to the current study area consisted of monitoring and sampling for underground storage sites (Desilets 2000). The underground storage sites were located at several different areas on BAFS, with Remediation Area 3 situated on the lower slopes of Keolu Hills, east of the current project. Two surface lithic scatters were identified in this area, but no material was

collected and no analysis was undertaken. The scatters were interpreted as a "simple lithic reduction workshop," and confirm that the Keolu Hills slopes were utilized in pre-contact times (Desilets 2000:21). It was posited that the Keolu Hills were the source of much of the basalt imported to other archaeological sites of BAFS during the pre-contact era (Desilets 2000:25). Together, the two scatters were designated as SIHP 50-80-15-5799 (Desilets 2000).

Previous Studies in the Current Project Area

In 2013, an archaeological inventory survey was conducted for the current project area. This was reported as an archaeological assessment because there were no findings (Dagher et al. 2015). The survey consisted of pedestrian transects that covered 5.5 acres of TMK: (1) 4-2-004:001. The project area was divided into several survey areas (Figure 10):

> Survey Area A [which included the proposed Primary Home Site and one portion of the Native Plant Area], Survey Area B [the Alternate Home Site], and the Photovoltaic Area [which overlapped and included the other portion of the Native plant area] and two linear survey corridors (a proposed driveway corridor, approximately 450 m long and 3 m wide, and a previously created private road corridor, approximately 650 m long and 3 m wide, that followed the ridgeline along the east side of the property for most of its length). Dagher et al. 2015:28

In addition to the pedestrian survey, four shovel probes were excavated, two in Area A and two in Area B. The shovel probes were excavated to 36–43 cm deep, and only natural deposits and modern fill were encountered. Pedestrian survey and subsurface testing did not yield any surface or subsurface archaeological sites or features. The only items found were "five brass .30-06 caliber blank rifle cartridges, dating to 1943, and a single isolated artifact, consisting of a Hazel-Atlas glass ketchup bottle manufactured from 1920 to 1964" (Dagher et al. 2015:29). All items were collected from the surface, the rifle cartridges from the road corridor on the ridgeline, and the bottle from the Photovoltaic Area.

Additionally, a cultural impact assessment for the same project area was also conducted. Based on archival research and community consultation, it was determined that the proposed construction project would not impact any traditional cultural practices nor impact access to any place of cultural significance (Dagher and Spear 2015).

Summary of Background Information

Kailua was a culturally significant area with many of the natural resources which supported traditional subsistence activities such as fishing and kalo cultivation. Fishponds were maintained along the shoreline, and lo'i were farmed in the wetlands. These resources supported a large pre-contact population, and Kailua was chosen as the seat of governance and/or place of residence for many of O'ahu's rulers.

Historically, sugar and pineapple cultivation were attempted in Kailua, although neither enterprise was particularly lucrative. Cattle ranching had more success, however with large tracts of land used for ranching in the late 1800s. The 20th century saw copra agriculture, dairy farming, increased housing, and military use in Kailua.

Previous archaeological research has identified a number of heiau in Kailua, although only one is in the vicinity of the current project area. Also in the vicinity is a family cemetery. On the lower slopes of Keolu Hills, in BAFS, lithic scatters have been found. It is thought that the hills were a source of basalt that was imported to other pre-contact sites on BAFS. Previous archaeological work within the project area did not identify anything of significance.

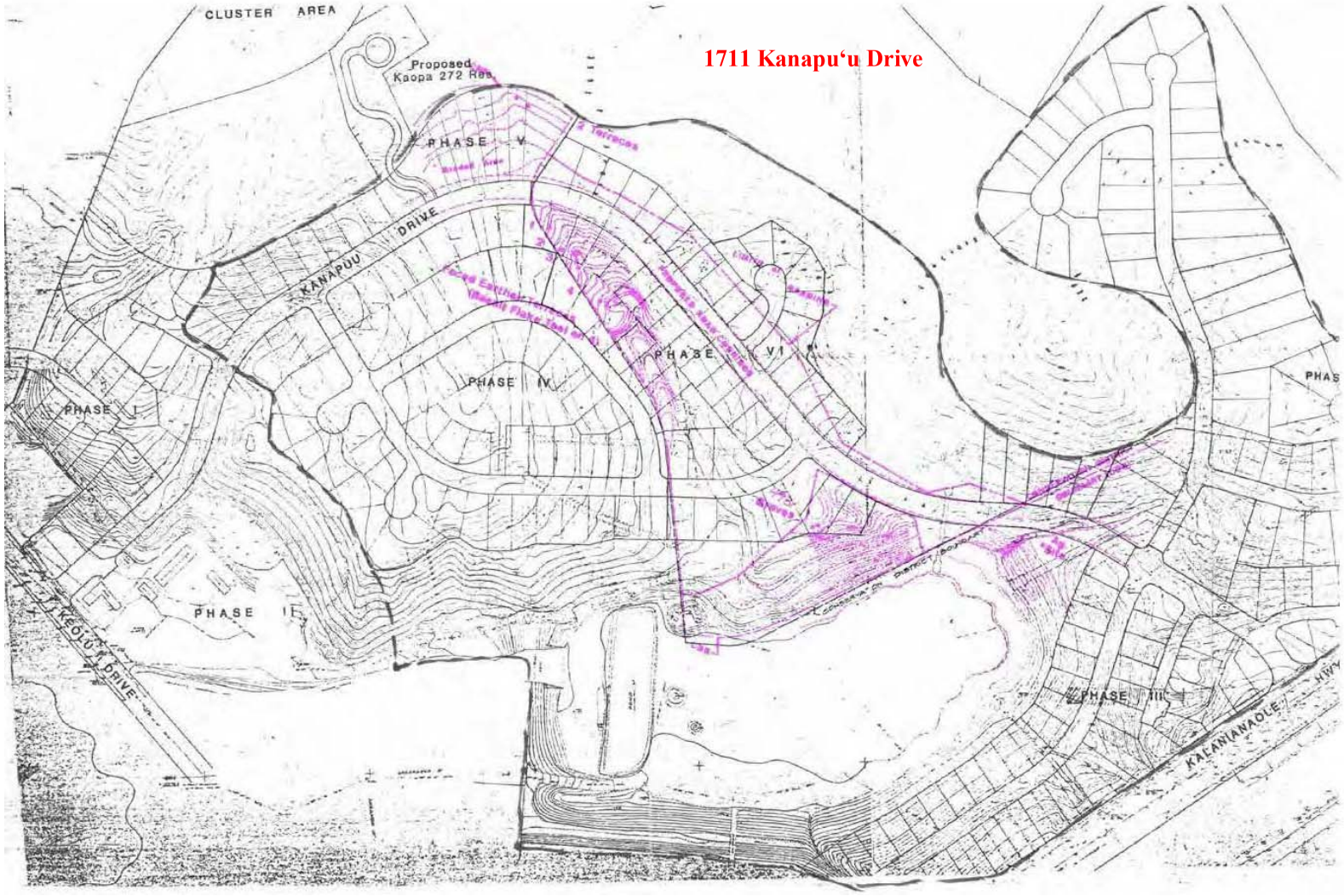


Figure 8. Kaopa Subdivision Unit 4 Hammatt (1985) project area (adopted from Dagher et al. 2015: Figure 7).

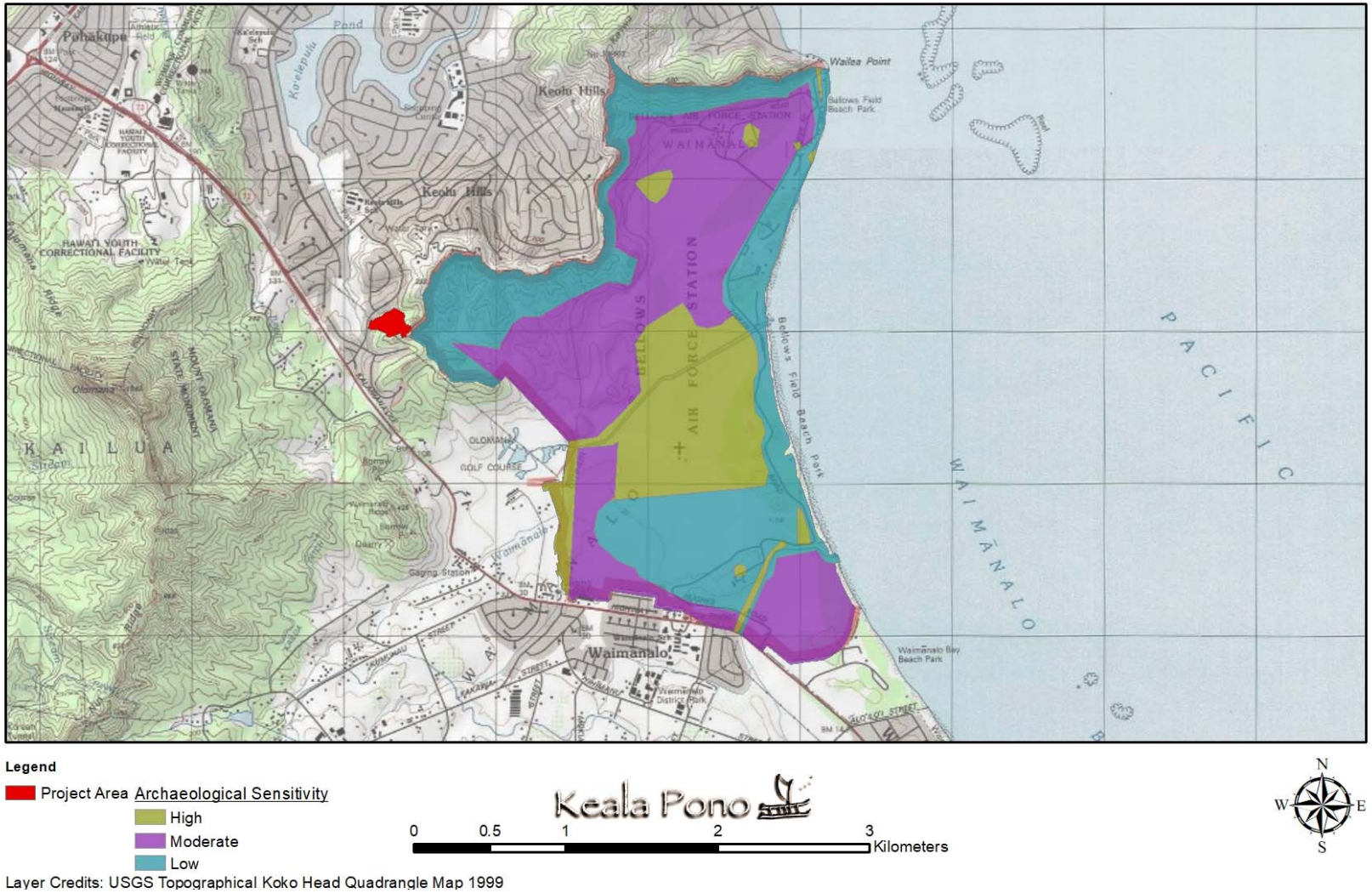


Figure 9. Archaeological sensitivity map for BAFS (data from Eidsness 1993, Farrell and Spear 1997).

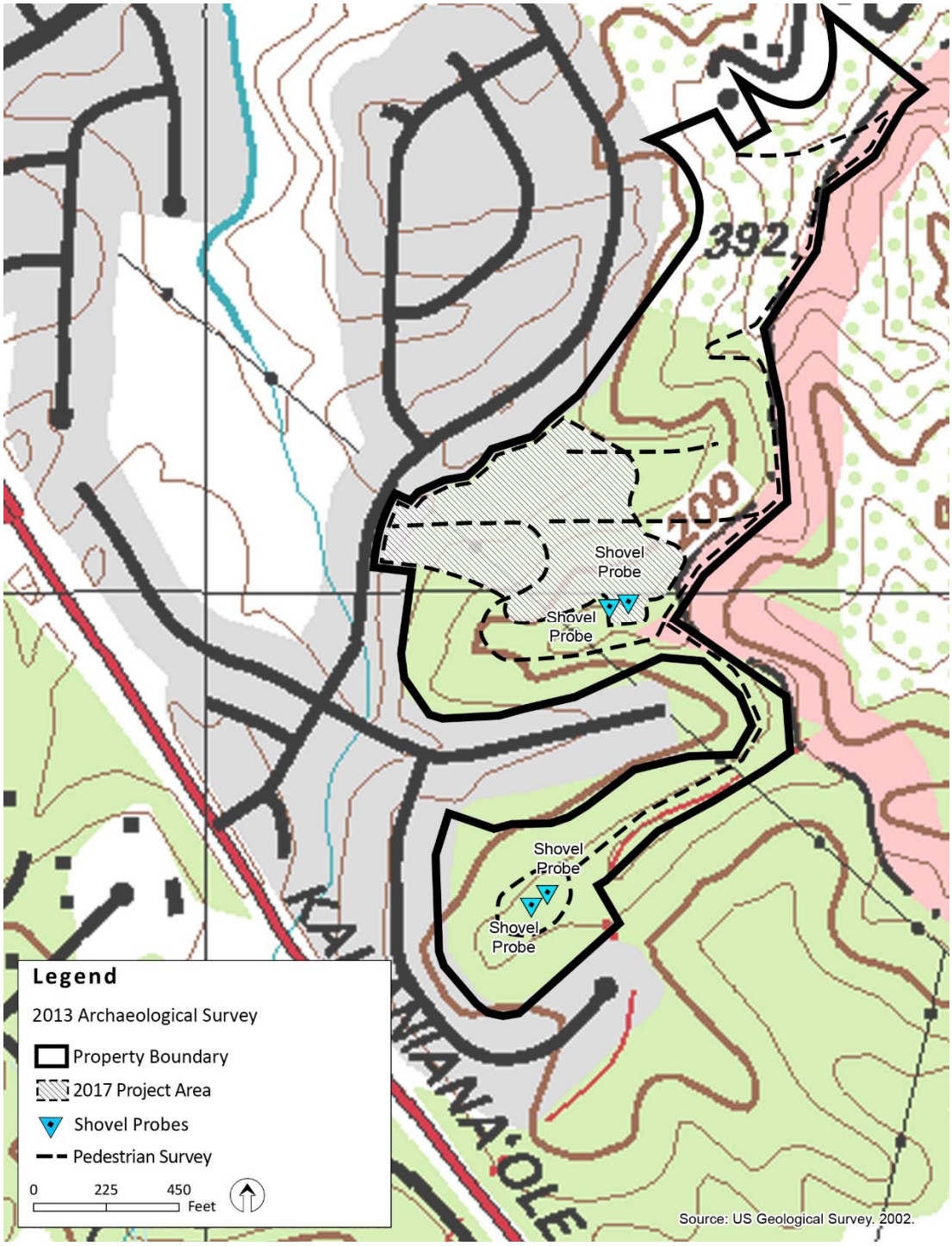


Figure 10. Previously surveyed areas of TMK: (1) 4-2-004:001 (courtesy of G70).

SUMMARY AND CONCLUSION

A literature review was conducted for 1711 Kanapuʻu Drive in Kailua Ahupuaʻa, Koʻolaupoko District, on the island of Oʻahu. The project covers approximately 8 acres on TMK: (1) 4-2-004:001. The literature review consisted entirely of library review, including archaeological studies on the parcel, with no archaeological fieldwork conducted.

Several archaeological implications can be made based on the literature review presented above. Key data include historical maps, the results of previous archaeological work, and data for previous land use. Archival sources relate that Kailua was a culturally significant area with many of the natural resources which supported traditional subsistence activities such as fishing and kalo cultivation. Fishponds were maintained along the shoreline, and loʻi were farmed in the wetlands. These resources supported a large pre-contact population, and Kailua was chosen as the seat of governance and/or place of residence for many of Oʻahu's rulers.

Historically, sugar and pineapple cultivation were attempted in Kailua, although neither enterprise was particularly lucrative. Cattle ranching had more success, however with large tracts of land used for ranching in the late 1800s. The 20th century saw copra agriculture, dairy farming, increased housing, and military use in the region.

Previous archaeological research has identified a number of heiau in Kailua, although only one is in the vicinity of the current project area. Also in the vicinity is a 20th century cemetery. On the lower slopes of Keolu Hills, in BAFS, lithic scatters have been found. It is thought that the hills were a source of basalt that was imported to other pre-contact sites on BAFS. A previous archaeological inventory survey on the subject property itself did not identify anything of significance, therefore it is not expected that any archaeological sites or features will be found there. A larger scale survey of the nearby Kaopa Subdivision also had no findings, aside from the 20th century cemetery, which is located across the street from the current project area. Whereas pre-contact human burials are often found in sandy beach deposits, they are less likely to be encountered in the soils of the project area.

GLOSSARY

ahupuaʻa	Traditional Hawaiian land division usually extending from the uplands to the sea.
ʻāina	Land.
akua	God, goddess, spirit, ghost, devil, image.
aliʻi	Chief, chiefess, monarch.
aliʻi nui	High chief.
aloha	Love, affection, compassion, sympathy, kindness, greeting.
anana	A distance of measurement also known as a fathom. It was formerly measured from fingertip to fingertip, with arms outstretched.
ʻeʻepa	Extraordinary, incomprehensible, abnormal, peculiar.
hau	The indigenous tree *Hibiscus tiliaceous*, which had many uses in traditional Hawaiʻi. Sandals were fashioned from the bark and cordage was made from fibers. Wood was shaped into net floats, canoe booms, and various sports equipment and flowers were used medicinally.
heiau	Place of worship and ritual in traditional Hawaiʻi.
hoaʻāina	Native tenants that worked the land.
ʻili	Traditional land division, usually a subdivision of an ahupuaʻa.
kalo	The Polynesian-introduced *Colocasia esculenta*, or taro, the staple of the traditional Hawaiian diet.
kamaʻāina	Native-born.
kapu	Taboo, prohibited, forbidden.
kiaʻi	Guard, caretaker; to watch or guard; to overlook, as a bluff.
koa haole	The small tree *Leucaena glauca*, historically-introduced to Hawaiʻi.
kōnane	A traditional Hawaiian game played with pebbles on a wooden or stone board.
kuhina nui	Prime minister or premier. Kaʻahumanu was the first kuhina nui. The position was abolished in 1864.
loʻi, loʻi kalo	An irrigated terrace or set of terraces for the cultivation of taro.
Māhele	The 1848 division of land.
maika	Ancient Hawaiian game suggesting bowling.
makaʻāinana	Common people, or populace; translates to "people that attend the land."
mālama	To care for, preserve, or protect.
mele	Song, chant, or poem.
menehune	Small people of legend who worked at night to build structures such as fishponds, roads, and heiau.
mōʻī	King.
moʻo	Lizard, dragon, water spirit.
moʻolelo	A story, myth, history, tradition, legend, or record.

‘ōlelo no‘eau Proverb, wise saying, traditional saying.

oli Chant.

oli komo The chant that answers the oli kahea (the chant which asks permission to enter). The oli komo comes from the one inside, and it is in response to the oli kahea chanted by the one outside wishing to come in.

ti (kī) The plant *Cordyline terminalis*, whose leaves were traditionally used in house thatching, raincoats, sandals, whistles, and as a wrapping for food.

REFERENCES

Beamer, B.
2008 *Na wai ka mana? ʻŌiwi Agency and European Imperialism in the Hawaiian Kingdom*. Diss. University of Hawaiʻi, Honolulu.

2014 *No Mākou Ka Mana Liberating the Nation*. Kamehameha Publishing, Honolulu.

Dagher, C.
1994 *Recording of Mauliola Family Cemetery, Kailua, Koʻolaupoko, Oʻahu, State No. 50-80-15-4931*. State Historic Preservation Division, Kapolei.

Dagher, C.A., A.D. Hazlett, and R.L. Spear
2014 *An Archaeological Assessment Report for a Property Located at 1711 Kanapuʻu Drive, Kailua, Kailua Ahupuaʻa, Koʻolaupoko District, Island of Oʻahu, Hawaiʻi [TMK: (1) 4-2-004:001 por.]*. Draft dated November, 2014. Scientific Consultant Services, Inc., Honolulu.

2015 *An Archaeological Assessment Report for a Property Located at 1711 Kanapuʻu Drive, Kailua, Kailua Ahupuaʻa, Koʻolaupoko District, Island of Oʻahu, Hawaiʻi [TMK: (1) 4-2-004:001 por.]*. Revised March, 2015. Scientific Consultant Services, Inc., Honolulu.

Dagher, C.A. and R.L Spear
2015 *A Cultural Impact Assessment for a Property Located at 1711 Kanapuʻu Drive, Kailua, Kailua Ahupuaʻa, Koʻolaupoko District, Island of Oʻahu, Hawaiʻi [TMK: (1) 4-2-004:001]. Scientific Consultant Services, Inc*., Honolulu.

Davis, B.D.
1984 Letter to the State of Hawaii Land Use Commission Re: Declaration of No Adverse Effect and Application for Special Use Permit on 7.9 Acres of Conservation District Land in Keolu Hills, Kailua, By Lone Star Hawaii Properties.

Desilets, M.
2000 *Archaeological Monitoring and Sampling Interim Removal Action, Five Underground Storage Sites—OU7 Bellows Air Force Station, Waimānalo, Koʻolaupoko District, Oʻahu, Hawaiʻi*. International Archaeological Research Institute, Inc., Honolulu.

Eidsness, J.
1993 *Draft Summary: Cultural Resources Management Plan for Native Hawaiian Archaeological Resources, Bellows Air Force Station*. Biosystems Analysis, Inc., Santa Cruz, California.

Farrell, N. and R. L. Spear
1997 *Cultural Resources Management Plan (CRMP) for Bellows Air Force Station, Waimanalo, Koʻolaupoko, Island of Oʻahu, Hawaiʻi*. SCS/CRMS, Honolulu.

Fong, J., D. Borthwick, and H.H. Hammatt
2007 *An Archaeological Monitoring Report for the Kainehe Street, Hamakua Drive, and Keolu Drive Reconstructed Sewer Project, Kailua Ahupuaʻa, Koʻolaupoko District, Island of Oʻahu. TMK: (1) 4-2-01, -77, 81, -89, 90, -93, -94, and -95*. Cultural Surveys Hawaii, Inc., Kailua, Hawaiʻi.

Foote, D., E. Hill, S. Nakamura, and F. Stephens
1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*. United States Department of Agriculture, Soil Conservation Service. Published in cooperation with the University of Hawaii Agricultural Experiment Station, Washington, D.C.

Giambelluca, T.W., Q. Chen, A.G. Frazier, J.P. Price, Y.-L. Chen, P.-S. Chu, J.K. Eischeid, and D.M. Delparte
2013 *Online Rainfall Atlas of Hawai'i*. Bulletin of the American Meteorological Society 94, 313–316, doi: 10.1175/BAMS-D-11-00228.

Groza, R. and H.H. Hammatt
2010 *Archaeological Monitoring Report for the Wana'ao Road/Keolu Drive Reconstructed Sewer (Job No. W2-06) Project, Kailua Ahupua'a, Ko'olaupoko District, O'ahu Island, TMK [1] 4-02-001, -002 (Wana'ao Road/Keolu Drive)*. Cultural Surveys Hawai'i, Inc., Kailua, Hawai'i.

Hall, W.T.
1998 *The History of Kailua, Hawaii*. Dolphin Printing and Publishing, Kailua, Hawai'i.

Hammatt, H. H.
1985 *Archaeological Survey of Kaopa Subdivision, Unit 4, Kailua, Oahu, HI, TMK: 4-2-04:1*. Cultural Surveys Hawaii, Honolulu.

Hammatt, H., and D. Borthwick
1988 *Archaeological Reconnaissance of the Mauka Portion Of Phase II Waimanalo Agricultural Park Waimanalo, O'ahu*. Cultural Surveys Hawai`i, Inc., Kailua.

Hammermeister, A., W. Petrey, and H.H. Hammatt
2008 *Archaeological Inventory Survey for an Approximately 63-Acre Dey Family Subdivision Project, Olomana, Kailua Ahupua'a, Ko'olaupoko District*. Cultural Surveys Hawai'i, Inc., Kailua, Hawai'i.

Handy, E.S.C., E.G. Handy, and M.K. Pukui
1991 *Native Planters in Old Hawaii: Their Life, Lore, and Environment*. Bishop Museum Press, Honolulu.

Kailua Historical Society
2009 *Kailua: In the Wisps of the Malanai Breeze*. Kailua Historical Society, Kailua, Hawai'i.

Kamakau, S.M.
1991 *Tales and Traditions of the People of Old: Na Mo'olelo a ka Po'e Kahiko*. Translated by M.K. Pukui. Edited by D.B. Barrere. Bishop Museum Press, Honolulu.

1996 *Ke Kumu Aupuni*. 'Ahahui 'Ōlelo Hawai'i, Honolulu.

Kanahele, G.S.
1995 *Waikiki 100 B.C. To 1900 A.D.: An Untold Story*. The Queen Emma Foundation, Honolulu.

Kawachi, C. and M. Smith
1989 *Kaiwa Ridge Field Check, Lanikai, Kailua, Koolaupoko, O'ahu*. HSS Archaeologists, place of publication not noted.

Kelly, M. and B. Nakamura
1981 *Historical Study of Kawainui Marsh Area*. Bishop Museum, Honolulu.

King, R.D.
1900 Kailua Koolaupoko – Oahu. Scale 10 chains = 1 in. Traced from Register Map 588.

Maly. K. and O. Maly
2003 *He Wahi Mo'olelo No Ponahawai A Me Punahoa Ma Hilo: A Collection of Traditions and Historical Accounts for Ponahawai and Punahoa, District of Hilo, Island of Hawai'i (TMK 2-344:19; 2-3-49:53; 2-3-37:01)*. Kumu Pono Associates, Hilo, Hawai'i.

McAllister, J.G.
1933 *Archaeology of O'ahu*. Bishop Museum, Bulletin 104, Honolulu.

McElroy, W.K.
2004 *Archaeological Monitoring Plan for Treatability Study at Area of Concern 18 Sinkhole, Marine Corps Training Area Bellows, O'ahu, Hawai'i*. T.S. Dye & Colleagues, Honolulu.

Mitchell, A. and H.H. Hammatt
2004 *Kalaniana'ole Improvement Project, Cultural Impact Assessment, Waimānalo Ahupua'a, Ko'olaupoko District, Island of O'ahu, Por. TMK: 4-1-03 through 09, 12, 13, 15, 16, 18,19, 20, 21, 22, 28, 33, 34*. Cultural Surveys Hawai'i, Inc., Kailua, Hawai'i.

Moffat, R.M. and G.L. Fitzpatrick
1995 *Palapala'aina: Surveying the Mahele*. Editions Limited, Honolulu.

Morawski, L. and C. Monahan
2005 *Archaeological Inventory Survey of Approximately 25 Acres in Kailua Ahupua`a, Ko`olaupoko District, O`ahu, Hawai`i [TMK: (1) 4-2-003: 004 (Por.) & 022 (Por.)]*. Scientific Consultant Services, Inc. Honolulu.

Nogelmeier, M.P.
2006 Commentary. *The Epic Tale of Hi'iakaikapoliopele*. Awaiaulu: Hawaiian Literature Project, Honolulu.

Pammer, M.F. and H.H. Hammatt
2014 *Archaeological Inventory Survey Report for the Proposed Central Pacific Bank (CPB) Project, Kailua Ahupua'a, Ko'olaupoko District, O'ahu (TMK: [1] 4-3-057:073)*. Cultural Surveys Hawai'i, Inc., Kailua.

Pukui, M.K.
1983 *'Ōlelo No'eau: Hawaiian Proverbs & Poetical Sayings*. Bishop Museum Press, Honolulu.

Pukui, M.K., S.H. Elbert, and E.T. Mookini
1974 *Place Names of Hawaii*. University Press of Hawai'i, Honolulu.

Sai, D.
2008 *The American Occupation of the Hawaiian Kingdom: Beginning the Transition from Occupied to Restored State*. Diss. University of Hawai‘i, Honolulu.

Spriggs, M.
1984 Letter to the Chairman of the State of Hawaii Board of Land and Natural Resources Re: Conservation District Use Application No. OA/20/84-1715 for grading on TMK: 4-2-04: 01, Kailua, Oahu. Society for Hawaiian Archaeology, Honolulu.

Sterling, E.P. and C.C. Summers
1978 *Sites of Oahu*. Bishop Museum Press, Honolulu.

Stride, M., D.F. Borthwick, and H.H. Hammatt
1992 *Archaeological Reconnaissance Survey of 56 Acres for the Proposed Olomana Golf Course Expansion Area (TMK 4-1-13:11)*. Cultural Surveys Hawaii, Kailua, Hawai‘i.

Tome, G. and R. Spear
2012 *Archaeological Assessment on 6.255-acres of Land in Enchanted Lakes Within the Ahupua`a of Kailua, Ko`olaupoko District, Island of O`ahu, Hawai`i [Tax Map Key (1) 4-2-083: 074, 075, 077, and 079]*. Scientific Consultant Services, Inc. Honolulu.

Wilkinson, S., D. Borthwick, and H.H. Hammatt
2010 *Final Archaeological Monitoring Report for the Kalaniana‘ole Improvement Project (Phase I), Waimānalo Ahupua‘a, Ko‘olaupoko District, Island of O‘ahu, Por. TMK: [1] 4-1-013:010, 011, 012, 017; [1] 4-1-08:059; and [1] 4-2-005:005*. Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Wall, W.A.
1899 Map of Kailua Kookaupoko Oahu. Scale 500 ft. = 1 in. Register Map 2049.

APPENDIX: SHPD LETTER LOG NO. 2014.05547; DOC NO. 1412GC20

DAVID Y. IGE
GOVERNOR OF HAWAII

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DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

January 5, 2015

Mr. Samuel J. Lemmo, Administrator
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, Hawaii 96809

LOG NO: 2014.05547
DOC NO: 1412GC20
Archaeology

Dear Mr. Clark:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Conservation District Use Application (CDUA) OA-3732 and
Draft Environmental Assessment (DEA) for
Single Family Residence (SFR), Horn Residence
Kailua Ahupua'a, Ko'olaupoko District, Island of O'ahu
TMK: (1) 4-2-004:001

Thank you for the opportunity to respond to your request for comments regarding Conservation District Use Application (CDUA) OA-3732 and Draft Environmental Assessment (DEA), which we received on December 11, 2014. The proposed project will include (1) construction of a new two-story single family residence and appurtenances, (2) land and resource management activities to conduct invasive species removal, (3) landscaping and (4) subsistence agriculture. The approximately 37 acre parcel is owned by MDHE, LLC, and includes both Conservation and Urban District zoned lands. The proposed improvements will be contained within a 10-acre portion of the parcel.

According to the DEA the project will also include (1) construction of retaining walls, (2) excavations to provide an access driveway of approximately 1,220 feet, and (3) grading of a portion of a spur ridge. The estimated ground disturbances will include 5,000 cubic yards of excavation, and 8,000 cubic yards of fill. The DEA also indicates that "Best Management Practices will be implemented for Storm Drainage, Wastewater and as required by the Grading Permit."

Our records indicate that SHPD reviewed and requested revisions to the archaeological inventory survey conducted in support of the proposed project (September 10, 2014; Log No. 2014.1898, Doc. No. 1409TR02). Our records also indicate several archaeological surveys have been conducted within the vicinity which have resulted in the identification of historic properties. These sites include the Mauli'oli Family Cemetery (SIHP 50-80-15-04931), the Waimanalo Wall Complex (Site 04009), the Waimanalo Agricultural Terraces Complex (Site 04008), and Bellows Field which was added to the National Register of Historic Properties on August 14, 1973. Although these sites are not within the project area, their locations and significance indicate potential exists for other evidence of traditional and/or historic sites in this area, including agricultural remains and possible military remains.

At this time we are unable to make a determination regarding potential impacts to archaeological historic properties due to inadequate information about the proposed project. We request receiving the following information:

- A scope of work that includes a narrative description and construction plans for all proposed work, including all ground disturbing activities (e.g., construction of new driveway, utility trenching, storm

water drainage, house foundation and CRM walls), as well as all plant types and locations proposed for removal (e.g., banyon and albizia trees) and for all proposed agricultural activities;

- A map illustrating the previous archaeological investigations conducted in the vicinity, including their project boundaries relative to the project area; and
- A map accurately showing the boundaries of the 10-acre portion comprising the project area.

In addition, we request that issuance of the CDUA be delayed until SHPD has an opportunity to review and accept the requested revisions of the archaeological inventory survey.

Please contact me at (808) 692-8015 or at Susan.A.Lebo@hawaii.gov if you have any questions or concerns about this letter.

Aloha,

Susan A. Lebo

Susan A. Lebo, PhD
Oahu Lead Archaeologist
Acting Archaeology Branch Chief

cc: Alex J. Roy, OCCL (Alex.J.Roy@hawaii.gov)

Appendix E

Cultural Impact Assessment

SCS Project Number 1459-CIA-~~1~~2

A CULTURAL IMPACT ASSESSMENT FOR A PROPERTY LOCATED AT 1711 KANA PU`U DRIVE, KAILUA KAILUA AHUPUA`A, KO`OLAUPOKO DISTRICT ISLAND OF O`AHU, HAWAI`I [TMK: (1) 4-2-004:001]

Prepared by:
Cathleen A. Dagher, B.A.
and
Robert L. Spear, Ph.D.

~~April 2014~~
March 2015

Prepared for:
Mr. Jeff Overton
Group 70 International
925 Bethel St
Honolulu, HI 96813

SCIENTIFIC CONSULTANT SERVICES Inc.

1347 Kapiolani Blvd., Suite 408 Honolulu, Hawai`i 96814

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INTRODUCTION

At the request of Mr. Jeff Overton of Group 70 International, Inc., Scientific Consultant Services, Inc. (SCS), has prepared a Cultural Impact Assessment (CIA) for ~~approximately 4.3 acres of~~ undeveloped land within a 37- acre property project located at 1711 Kanapu`u Drive, Kailua, Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu, Hawai`i [Tax Map Key (1) 4-2-004: 001] (Figures 1 and 2).

The Constitution of the State of Hawai`i clearly states the duty of the State and its agencies is to preserve, protect, and prevent interference with the traditional and customary rights of Native Hawaiians. Article XII, Section 7 (2000) requires the State to "protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by *ahupua`a* tenants who are descendants of Native Hawaiians who inhabited the Hawaiian Islands prior to 1778." In spite of the establishment of the foreign concept of private ownership and western-style government, Kamehameha III (Kauikeaouli) preserved the peoples traditional right to subsistence. As a result in 1850, the Hawaiian Government confirmed the traditional access rights to Native Hawaiian *ahupua`*a tenants to gather specific natural resources for customary uses from undeveloped private property and waterways under the Hawaiian Revised Statutes (HRS) 7-1. In 1992, the State of Hawai`i Supreme Court, reaffirmed HRS 7-1 and expanded it to include, "native Hawaiian rights…may extend beyond the *ahupua`a* in which a Native Hawaiian resides where such rights have been customarily and traditionally exercised in this manner" (Pele Defense Fund v. Paty, 73 Haw.578, 1992).

Act 50, enacted by the Legislature of the State of Hawai`i (2000) with House Bill (HB) 2895, relating to Environmental Impact Statements, proposes that:

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

Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on government agencies a duty to promote and protect cultural beliefs and practices, and resources of Native Hawaiians as well as other ethnic groups. Act 50 also requires state agencies and other developers to assess the effects of proposed land use or shore line developments on the "cultural practices of the community and State" as part of the HRS Chapter 343 (2001) environmental review process.

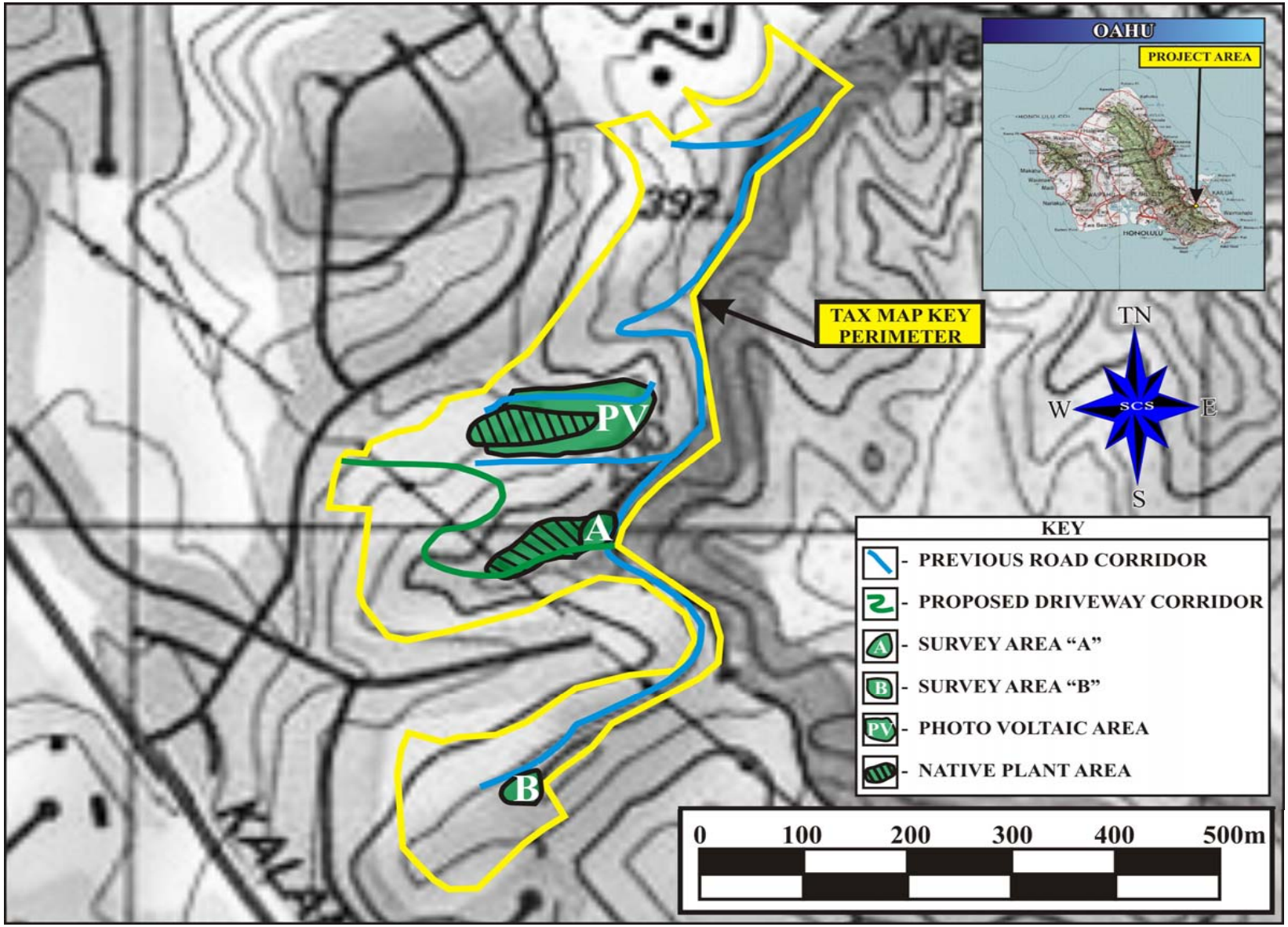

Figure 1: USGS Quadrangle (Koko Head 1999) Map Showing Project Area Location.

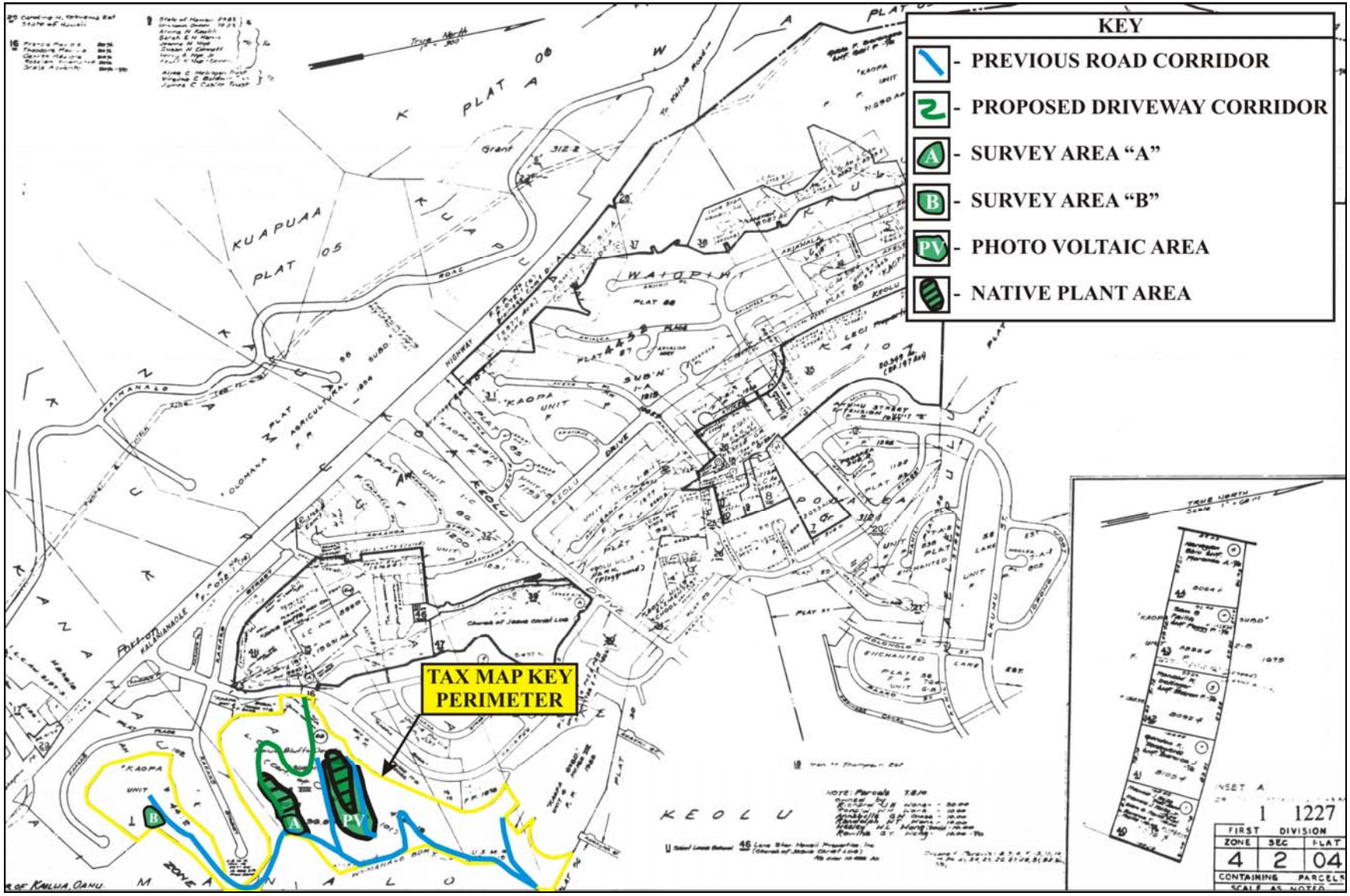

Figure 2: Tax Map Key [TMK: (1) 4-2-004) Showing Project Area Location.

It also re-defined the definition of "significant effect" to include "the sum of effects on the quality of the environment including actions impacting a natural resource, limit the range of beneficial uses of the environment, that are contrary to the State's environmental policies . . . or adversely affect the economic welfare, social welfare or cultural practices of the community and State" (H.B. 2895, Act 50, 2000). Cultural resources can include a broad range of often overlapping categories, including places, behaviors, values, beliefs, objects, records, stories, etc. (H.B. 2895, Act 50, 2000).

Thus, Act 50 requires that an assessment of cultural practices and the possible impacts of a proposed action be included in Environmental Assessments and Environmental Impact Statements, and to be taken into consideration during the planning process. As defined by the Hawaii State Office of Environmental Quality Control (OEQC), the concept of geographical expansion is recognized by using, as an example, "the broad geographical area, e.g. district or *ahupua`a*" (OEQC 2012:12). It was decided that the process should identify 'anthropological' cultural practices, rather than 'social' cultural practices. For example, *limu* (edible seaweed) gathering would be considered an anthropological cultural practice, while a modern-day marathon would be considered a social cultural practice.

Therefore, the purpose of a Cultural Impact Assessment is to identify the possibility of on-going cultural activities and resources within a project area, or its vicinity, and then assessing the potential for impacts on these cultural resources. The CIA is not intended to be a document of in depth archival-historical land research, or a record of oral family histories, unless these records contain information about specific cultural resources that might be impacted by a proposed project.

According to the Guidelines for Assessing Cultural Impacts established by the Hawaii State Office of Environmental Quality Control (OEQC 2012:12):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religions and spiritual customs. The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both manmade and natural, which support such cultural beliefs.

The meaning of "traditional" was explained in *National Register Bulletin*:

> Traditional" in this context refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations', usually orally or through practice. The traditional cultural significance of a historic property then is significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices. . . . [Parker and King 1998:1]

METHODOLOGY

This Cultural Impact Assessment was prepared as much as possible in accordance with the suggested methodology and content protocol in the Guidelines for Assessing Cultural Impacts (OEQC 2012:11-13). In outlining the "Cultural Impact Assessment Methodology", the OEQC (2012:11) states that:

> "…information may be obtained through scoping, community meetings, ethnographic interviews and oral histories…"

This report contains archival and documentary research, as well as communication with organizations having knowledge of the project area, its cultural resources, and its practices and beliefs. An example of the letters of inquiry is presented in Appendix A, copies of the posted legal notice and Affidavit are presented in Appendix B, an example of the follow-up letter of inquiry is presented in Appendix C, and responses to the inquiries are presented in Appendix D. This Cultural Impact Assessment was prepared in accordance with the suggested methodology and content protocol provided in the Guidelines for Assessing Cultural Impacts (OEQC 2012:13), whenever possible. The assessment concerning cultural impacts may include, but not be limited to:

A. A discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints or limitations which might have affected the quality of the information obtained.

B. A description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken.

C. Ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained.

D. Biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area.

E. A discussion concerning historical and cultural source materials consulted, the institutions and repositories searched and the level of effort undertaken. This discussion should include, if appropriate, the particular perspective of the authors, any opposing views, and any other relevant constraints, limitations or biases.

F. A discussion concerning the cultural resources, practices and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site.

G. A discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area affected directly or indirectly by the proposed project.

H. An explanation of confidential information that has been withheld from public disclosure in the assessment.

I. A discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs.

J. An analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place.

K. A bibliography of references, and attached records of interviews which were allowed to be disclosed.

If on-going cultural activities and/or resources are identified within the project area, assessments of the potential effects on the cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

ARCHIVAL RESEARCH

Archival research focused on a historical documentary study involving both published and unpublished sources. These included legendary accounts of native and early foreign writers; early historical journals and narratives; historic maps, land records, such as Land Commission

Awards, Royal Patent Grants, and Boundary Commission records; historic accounts, and previous archaeological reports.

INTERVIEW METHODOLOGY

Interviews are conducted in accordance with Federal and State laws, and guidelines, when knowledgeable individuals are able to identify cultural practices in, or in close proximity to, the project area. If they have knowledge of traditional stories, practices and beliefs associated with a project area or if they know of historical properties within the project area, they are sought out for additional consultation and interviews. Individuals who have particular knowledge of traditions passed down from preceding generations and a personal familiarity with the project area are invited to share their relevant information concerning particular cultural resources. Often people are recommended for their expertise, and indeed, organizations, such as Hawaiian Civic Clubs, the Island Branch of Office of Hawaiian Affairs (OHA), historical societies, Island Trail clubs, and Planning Commissions are depended upon for their recommendations of suitable informants. These groups are invited to contribute their input, and suggest further avenues of inquiry, as well as specific individuals to interview. It should be stressed again that this process does not include formal or in-depth ethnographic interviews or oral histories as described in the OEQC's Guidelines for Assessing Cultural Impacts (2012). The assessments are intended to identify potential impacts to on-going cultural practices, or resources, within a project area or in its close vicinity.

If knowledgeable individuals are identified, personal interviews are sometimes taped and then transcribed. These draft transcripts are returned to each of the participants for their review and comments. After corrections are made, each individual signs a release form, making the interview available for this study. When telephone interviews occur, a summary of the information is usually sent for correction and approval, or dictated by the informant and then incorporated into the document. If no cultural resource information is forthcoming and no knowledgeable informants are suggested for further inquiry, interviews are not conducted.

ENVIRONMENTAL SETTING

PROJECT AREA DESCRIPTION AND ENVIRONMENTAL SETTING

The property is located at 1711 Kanapu`u Drive, Kailua, Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu, Hawai`i [Tax Map Key (1) 4-2-004: 001]. Bellows Air Force Base forms the eastern property boundary, Koa Haole forest and residential housing form the northern property boundary, the Kaopa Subdivision forms western and southern boundaries, and the Koa Haole forest also bounds the property on the south.

The project area is located approximately between 100 and 200 feet above mean sea level (amsl). At this elevation, temperatures range from the high 50s to the high 80s during the winter months and from the mid-60s to the high 80s or low 90s during the summer (Armstrong 1980: 62).

PROJECT AREA SOILS

According to Foote *et al*. (1972:26, 110, Map 66), the project area is situated within the matrices described as Alaeloa Silty Clay (AeE) and Papaa clay (PYF). The Alaeloa soil series consists of well-drained soils which are gently sloping to very steep, developed in material weathered from igneous rock. The Alaeloa silty clay, 15 to 35 percent slopes (AeE), exhibit moderately rapid permeability, medium runoff and moderate erosion hazard. This soil type is utilized for agriculture (pineapple), pasture, wildlife habitat, homesites, and water supply. The Papaa series soils are formed in basalt end up as colluvium. The Papaa clay with 35 to 70 percent slopes (PYF), has convex, very steep slopes. This soil is very sticky and very plastic and cracks widely when dry. Runoff is rapid and the erosion hazard is severe for this soil. This soil is primarily used for pasture.

PROJECT AREA VEGETATION

Within the project area's perimeters were mainly non-native vegetation that included Formosan Koa (*Acacia confusa*), Chinese violet (*Asystasia gangetica*), Koa Haole (*Leucaena leucocephala*), Kikuyu (*Pennisetum clandestinum*), (*Brachiara* sp) and California grass (*Urochloa mutica*).

CLIMATE

The project area is situated within the wet region of O`ahu's windward (eastern) side. According to Price (1983:62), the project area usually receives about ten inches a year during December and January. Higher elevations within the Kailua Ahupua`a are prone to receive more precipitation due to cloud descent and lower temperature climates.

TRADITIONAL AND HISTORIC SETTING

TRADITIONAL SETTING

Recent re-evaluation of radiocarbon dates suggests O`ahu Island was first settled between A.D. 850 and 1100 by Polynesians sailing most likely from central East Polynesia (Kirch 2011:24). Archaeological settlement pattern data indicates that the initial colonization and occupation of the Hawaiian Islands first occurred on the windward shoreline areas of the main islands, with populations eventually settling into drier leeward areas at later periods (Kirch 1985). Coastal

settlement was still dominant, but populations began exploiting and living in the upland (*kula*) zones. Greater population expansion to inland areas began about the A.D. Twelfth Century, but continued through the16th Century.

As the Hawaiian culture developed, land became the property of the king, or *ali`i `ai moku* (the *ali`i* who eats the island/district), which he held in trust for the gods. His title of *ali`i `ai moku* ensured rights and responsibilities to the land, but did not confer absolute ownership. The king kept the parcels he wanted, his higher chiefs received large parcels from him and, in turn they, distributed smaller parcels to lesser chiefs. The *maka`āinana* (commoners) worked the individual plots of land (Kirch and Sahlins 1992 vol.1:25).

In general, several terms, such as *moku*, *ahupua`a*, *`ili* or *`ili`āina* were devised to describe various land sections. A district (*moku*) contained smaller land divisions (*ahupua`a*), which customarily continued inland from the ocean and upland into the mountains. Extended household groups living within the *ahupua`a* were, therefore, able to harvest from both the land and the sea. As the Polynesian economy was based on agricultural production and marine exploitation, as well as animal husbandry and utilizing forest resources, this situation ideally allowed each *ahupua`a* to be self-sufficient by supplying needed resources from different environmental zones (Lyons 1875:111). The *`ili `āina,* or *`ili,* were smaller land divisions next in importance to the *ahupua`a* and were administered by the chief who controlled the *ahupua`a* in which the *ili* were located (*ibid*:33; Lucas 1995:40). The *mo`o`āina* were narrow strips of land within an *`ili*. The land holding of a tenant, or *hoa `āina,* residing in an *ahupua`a* was called a *kuleana* (Lucas 1995:61). Oral history notes that the division of O`ahu's lands into districts (*moku*) and sub-districts was solidified by the *ali`i nui*, Mā`ili-kūkahi during the early part of the 16th century (Kamakau 1991:53-56). O`ahu contained six districts including Wai`anae, `Ewa, Waialua, Ko`olauloa, Ko`olaupoko, and Kona at the time of contact.

The Hawaiian economy was based on agricultural production and marine exploitation, as well as raising livestock and collecting wild plants and birds. Extended household groups settled in various *ahupua`a*. During pre-Contact times, there were primarily two types of agriculture, wetland and dry land, both of which were dependent upon geography and physiography. River valleys provided ideal conditions for wetland *kalo* (*Colocasia esculenta*) agriculture that incorporated pond fields and irrigation canals. Other cultigens, such as *kō* (sugar cane, *Saccharum officinaruma*) and *mai`a* (banana, *Musa* sp.), were also grown and, where appropriate, such crops as *`uala* (sweet potato, *Ipomoea batatas*) were produced. This was the

typical agricultural pattern seen during traditional times on all the Hawaiian Islands (Kirch 1985). Agricultural development on the windward side of O`ahu was likely to have begun early (A.D. 1100–1300) during what is known as the Expansion Period (*ibid*).

Kailua Ahupua`a is the largest valley on the windward coast and the largest *ahupua`a* in the Ko`olaupoko District. Kailua Ahupua`a is situated between the *ahupua`a* of Waimānalo, to the southeast, and Kāne`ohe, to the north and west. Compared with other areas of O`ahu and the Hawaiian Islands, in general, Kailua Ahupua`a has been blessed with an abundant and diverse set of natural resources. Large extensive sandy beaches front the *makai* portion of the *ahupua`a.* The extensive reef environment and nearby offshore islands, including Mōkōlea and the two Mokulua islets, provide additional resource gathering environments. Two extensive inland freshwater areas, Kawainui Marsh and Ka`elepulu Pond, exist inland from the coast. Kawainui Marsh and Ka`elepulu Pond, along with 18 permanent freshwater streams, provided an abundance of ecologically diverse environments. Mount Olomana (1,643 feet) dominates the landscape in the central portion of the *ahupua`a*. Other low ridgelines and gulches exist in the central portion southern half of the *ahupua`a*. The massive cliffs of the Ko`olau uplands of Maunawili provide a natural barrier to Honolulu District as well as an extensive upland mountain environment. These mountains would have been important raw material sources in ancient times, containing diverse and numerous lithics (for making stone tools), medicinal plants, and hardwoods.

Kailua Ahupua`a supported one of the largest pre-Contact populations in O`ahu, and possibly in the Hawaiian Islands, due to its bountiful natural resources, environment, and favorable physiographic setting. Access to abundant fresh water, coastal environments, and the mountains, as well as large areas amenable to both agriculture and habitation, made Kailua a favorite place for members of the *ali`i* class as well as the *maka`āinana* (commoners). Kailua was known as a favorite place for the *ali`i* to visit and recreate. Handy and Handy (1972:457) relay that "Kailua was the home of the *ali`i* Kuali`i in the early 18th century, and presumably had been the seat of the high chiefs of the Ko`olaupoko from very early times." Large agricultural systems provided *kalo* (taro) and a variety of other crops such as *mai`a* (banana) and *`uala* (sweet potato). Handy and Handy (1972:457) state that terraced areas were present on the flanks of Ka`elepulu Pond near the base of a ridge located to the east. It is possible that the ridge to which Handy and Handy (1972:457) are referring is Ka`iwa Ridge. Fish were farmed in abundance in the two large natural *loko i`a* (fishponds) Kawainui and Ka`elepulu, along with the numerous fortified fishponds that were constructed along the shoreline and inland areas of Kawainui. The extensive *kai lawai`a* (fishery) of Kailua Bay and the offshore islands provided a

patchwork of ocean resource zones that extended a mile offshore from the beaches of Oneawa and Kailua Bay.

The earliest inhabitants of Kailua Ahupua`a more than likely settled from the coast to the mid to upper regions (more inland), a pattern typical of the *ahupua`a* resource acquisition strategies of Hawai`i (Tuggle 1994). The plentiful freshwater sources, use of fishponds, favor of the land by the *ali`i*, and the nearby tool resource site aptly places Kailua as an important and well-used area of O`ahu.

WAHI PANA

There are many important legends associated with the environs of Kailua Ahupua`a (Fornander 1969; Beckwith 1970; Sterling and Summers 1978; Drigot and Seto 1982). Legends and oral histories provide the meaning of the specialness of this place, the name Kailua means "two seas" which apparently refer to the two inland water sources, Kawainui Marsh and Ka`elepulu Pond (Pukui *et al.* 1976:69). Few other areas in the Hawaiian Islands have as many landforms named for sacred persons and events as does Kailua (Drigot and Seto 1982).

Of special interest is the significance of the channel that connected Kawainui Marsh and Ka`elepulu Pond in Hawaiian legendary accounts. A sacred connection of great *mana* was considered between the two bodies of water, Kawainui Marsh (male) and Ka`elepulu Pond (female), where legend has it that the two were mated at Kawailoa (O'Leary and Hammatt 2004).

Many important legends center focus on Kawainui and Ka`elepulu, as well as the peak of Olomana, Mōkapu Peninsula and Alāla Point (*i.e.,* the high point-lookout between Kailua Beach and Lanikai). Themes of voyaging, creation, fertility and genealogical ties to ancestor gods are mentioned repeatedly throughout the legends. One well-known legend involved the creation of the first man (Kanehulihonua) and woman (Keakahulilani) by the gods Kāne, Kū and Lono at Mōkapu. There are many legends involving the famous Ali`i Olopana who is remembered as residing in Kailua. Well remembered and recorded in *oli* and *mo`olelo* are many historic episodes involving Olopana who, with his brother Kahikiula came to O`ahu from Kahiki and settled in Kailua with his wife Hina. Olopana is credited with the establishment of Pahukini and Holomakani Heiau near Kawainui, and with other *heiau* throughout Ko`olaupoko. Hina and Kahikuila, Olopana's brother, gave birth to Kamapua`a whose capture, escape, and subsequent rebellions against his *`anakala* (uncle) resulted in Olopana's eventual death and Kamapua`a's subsequent return to Kahiki (Fornander 1969). The development of Kamapua`a into one of

Hawai`i's preeminent legendary figures, following his exploits with Olopana and his tumultuous love affair with Pele, were documented by numerous sources in the past. Some epics were written as segments in Hawaiian Language newspaper that lasted over a year. The significance of these legends is paramount and this is evidenced by the continued interest as versions of these events continue to be translated. These legends are primary sources of insight into traditional Hawaiian epistemologies, and their connection to specific places within the Hawaiian landscape are immeasurably valuable.

In *Ho`ona`auao No Kawai Nui,* Drigot and Seto (1982) describe some of the numerous *mele* and *oli* (chants) that were composed describing the fishponds Kawainui and Ka`elepulu. These chants describe the environment and relationships between people and the land. These chants tell of the *mo`o akua* ('lizard god' 'dragon') or the *mo`o* goddesses Hauwahine and Haumea, who were respected guardians of the land; these goddesses protected and nourished the Kailua fishponds, which were known for their production of mullet and *awa* (milkfish). These *mo`o* goddesses were said to reside on the ridge between Olomana and Pu`u O Ehu. There are numerous legends describing the *mo`o* goddesses of Kawainui Hauwahine. For example, Hauwahine is referred to in the epic *Hiiakaikapoliopele* by Hi`iaka as the guardian of Kawainui. Her ability to take the forms of a *mo`o* and a woman allude to her supernatural powers.

On the banks of Kawainui stood the great fish-attracting tree or stick named Makalei, which brought prosperity to the people who honored and respected the tree; and, to the creator goddess Haumea, who brought the tree from Paliuli, Hilo, Hawai`i Island. In *Hawaiian Mythology*, Martha Beckwith (1970) discusses Haumea as associated with themes surrounding food supplies for the life of man and marriages and births for the increase of healthy family populations. The Makelei tree/stick is associated with a source of a never-ending supply of food. If treated properly, this tree/stick will feed and nourish the Hawaiian people, and allow for healthy, fertile populations. According to Beckwith (1970), in the Kumulipo version of this legend, Haumea is referred to as a genealogical link to the ancestor gods. Her role as midwife to Olopona's daughter (Muleiula) and her status as patroness of painless childbirth is connected to the bringing of these gods and certain chiefly lineages to O`ahu (*ibid.*). The Makalei tree or branch is also symbolic of the ability to produce healthy offspring of strong stock; thus, providing longevity and continuity to the genealogic line (*ibid.*).

Other well-known traditions about the ample productivity of the Kailua region and its ability to nourish the Hawaiian people include the legend of the *lepo `ai `ia* (edible mud). This *lepo `ai `ia*, which was brought to Kawainui by the famous voyager Ali`i Kaulaakalana from

Kahiki was served as a substitute for *poi* to Kamehameha's warriors during a time of *kalo* shortage in Kailua Ahupua`a (Sterling and Summers 1978:231-232). Protocols surrounding the procurement of the mud included inappropriate speech, which would result in the death of the harvester. Informants provided descriptions of the mud; it was found only in Kawainui, it was thick and jelly-like, like *haupia* pudding in texture but the color of *poi*.

Kailua Ahupua`a also has strong connections to the legends of the well-known *menehune*, the race of "little people" who built monumental structures (*e.g.,* fishponds and *heiau*) at night for the Hawaiians.[1] The *menehune* have been credited with the construction of Ulupō Heiau, one of the largest structures on the Windward side of O`ahu. Ulupō Heiau is located on the Kāne`ohe (north) side of Kailua Road, just *makai* (east) of Castle Junction. It is located near the head of the former Kawainui fishpond (McAllister, in Sterling and Summers 1978:232). According to Kirch (1996:32), "[a]lthough not the largest temple site on O`ahu in terms of area … Ulupō ("night inspiration") may be the greatest in terms of the sheer mass and volume of stones used in its construction." During McAllister's visit to Ulupō, an elderly Hawaiian man named Mahoe pointed out to him a narrow pathway on the northwest corner called the "*menehune* pathway" that led from the spring. According to Akuni Ahau, an informant, this was the spring in which the sacrificial pigs were washed prior to bringing them up to the temple oven of Ulupō (McAllister in Sterling and Summers 1978:233).

Many famous *ali`i* were known to reside in Kailua and to come to Kailua to visit and recreate. In addition to the aforementioned famous Olopana, Kakuhihewa was said to reside at `Ālele, which refers to central Kailua, a flat plain previously known as Kula o `Ālele (Fornander 1969, Volume 2:274). Fornander (*ibid)* described the Kākuhihwea residence at Kailua as one of three (Kakuhihewa) royal residences (Waikīkī and `Ewa being the other two). Fornander (*ibid*) described the residence, named Pāmoa, as a large house but not as overtly large as past residences of lesser chiefs and estimated that Kakuhihewa lived in the last half of the 16th century. Kamakau's (1991:69) description of Kakuhihewa's residence suggests a wide variety of games and other activities took place here:

> At `Ālele in Kailua he built his "government house", *Hale Aupuni*. It was forty *anana* long and fifteen *anana* wide: Pāmoa was its name. All these were done here: storytelling, distribution of lands, recalling traditions of the ancestors, reciting of genealogies,

[1] There are interesting alternative interpretations of the *menehune legends; including the idea that the term was initially mistranslated (or incompletely understood), and that the word-concept is actually closer to "commoner" or maka`āinana* than it is to mythical entities.

> practicing of battle skills, wielding of war clubs, thrusting of spears, observation of omens, study of land features, study of stars, playing *kōnane*, learning the *mele* of ancestors and chiefs, running, learning to leap from cliffs, *maika* rolling, dart throwing, boxing, hand wrestling, sitting wrestling, shoulder wrestling, hand to hand fighting, all kinds of sports that strengthened the body, cultivating and fishing.

Other chiefs known to reside in Kailua include Kūali`i, whose *piko*-cutting ceremony occurred at the *heiau* of `Ālala, and the sacred drums of Opuku and Hāwea were used at the *heiau* to announce the event to people (Fornander and Sterling, in Kelly and Nakamura 1981). Kūali`i is remembered as leading many battles in his quest as *mō`ī* (supreme ruler) of O`ahu. He and his forces battled rival chiefs in O`ahu, as well as voyaging to other battles, collecting additional allied warriors, and aiding in the battles of other chiefs with whom he was aligned on other islands (Fornander 1969, Volume 2: 280-282). Kūali`i was known to reside in both Kailua and Kualoa, but preferred Kailua, where he died at an advanced age. Fornander (Fornander 1969, Volume 2: 284) explains the extent to which Kūali`i went to conceal his bones after his death. Before his death he entrusted his dearest *kahu* ('attendant' or 'guardian') to attend to his funerary arrangements. After his death and the subsequent defleshing and preparation of his *iwi* (bones) for concealment, which was done to avoid access and desecration by mortal men, Kūali`i's trusted *kahu* secretly ground the *iwi* into a fine powder. Afterwards he announced that a great feast must be prepared to honor Kūali`i, and chiefs from far and near were invited to attend. Great preparations were undertaken, and on the arrival of the feast day, the *kahu* secretly mixed the powdered remains into the *poi* that was served at the feast. When asked if he had carried out his chief's wishes he replied "…he had hidden his masters bones in a hundred living tombs."

The practice and popularity of maintaining a residence in Kailua by other prominent and famous *ali`i* continued into early Post-Contact times. For example, Kelly and Nakamura (1981) report that Kahekili, a paramount chief of Maui, was said to have resided in Kailua in the 1780s, during which time he battled many O`ahu warrior-chiefs, killed Kahahana, and took his place as high *ali`i* of O`ahu (Kelly and Nakamura 1981). During his period of residence in Kailua, Kamehameha I reportedly worked in the fishponds of both Kawainui and Ka`elepulu, in order to encourage and stimulate fishing and the growing of food to feed his warriors brought from Hawai`i to conquer O`ahu in 1795 (Kamakau, in Kelly and Nakamura 1981). In the 1870s, Queen Lili`uokalani was said to reside at Maunawili at the Boyd Estate. According to Brennan (2000), "[s]he would come on the water by way of Waimānalo. And then the carriage pulled by

horses would bring her into Maunawili. And Maunawili was the place where she chose to rest and recuperate."

HISTORIC PERIOD

Historic accounts of Kailua directly after contact are limited, and while great changes were occurring in land use practices, little written documentation exists to create a precise timeline. Levi Chamberlain, a missionary who traveled around the islands in 1828 to inspect the conditions of the mission schools, recorded one of the only written accounts. On approaching and passing through Kailua he recorded his interpretations of Kawainui:

> Here at Kailua we found a small school under the care of a female not very well qualified for an instructor. Kailua is a large district and the schools of which there are several; have on former examinations, made a very good appearance. At the present time, most of the males are absent procuring house timber for Kaleohano, the proprietor of the district.
>
> Directing our course towards Kaneohe, the next district, we were obliged to pass over a tract of land mostly overflowed with water from the late rains. Here I was obliged to wade, as the distance was too great to admit of my being carried on the shoulders of my attendants, as was generally the case in passing a small stream of water. After emerging from the flat, our path was not improved, for we had now to walk through mud instead of water—we walked some distance along the steep hill, and at length by a winding path ascended to the top of it. We sat down to rest for a few minutes, and I found myself upon the summit of a ridge extending from the mountains in a right line to the sea and dividing the low lands of Kailua from those of Kāne`ohe (Chamberlain Ms.: 664, in Kelly and Nakamura 1981:7).

THE MĀHELE (1848-1851)

In the 1840s, a drastic change in the traditional land tenure resulted in a division of island lands and a system of private ownership based on Western law. While it is a complex issue, many scholars believe that in order to protect Hawaiian sovereignty from foreign powers, Kauikeaouli (Kamehameha III) was forced to establish laws changing the traditional Hawaiian economy to that of a market economy (Kuykendall 1938, Vol. I:145; Daws 1977:111; Kelly 1983:45; Kame`eleihiwa 1992:169-70, 176; Kelly 1998:4). The Māhele of 1848 divided Hawaiian lands between the king, the chiefs, the government, and began the process of private ownership of lands. The subsequently awarded parcels were called Land Commission Awards (LCAs). Once lands were thus made available and private ownership was instituted, the *maka`āinana* (commoners), if they had been made aware of the procedures, were able to claim the plots on which they had been cultivating and living. These claims did not include any

previously cultivated but presently fallow land, *`okipu`u* (forest clearing on O`ahu), stream fisheries, or many other resources necessary for traditional survival (Kelly 1983; Kame`eleihiwa 1992:295; Kirch and Sahlins 1992). If occupation could be established through the testimony of two witnesses, the petitioners were awarded the claimed LCA and issued a Royal Patent after which they could take possession of the property (Chinen 1961:16).

Māhele land records provide a component to understanding land use history during the early to mid 1800s. However, due to the fact that many people who had use rights in the land did not register their claims with the Board of Commissioners, the land commission documents represent only a portion of the population that was living on and cultivating the land (Kelly and Nakamura 1981). These authors discussion of land history of Kailua indicates the importance of the *ahupua`a* of Kailua in relation to the individual naming of at least 63 *`ili* (smaller land divisions) within the region. This is compared with to the average of 30 to 40 named *`ili* within larger *ahupua`a* (Lyons, in Kelly and Nakamura 1981). The additional amount of individually-named parcels attests to the importance and value of the lands of Kailua to the Hawaiians before the Māhele. According to the Māhele documents, the *ahupua`a* of Kailua, except for the *`ili* claimed by the king and by other chiefs, was claimed by Kamehameha III to his wife Kalama. In addition to Kalama, forty-one high-ranking chiefs claimed an interest in Kailua Ahupua`a. Kamehameha III kept the *`ili* of Kawailoa (in which the current project area is located) as Crown Lands (Kelly and Nakamura 1981). Kawailoa was an *`ili lele* (essentially a discontinuous piece of land) made up of several parcels located at the coast, along the banks Ka`elepuhu Pond and Kawainui, and in the upper reaches of Maunawili Valley.

Land Commission Awards (LCA) for Kailua documented garden areas clustered around all eighteen permanent and perennial streams and in areas of natural springs. Two LCA are located within the project area, located near an unnamed stream, and are identified as LCA 44:2 and LCA 4452:12 on TMK (1) 4-2-004 (Appendix E). According to the Waihona `Aina Database (2014), LCA 44 M.A. (Royal Patent 8262) consisted of on half of the *`ili* of Kaula (204 acres) and includes a portion of the project area (See Figure 2). Land Court Award 44 was awarded to Kalaau and signed by Kamehameha III at the "Royal Palace on 2 February 1848" (see Appendix E).

Land Court Award 4452 included 11,885 acres within the *ahupua`a* of Kailua awarded to Queen Kalama and also included a portion of the project area (see Figure 2). As specified in LCA 4452, these lands were awarded to Queen Kalama as house lots (see Appendix E).

During the 100 or so years following the Māhele, the agricultural patterns of Kailua were drastically altered. Rice production began in earnest after the initial wave of Chinese immigrants reached Hawai`i. Many of the abandoned *kalo lo`i* in Kailua were converted to rice. Land was rented from farmers not using their lands for rice cultivation, and several mills were constructed (*e.g.,* one was located in the *`ili* of Makali`i). Rice farming began as early as 1789 in Hawai`i (Kelly and Nakamura 1981). Until 1900, rice was the most important crop in Kailua. After 1900, truck-farming of taro and introduced, western crops was most prevalent (*ibid.*). In 1876, the Reciprocity Treaty between the Hawaiian Kingdom and the United States was signed. After the signing of this treaty, the sugar industry in Hawai`i was greatly expanded.

Following this treaty, sugarcane production underwent a great expansion and its reliance on water from Kailua was substantial. By 1878, construction of a complex of flumes, ditches, and tunnels was completed in the *mauka* portions of Maunawili to collect water from streams and springs. This system facilitated the delivery of water to Waimānalo's sugarcane fields. By 1900, this system was 4 ½ miles long, and diverted all of Maunawili's stream water to Waimānalo. In the 1920s, improvements to the existing system were added. This included catchment tunnels excavated into the Ko`olau Mountains to increase water flow (Wilcox 1996).

In 1909, the Hawaiian Copra Company decided to level the "sand dunes and smooth[ing] out the former dune areas" (Hall 1997:77-78). They planted 130,000 coconut trees on 200 acres of beach sand, calling the area Coconut Grove. This unfortunate event likely disturbed numerous types of culturally significant sites. Incomplete and disarticulated human burials along with truncated cultural deposits resulted from these actions.

By 1924, a system of pumps, pipelines, tunnels, and ditches was completed that pumped water from Kawainui Marsh into the Kailua reservoir, which was part of the Waimānalo Irrigation System. This was used until the early 1950s (Wilcox 1996:111; map of Kailua Ditch on 106). Use of the Kawainui water rapidly declined after the liquidation of the Waimānalo Sugar Company in 1947 (*ibid.*).

Ranching began in Kailua Ahupua`a in the early 1900s, and the Kaneohe Ranch began to dominate land holdings in the Kailua and Kāne`ohe areas. Cattle, sheep, and horses were pasturing throughout Kailua's open plains landscape. As a result of this, it is likely that cattle grazing destroyed many abandoned gardens and *lo`i*. Kaneohe Ranch (Castle Trust) was also involved in commercial agriculture growing pineapple and sugarcane on its vast land holdings.

By the 1950s truck farming and ranching began to give way to housing, municipal, and commercial development. The realignment of the Pali Highway in 1959 allowed for the advertisement of Kailua as the ultimate "bedroom" community of Honolulu, just 10 miles and 25 minutes (by car) away. Kailua's expansion has continued until the present time.

PREVIOUS ARCHAEOLOGY

Based on previous archaeological studies and archival research, at the time of Contact (1778) , Kailua was a thriving community during the pre-Contact Period. Kailua Ahupua`a was close to the shoreline, and included prime agricultural lands including the Kawainui Marsh, the largest freshwater marsh in Hawai`i. Additionally, resources included an inland pond (Ka`elepulu) and as many as 18 streams fed the terraced taro fields. All of the freshwater made the ground rich and fertile and "provided bountiful agricultural and resource gathering areas" (Mann et al. 2002). Mele (chants) also suggest there may have been two very productive fishponds in Kailua. Additionally, geological studies have confirmed that the caldera of the Ko`olau Volcano (in the shadow of which Kailua lies) was a basalt quarry, ideal for stone tool production. Kailua, a populous community favored by ali`i, was also the center of a large royal complex in the 15th and 16th centuries that included playgrounds for sports and physical training (Sterling and Summers 1978:231-232).

Since Thrum's study of the island in 1907, numerous studies have been conducted in Kailua during which additional sites have been identified. Site types range from terraces to habitation platforms, to *heiau*, and skeletal remains. Although diverse site types have been found in Kailua, a great number of such sites have been burials. Ancient Hawaiians typically buried their ancestors in sand, land with no potential agricultural value (Kirch 1985). Since Kailua Town was built on former sand dunes and due to the previously documented human skeletal remains in the area, Native Hawaiian burials continue to be inadvertently encountered during construction-related activities associated with ever-increasing development. Thus, the inventory of burials has been increasing. More than 83 archaeological reports describing finds of burials, temporary and permanent habitation sites, agricultural sites and the like have been filed on this *ahupua`a*, a testament to its importance. However, most of these studies are from the *mauka* regions, as the coastal area had already undergone extensive development.

ARCHAEOLOGICAL STUDIES WITHIN KAILUA AHUPUA`A

Ka`elepulu Fishpond (State Site 50-80-11-377) was initially recorded by McAllister during the 1930 Bishop Museum survey of the island of O`ahu (McAllister 1971:190).

According to Pukui *et al.* (1976:69) the literal meaning of Ka`elepulu is the "moist blackness". McAllister describes the inland pond as a having once been a “fresh water pond of much importance” (*ibid*). McAllister (*ibid*) states that Ka`elepulu Fishpond appears on the Alexander map of 1884 as encompassing an area of 190 acres with marshland amounting to 90 acres. There was a sluice gate (*mākāhā*) on the northeastern (*makai*) side of the pond and an outlet which extended to Kailua Bay. Taro patches (*lo`i*) once extended between Ka`elepulu and the stream from Kawai Nui Marsh (*ibid*:119). According to Mrs. Charles Olona (an informant in Sterling and Summers 1978:240) an informant, the pond was kept remarkably clean and it produced the most abundantly healthy and tender fish, including: mullet, *awa, āhole,* and *`o`opu*. Hammatt and Shideler (1992:7) suggest that these areas, including the extensive marsh lands of Puha and Ka`elepulu Pond, would have made the relatively flat coastal margins just north and south of Wailea Point, logical choices for early Polynesian settlement.

Kawai Nui Marsh (State Site 50-80-11-370) also was initially recorded by McAllister, under the auspices of the 1930 Bishop Museum survey of the island of O`ahu (McAllister 1971:186). McAllister (*ibid*) describes Kawai Nui Marsh as having been at one time a large inland pond which…

> …belonged to the alii. Any person coming from this area…had royal blood in his veins and could go where he wished, apparently taking precedence over alii from other sections.

In 1977, Stephen Clark conducted a cursory Archaeological Surface Survey of the roadway corridor for the proposed extension of Hamakua Drive between Hahani Street and Akoakoa Street, in Kailua [TMK: (1) 4-2, 5] (Clark 1977). During the survey two sites were newly identified (State Site 50-80-11-4699 and State Site 50-80-11-4700). State Site 50-80-11-4699, a possible agricultural/habitation complex consisting of a large earthen mound, a possible wall, alignments, a human mandible, a paved enclosure, two possible agricultural plots, and two possible *`auwai*. State Site 50-80-11-4700 is a T-shaped site which was tentatively interpreted as a *heiau* and additional features including, two partially paved platforms, one paved with coral and containing an interior alignment; alignments, including a rectangular notched alignment; a rectangular mound with associated alignments; additional alignments with interior features. Artifacts identified during the survey include: a possible sharpening stone; coral; a muller; basalt flakes; four possible post, or image, holes; two sharpening stone fragments; historic bottle glass fragments.

In 1984 Chiniago conducted a cursory Archaeological Survey at the two proposed locations of the Maunawili Pump Station on the corner of Auloa Road and Kalaniana`ole Highway, and Kukanon Pump Station, on the southeast side of the existing Kukanono Sewage Treatment Plant at the end of Manu-Oo Street, and the associated force mains, in Kailua [TMK: (1) 4-2-7, 3, 13, 51] (Barrera 1984). No historic properties were identified during the survey.

The Bishop Museum conducted an Archaeological Reconnaissance Survey of the area proposed for the Windward Park in Kailua [TMK: (1) 4-2-014:002 and 004] (Pantaleo and Cleghorn 1989). During the survey archaeological five sites (State Sites 50-80-11-2034 through -2037 and -3739) were documented. State Site 50-80-11-2034 consists of a terrace and an L-shaped terrace; Site -2035 consists of two rock walls; Site -2036 consists of a rock wall and a mound; Site -2037 consists of a linear mound. Site -3739 is a site complex of five features including: Feature A (terrace), Feature B (alignment), Feature C (a rock mound), Feature D (C-shaped alignment), and Feature E (alignment).

The inadvertent discovery of human skeletal remains at 1414 Aalapapa Street, Lanikai, O`ahu [TMK: (1) 4-3-004:005] was found upon construction at the Cole House site. In accordance with State Historic Preservation Division and in consultation with the O`ahu Island Burial Council, Cultural Surveys Hawai`i, Inc. conducted the removal of three burials under the direction of the State Historic Preservation Department. It was determined that the remains were part of State Site 50-80-11-3738 (Bath and Smith 1988), which were more than likely an expanded area of the site; further disinterment of burials was halted (Hammatt and Shideler 1992).

Cultural Surveys Hawai`i, Inc. (CSH) conducted an Archaeological and Historical Assessment and Field Inspection of a 0.8 mile segment of the Auloa Road right-of way in anticipation of the installation of a 16-inch water line, in Kailua [TMK: (1) 4-2] (Hammatt and Chiogioji 1997). No new sites were identified during the Field Inspection. However, CSH made note of two existing historic properties located at Castle Junction (the Kaneohe Ranch office building, State Site 50-80-10-1360, and a war memorial monument) adjacent to the CSH project area.

Between December 1999 and August 2000 the International Archaeological Research Institute (IARII) conducted Archaeological Monitoring during sewerline installations along Kalaheo Avenue, Kailua [TMK: (1) 4-2-001, 019, 020; 4-4-022 through 032; 4-4-011] (Ormsby *et al*. 2003). No historic properties were identified.

Scientific Consultant Services, Inc. (SCS) conducted Archaeological Monitoring during ground alterations associated with fire hydrant installations at Kailua Elementary School [TMK: (1) 4-3-056:003] (Calis 2003). During the course of the monitoring activities Site 50-80-10-6524, a burial site containing three burials, was newly identified. Burials 1 and 2 were "…identified *in situ,* in a primary burial context" (*ibid*: 12). Both Burials 1 and 2 were in flexed position and determined to be adult females of Polynesian ancestry interred during the pre-Contact Period. Burial 3, extensively disturbed during backhoe trenching, was recovered from the backdirt pile (*ibid*: 12, 15, and 16). The age of Burial 3 was determined to be pre-pubescent. However, as Burial 3 was in fragmented condition, gender and ethnicity could not be determined (*ibid*: 12).

Between April and November 2003 Archaeological Monitoring was conducted by CSH during the Anti-Crime Street Lights Project along both sides of Kailua Road [TMK: (1) 4-3-056; 4-2-038] (Jones and Hammatt 2004). Site 50-80-11-6657, a firepit yielding a date of A.D. 1400 to 1850 was identified. The findings of the archaeological monitoring indicate the ground surface and the subsurface strata, to a lesser extent, have undergone extensive modifications due to the urbanization of the area.

Between April 2003 and April 2005 CSH conducted Archaeological Monitoring of the Kalāheo Avenue Reconstructed Sewer Project [TMK: (1) 4-3-016, 017-020, 024-027, 075, & 080] (Borthwick *et al.* 2006). Two site were identified (State Site 50-80-11-6770 and 50-80-11-6818) during the monitoring activities. State Site 50-80-11-6770 consists of five sets of human skeletal remains (Features A through E) encountered near the intersection of Wilikoki Place and North Kalāheo Street. State Site 50-80-11-6818 consists of fragmented, previously disturbed, human skeletal remains discovered at the intersection of `Ōma`o Street and North Kalāheo Street.

T. S. Dye and Associates conducted an Archaeological Inventory Survey of an approximately 192, 862 square foot beach lot located at 55 Kailuana Place, Kailua [TMK: (1) 4-3-022:011] (Putzi and Dye 2004a). During the inventory survey one site (State Site 50-80-11-6642) was newly identified. State Site 50-80-11-6642 "…yielded evidence of traditional Hawaiian habitation and [five intact} early Historic-era human burials…" and included Traditional-type materials (midden deposit and artifacts) and a pig burial *(ibid*: 24–25).

Subsequent to the Archaeological Inventory Survey (Putzi and Dye 2004a), T. S. Dye and Associates conducted Archaeological Data Recovery of Site -6642 [TMK: (1) 4-3-022:011]

during the re-internment of the five burials initially identified during the AIS (Putzi and Dye 2004b). Data Recovery yielded "…traditional Hawaiian artifacts, food remains, and the partially exposed remains of a sixth burial" (Putzi and Dye 2004b). Based on the findings of the Data Recovery excavations, State Site 50-80-11-6642 has been interpreted as a "a burial ground; a center of religious ceremony; a habitation area, including food processing and food procurement; a work area for craftsmen, such as woodworkers; animal husbandry; and as a residence for the *ali`i*" (*ibid*: 28). The variety of activities conducted at this site provides a clearer picture of traditional life-ways in the early post-Contact Period as well, as additional data pertaining to traditional Hawaiian mortuary practices.

In September 2006 Pacific Consulting Services, Inc. conducted an Archaeological Assessment (Archaeological Inventory-level Survey work with negative findings); with limited shovel excavation, of the 10.7 acre Kailua area proposed for emergency rock fall and landslide mitigation [TMK: (1) 4-2-003:014 and 017] (Collins and Nees 2007). The project area is located along Kailua Road. No historic properties were identified.

Cultural Surveys Hawaii, Inc. conducted an Archaeological Inventory Survey of a 0.7 acre property located on Hekili Street, in Kailua [TMK: (1) 4-2-038:009 and 010] (Tulchin *et al.* 2007). During the survey one site (State Site 50-80-11-6916) was identified. State Site 50-80-11-6916 consists of a pre-Contact cultural deposit (comprised of midden, basalt tools, lithic debitage, numerous pit features, and two human burials). The findings at Site -6916 suggest "…a pre-Contact indigenous occupation…with an emphasis on lithic reduction work related to the manufacture of stone tools" (*ibid*:95). The pre-Contact date is supported by radiocarbon analysis which yielded a calibrated 2-Sigma date, with 95.4 percent accuracy, ranging from 1440 A.D. to 1520 A.D. (Tulchin *et al.* 2007).

ARCHAEOLOGICAL STUDIES IN THE VICINITY OF THE PROJECT AREA

Only a handful of studies have been conducted in the vicinity of the current project area (Figure 3), these studies are described below.

Between April 2003 and October 2005 CSH conducted Archaeological Monitoring of ground altering activities associated with the Reconstructed Sewer Project located in Kailua within select portions of Keolu Drive, Hamakua Drive, and Kainehe Street [TMK: (1) 4-2-1; 77; 81; 82; 87; 89; 90; 93 through 95] (Fong *et al.* 2007). The southernmost end of this project was located approximately 590 m north of the current project area. No historic properties were encountered.

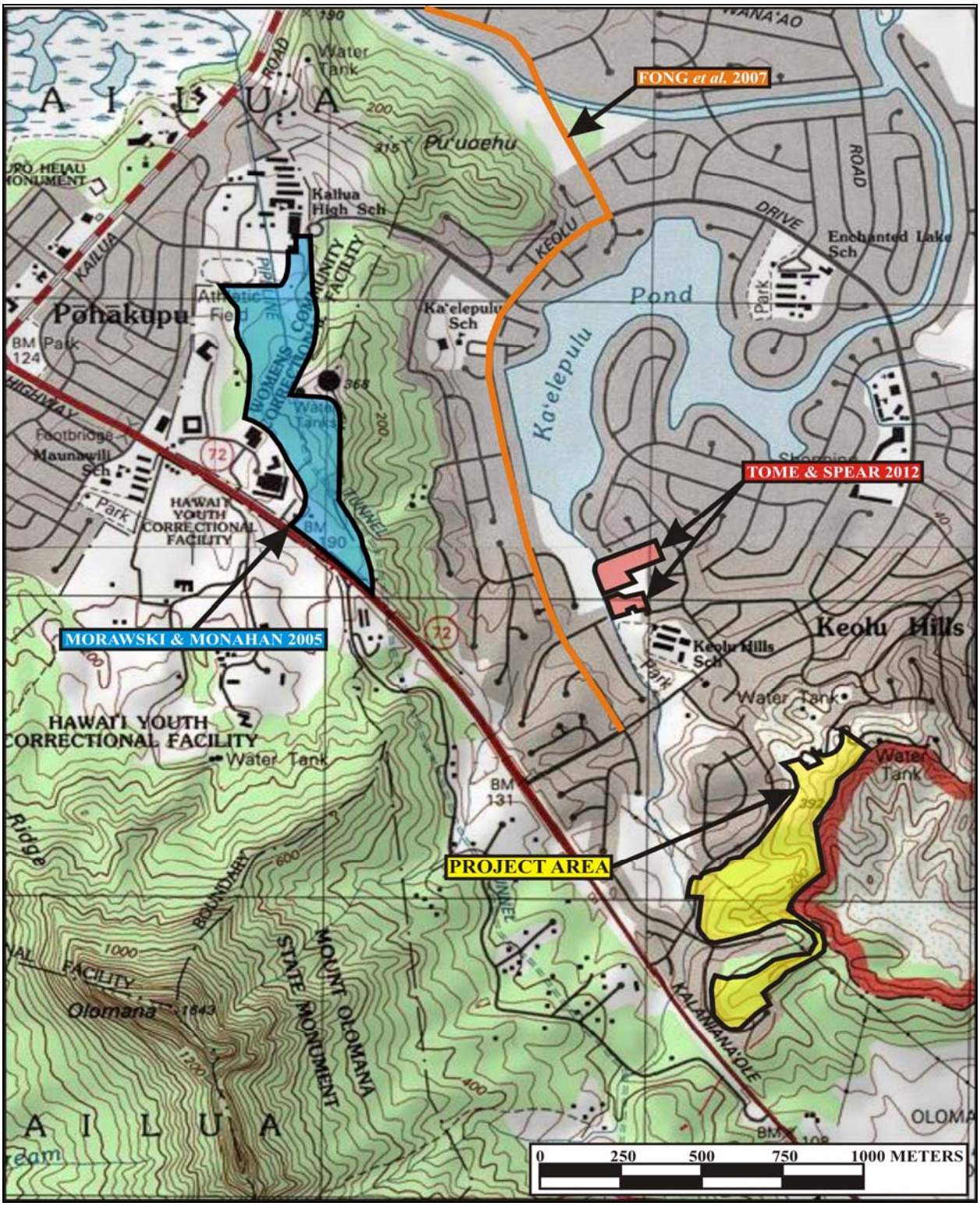

Figure 3: USGS Quadrangle (Koko Head 1999) Map Showing Previous Archaeological Studies in the Vicinity of the Project Area.

In 2005 Scientific Consultant Services, Inc. conducted an Archaeological Inventory Survey of 25 acres, in Kailua [TMK: (1) 4-2-003:004 por. & 022 por.] (Morawski and Monahan 2005). This project was located approximately 1500 m northwest of the current project area. During the survey two historic sites were identified: a lithic scatter (State Site 50-80-11-6816) and an Historic water-flow control structure (State Site 50-80-11-6817) comprised of two features. No excavation was conducted. Thus, no radiocarbon samples were available.

Scientific Consultant Services, Inc. conducted an Archaeological Assessment of four tax map key parcels totaling 6.255-acres of land, in Enchanted Lakes, Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu [TMK**:** (1) 4-2-083: 074, 075, 077, and 079] (Tome and Spear 2012). The combination of a pedestrian survey and a total of fourteen mechanically excavated trenches within the project area boundaries did not reveal the presence of archaeological cultural material or archaeological sites on the ground surface or within subsurface contexts. Modern debris was observed along the northeastern and southeastern perimeters of the project area.

In 2013, Scientific Consultant Services, Inc. conducted an Archaeological Assessment, including limited subsurface testing, on approximately ~~4.3~~ 5.5 acres of undeveloped land within the 37-acre current project area, located in the *ahupua`a* of Kailua, Ko`olaupoko District, Island of O`ahu, Hawai`i [Tax Map Key (1) 4-2-004: 001] (Dagher *et al*. 2013, in prep.). The combination of a pedestrian survey and a total of four manually excavated test pits within the project area boundaries did not reveal the presence of archaeological cultural material or archaeological sites on the ground surface or within subsurface contexts.

CONSULTATION

Consultation was sought from Ms. Hinaleimoana K.K. Wong-Kalu, Chair, O`ahu Island Burial Council; Kailua Hawaiian Civic Club; Ms. Nanette Napoleon, community member; Lanikai Canoe Club; Dr. Kamana`opono M. Crabbe, Chief Executive Officer, Office of Hawaiian Affairs; Mr. Aaron Mahi, O`ahu Island Burial Council, Ko`olaupoko District Representative; Mr. Kawika Farm, State Historic Preservation Division, Burial Sites Specialist; Ko`olaupoko Hawaiian Civic Club; Mr. Ricky Bermudez, Kahu and Traditional Cultural Practitioner; Brian Isaacson, community member; Skip Byron; community member; John Leong, community member; Teresa Parsons, community member; and Mr. William Ho`ohuli, community member.

In addition, a Cultural Impact Assessment Notice was published on August 18, 21, and 22, 2013, in *The Honolulu Star-Advertise*r, and in the September 2013 issue of the OHA newspaper, *Ka Wai Ola* (Lisa E. Asato, personal; communication) (see Appendix B). These notices requested information of cultural resources or activities in the area of the proposed project, stated the Tax Map Key (TMK) number, and where to respond with pertinent information. Based on the responses, an assessment of the potential effects on cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

CULTURAL IMPACT ASSESSMENT INQUIRY RESPONSES

Analysis of the potential effect of the project on cultural resources, practices or beliefs, the potential to isolate cultural resources, maintain practices or beliefs in their original setting, and the potential of the project to introduce elements that may alter the setting in which cultural practices take place is a requirement of the OEQC (2012:13). As stated earlier, this includes the cultural resources of the different groups comprising the multi-ethnic community of Hawai`i.

As stated elsewhere in this document, consultation was sought from the following individuals and organizations: Ms. Hinaleimoana K.K. Wong-Kalu, Chair, O`ahu Island Burial Council; Kailua Hawaiian Civic Club; Ms. Nanette Napoleon, community member; Lanikai Canoe Club; Dr. Kamana`opono M. Crabbe, Chief Executive Officer, Office of Hawaiian Affairs; Mr. Aaron Mahi, O`ahu Island Burial Council, Ko`olaupoko District Representative; Mr. Kawika Farm, State Historic Preservation Division, Burial Sites Specialist; Ko`olaupoko Hawaiian Civic Club; Mr. Ricky Bermudez, Kahu and Traditional Cultural Practitioner; Brian Isaacson, community member; Skip Byron; community member; John Leong, community member; Teresa Parsons, community member; and Mr. William Ho`ohuli, community member.

Responses were received from several community members including Brian Isaacson, Skip Byron, Teresa Parsons, and Leimomi Kekina, of the Lanikai Canoe Club. All responses were received electronically via a-mail and are presented below.

Brian Isaacson

Brian Isaacson stated that "..it appears that the recently purchased property owned by Dawn Horn is within the Conservation District Boundaries and that the ridge and associated topography may have historic sites on it. The Kaiwa Ridge has a significant drainage area, and there are a number of known sites in the general area, so even though I have no personal knowledge of possible sites on the property, information in the plan seems to indicate that they

may be there. I'm not sure that the plans that Ms. Horn has for developing the property are in accordance with the KSC plan or are consistent with preserving historic sites."

Skip Byron

Skip Byron stated that, "The SCP reference indicates the Kaiwa Ridge is a prominent land feature and within the conservation district boundary. I believe the SCP also suggests the Kaiwa Ridge contains clusters of historic sites in an area on or near the Horn property."

"Currently, I see trails being cut on the property in what appears to me to be arbitrary without regard for possible historic sites, disturbing the conservation land and scaring the scenic plain of this prominent land feature. I have heard the land owner report at public meetings that she intends to clear old roads across the land as well. I'm concerned the current and planned work on the property appears to be ongoing prior to, and without consideration, of a Cultural Impact Study."

Teresa Parsons, Lanikai Canoe Club

Teresa Parsons "...studied the maps and am having some difficulty determining the location of the proposed project(s). On the USGS Quad map, the project is indicated to be in the area contained between Kahako Street and Kahako Place, whereas the TMK map indicates the project as being located in the larger portion of this parcel of land. Can you clarify where Ms. Horn is proposing this project and how large the footprint will be?"

"The larger portion of the parcel is on the highest ground topographically and faces the ocean. There is evidence of cultural practices (possibly a he`iau?) on the higher elevation. Honestly, I am no longer in sufficient physical condition to climb in that region, but I can attest to seeing evidence in past years' hikes in the area."

"The smaller portion of the parcel is incredibly rocky and unstable, so I typically avoid it since there are cracks in the ground rock the size to allow a foot and leg to be swallowed or trapped."

Leimomi Kekini

Leimomi Kekini suggested contacting Cultural Surveys Hawai`i; Halau Mohala Ilima, of Kailua; the Kailua Hawaiian Civic Club; and Dr. Chuck Burrows.

SUMMARY

The "level of effort undertaken" to identify potential effect by a project to cultural resources, places or beliefs (OEQC 2012) has not been officially defined and is left up to the investigator. A good faith effort can mean contacting agencies by letter, interviewing people who may be affected by the project or who know its history, research identifying sensitive areas and previous land use, holding meetings in which the public is invited to testify, notifying the community through the media, and other appropriate strategies based on the type of project being proposed and its impact potential. Sending inquiring letters to organizations concerning development of a piece of property that has already been totally impacted by previous activity and is located in an already developed industrial area may be a "good faith effort". However, when many factors need to be considered, such as in coastal or mountain development, a good faith effort might mean an entirely different level of research activity.

In the case of the current undertaking, letters of inquiry were sent to individuals and organizations that may have knowledge or information pertaining to the collection of cultural resources and/or practices currently, or previously conducted in close proximity to the 37- acre property within the Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu, Hawai`i [Tax Map Key (1) 4-2-004: 001].

Historical and cultural source materials were extensively used and can be found listed in the References Cited portion of the report. Such scholars as Samuel Kamakau, Martha Beckwith, Jon J. Chinen, Lilikalā Kame`eleihiwa, R. S. Kuykendall, Marion Kelly, E. S. C. Handy and E.G. Handy, Elspeth P. Sterling, and Mary Kawena Puku`i and Samuel H. Elbert continue to contribute to our knowledge and understanding of Hawai`i, past and present. The works of these and other authors were consulted and incorporated in the report where appropriate. Land use document research was supplied by the Waihona `Aina Database (2014).

CULTURAL ASSESSMENT AND RECOMMENDATIONS

Analysis of the potential effect of the project on cultural resources, practices or beliefs, its potential to isolate cultural resources, practices or beliefs from their setting, and the potential of the project to introduce elements which may alter the setting in which cultural practices take place is also a suggested guideline of the OEQC (2012). Based on historical research, and no additional suggestion for contacts, analysis of the potential effect of the project on cultural

resources, practices or beliefs, its potential to isolate cultural resources, practices or beliefs from their setting, and the potential of the project to introduce elements which may alter the setting in which cultural practices take place is a requirement of the OEQC (2012). As indicated by the lack of responses received from the community, the project area has not been, and is not currently, used for traditional cultural purposes.

Based on the above research and the comments received from the community, it is reasonable to conclude that, pursuant to Act 50, the exercise of native Hawaiian rights, or any ethnic group, related to traditional cultural practices including, gathering, access, cultivation, the use of traditional plants, *oli* (chanting) and *ha`a* (dancing), making traditional-type tools (i.e., *poi* pounders, *poi* boxes, etc.), and access to the ocean will be not impacted by the proposed Horn property project, located on ~~approximately 4.3 acres of~~ undeveloped land within a 37-acre property of land in Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu, Hawai`i [Tax Map Key (1) 4-2-004: 001].

REFERENCES

Armstrong, R.W. (Editor)
1980 *Atlas of Hawaii*, 2nd Edition. The University of Hawaii Press, Honolulu.

Barrera, W.
1984 *Archaeological Services During Installation of Five Replacements Antennas at Bellows Air Force Station, Oahu, Hawaii*. Prepared for U.S. Army Engineer District, Honolulu. Chiniago, Inc., Honolulu.

Bath, J. and M. Smith
1988 *Lanikai Eight Inch Water Main Project: Burial Removal, Kailua, Ko`olaupoko, O`ahu.* Report on file at the State Historic Preservation Division, Kapolei.

Beckwith, M.W.
1970 *Hawaiian Mythology*. University of Hawai`i Press, Honolulu.

Borthwick, Doug, Jeff W. K. Fong, Karl Van Ryzin, and Hallett H. Hammett
2006 *Archaeological Monitoring Report for the Kainui Drive to Kaluamo`o Street Segment of the Kalāheo Avenue Reconstructed Sewer Project, Kailua Ahupua`a, O`ahu Island, Hawai`i. TMK: 4-3-56:03.* Cultural Surveys Hawaii. Kailua. Report on file at the State Historic Preservation Division, Kapolei.

Brennan, P.
2000 *Highlights of Kailua's history: from way back when till now*. Kailua Historical Society, Kailua.

Calis, Irene
2003 *Archaeological Monitoring Report for Kailua Elementary School Project Kailua Ahupua`a, O`ahu Island, Hawai`i. TMK: 4-3-016, 017–020, 024–027, 075, and 080.* Scientific Consultant Services, Inc., Honolulu.

Chamberlain, Levi
1957 Tour Around Oahu, 1828. Printed in the *Sixty-Fifth Annual Report of the Hawaiian Historical Society for the Year 1956*, Honolulu.

Chinen, J,J.
1961 *Original Land Titles in Hawaii*. Copyright 1961. Jon Jitsuzo Chinen.

City and County of Honolulu Real Property Assessment and Treasury Divisions
2014 Property Search of Parcel ID TMK (1) 4-2-083:074, 075, 077, and 079. (www.honoluluproperty tax.com). Accessed February 2014.

Clark, Stephen D.
1977 *Site Survey Report: Proposed Road Corridor for the Extension of Hamakua Drive Between Hahani Street and Akoakoa Street in Kailua.* City and County of Honolulu. Report on file at the State Historic Preservation Division, Kapolei.

Collins, Sara and Richard Nees
2007 *An Archaeological Assessment Report for the Proposed Kailua Road Permanent Rockfall and Landslide Mitigation Project, Kailua, Ko`olaupoko, Island of O`ahu TMKs: (1) 4-2-003:014 & 017.* Pacific Consulting Services, Inc., Honolulu. Report on file at the State Historic Preservation Division, Kapolei.

Cordy, R.
1974 Cultural Adaptation and Evolution in Hawaii: A Suggested New Sequence. Journal of the Polynesian Society, 83: 180–91.

1977 *Kāne`ohe Bay Urban Water Resources Study: Cultural Resources Planning, U.S. Corps of Engineers, Pacific Division, Honolulu, HI.*

2002 *The Rise and Fall of the O`ahu Kingdom*. Mutual Publishing, Honolulu.

Dagher, Cathleen A., Alex Hazlett, and Robert L. Spear
2014 A*n Archaeological I Report For the Horn Property Located in Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu, Hawai`i [TMK: (1) 4-2-004: 001]*. Scientific Consultant Services, Honolulu. (In prep).

Daws, Gavin
1977 *Shoal of Time: History of the Hawaiian Islands*. University of Hawai`i Press, Honolulu.

Drigot, D., and M. Seto
1982 *Ho`ona`auao No Kawai Nui (Educating About Kawai Nui): A Multi-Media Educational Guide.* University of Hawai`i-Mānoa, Honolulu.

Fong, Jeffrey, Douglas Borthwick, and Hallett H. Hammatt
2007 *An Archaeological Monitoring Report for the Kainehe Street, Hamakua Drive, and Keolu Drive Reconstructed Sewer Project, Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu. TMK: (1) 4-2-01, -77, 81, -89, -90, -93, -94, and -95.* Cultural Surveys Hawaii, Inc., Kailua. Report on file at the State Historic Preservation Division, Kapolei.

Foote, D.E., E.L. Hill, S. Nakamura, and F. Stephens
1972 *Soil Survey of the Islands of Kaua`i, O`ahu, Maui, Molokai, and Lanai, State of Hawai'i.* United State Department of Agriculture Soil Conservation Service, GPO, Washington. DC.

Fornander, A.
1969 *An Account of the Polynesian Race, Its Origin and Migrations and the Ancient History of the Hawaiian People to the Time of Kamehameha I. Volumes I and II.* Tuttle and Co., Rutland, Vermont.

Hall, W.T.
1997 *The History of Kailua: 77–78*. Kailua.

Hammatt, H. and R. Chiogioji
1997 *Archaeological and Historical Assessment and Field Inspection of a 0.8 –Mile Long Portion of the Auloa Road Right-of-Way in the Ahupua`a of Kailua, Ko`olaupoko District, Island of O`ahu.* Prepared by Cultural Surveys Hawai`i, Inc. Report on file at the State Historic Preservation Division, Kapolei.

Hammatt, H. and D.W. Shideler
1992 *Archaeological Disinterment of Inadvertent Finds at Site 50-80-11-3738, Kaohao ("Lanikai"), Ko`olaupoko, O`ahu at a Residential House Lot. TMK 4-3-4:5*. Prepared for Mr. Cole. Prepared by Cultural Surveys Hawai`i, Inc., Kailua.

Handy, E.S.C., and E. Handy
1972 *Native Planters in Old Hawaii: Their Life, Lore and Environment.* B.P. Bishop Museum Bulletin 233. B.P. Bishop Museum, Honolulu.

Hunt, T. and R. M. Holsen
1991 An Early Radiocarbon Chronology for the Hawaiian Islands: a Preliminary Analysis. *Asian Perspectives* 30(1):147-161.

Jones, C. Kulani and Hallett H. Hammatt
2004 *Archaeological Monitoring Report for the Anti-Crime Street Lighting Improvements Kailua Road (Ku`ulei Road to Hahani Street) Project, Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu. TMK: 4-3-56:4- 2-38.* Cultural Surveys Hawai`i, Inc., Kailua. Report on file at the State Historic Preservation Division, Kapolei.

Kamakau, Samuel
1991 *Ruling Chiefs of Hawaii*. The Kamehameha Schools Press: Honolulu.

Kame`eleihiwa, L.
1992 *Native Land and Foreign Desires*. Bishop Museum Press, Honolulu.

Kelly, Marion
1983 *Nā Māla o Kona: Gardens of Kona*. Dept. of Anthropology Report Series 83-2. Bishop Museum. Honolulu.

1998 "Gunboat Diplomacy, Sandalwood Lust and National Debt." In *Ka Wai Ola O Oha*, Vol 15, No. 4, April 1998.

Kelly, M., and B. Nakamura
1981 *Historical Study of Kawainui Marsh Area, Island of O`ahu.* B.P. Bishop Museum, Department of Anthropology, Honolulu.

Kirch, P.V.
1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory*. University of Hawaii Press, Honolulu.

1996 *Legacy of the Landscape: An Illustrated Guide to Hawaiian Archaeological Sites.* University of Hawai`i Press, Honolulu.

2011 "When Did the Polynesians Settle Hawai`i? A Review of 150 Years of Scholarly Inquiry and a Tentative Answer." Printed in *Hawaiian Archaeology* 2011. University of California, Berkley.

Kirch, P.V. and Marshall Sahlins
1992 *Anahulu: The Anthropology of History in then Kingdom of Hawaii,* Vol.1. The University of Chicago Press, Chicago and London.

Kuykendall, R.S.
1938 *The Hawaiian Kingdom*. Vol. 1. University of Hawai`i Press. Honolulu.

Lucas, Paul F. Nahoa
1995 *A Dictionary of Hawaiian Legal Land-terms*. Native Hawaiian Legal Corporation. University of Hawai`i Committee for the Preservation and Study of Hawaiian Language, Art and Culture. University of Hawai`i Press.

Lyons, C.J.
1875 Land Matters in Hawaii@. *The Islander*, Vol. I. Honolulu.

Mann, M. M., D. W. Shideler and H.H. Hammatt
2002 *Archaeological Monitoring Report for the Kalama Beach Park Project (Boettcher Estate) 248 North Kalaheo Avenue, Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu*. Cultural Surveys Hawai`i, Inc., Kailua.

McAllister, J. G.
1933 *Archaeology of O`ahu.* B.P. Bishop Museum. Bulletin 104. Bishop Museum Press, Honolulu.

Morawski, L. and C. Monahan
2005 *Archaeological Inventory Survey of Approximately 25 Acres in Kailua Ahupua`a, Ko`olaupoko District, O`ahu, Hawai`i [TMK: (1) 4-2-003: 004 (Por.) & 022 (Por.)]*. Scientific Consultant Services, Inc. Honolulu.

O'Leary, O. L. and H.H. Hammatt
2004 *Archeological Monitoring Plan for the Mōkulua Drive 8-inch Water Mains, Part II: Kailua Ahupua`a, Ko`olaupoko District, O`ahu Island. TMK: 4-3-1, 3, 4, 5, 6, 7, 8, 9, 10.* Cultural Surveys Hawai`i, Inc., Kailua.

Ormsby, Thomas, John A. Peterson, and J. Stephen Athens
2003 *Archaeological Monitoring for the Kalaheo Avenue Sewer Project, Kailua, O`ahu. TMK 4-2-1-, 19, 20; 4-4-22 thru 32; 4-4-11.* International Archaeological Research Institute Incorporated, Honolulu. Report on file at the State Historic Preservation Division, Kapolei.

Pantaleo, J. and P. Cleghorn
1989 *A Reconnaissance Survey of the Proposed Windward Park, Kailua, and O`ahu Island (TMK 4-2-14:2 and 4).* Applied Research Group, Bishop Museum, Honolulu. Report on file at the State Historic Preservation Division, Kapolei.

Parker, Patricia L., and Thomas F. King
1998 *Guidelines for Evaluating and Documenting Traditional Cultural Properties*. National Register Bulletin 38. Washington, D.C.: National Park Service.

Pearson, R.J., P.V. Kirch, and M. Pietrusewsky
1971 Early Prehistoric Site at Bellows Beach, Waimānalo, Oahu, Hawaiian Islands. *Archaeology and Physical Anthropology in Oceania* VI (3):204-234.

Price, S.
1983 Climate. In *Atlas of Hawaii* (2nd edition), ed. By R.W. Armstrong. University of Hawaii Press, Honolulu.

Pukui, M.K., S.H. Elbert, and E.T. Mookini
1976 *Place Names of Hawaii.* Revised and expanded paperback edition. University of Hawaii Press, Honolulu.

Putzi, J. and T. Dye
2004a *Archaeological Inventory Survey of a Beach Lot in Kailua, TMK: 4-3-22:11.* T.S. Dye and Colleagues, Archaeologists, Inc., Honolulu. Report on file at the State Historic Preservation Division, Kapolei.

2004b *Archaeological Data Recovery During Re-Interment of Human Burials at Site 50-80-11-6642, Located at 55 Kailuna Place, Kailua, Hawaii (TMK: 4-3-22:11).* T.S. Dye and Colleagues, Archaeologists, Inc., Honolulu. Report on file at the State Historic Preservation Division, Kapolei.

Spriggs, M. and A. Anderson
1993 Late Colonization of East Polynesia. *Antiquity* 67:200–217.

State of Hawaii Office of Environmental Quality Control
2012 *Guide to the Implementation and Practice of the Hawaii Environmental Policy Act, 2012 Edition*. State of Hawaii, Office of Environmental Quality Control, Honolulu. (http:// www.hawaii.gov/health/environmental/oeqc/index.html).

Sterling, E.P. and C.C. Summers
1978 *Sites of Oahu*. Departments of Anthropology and Education, B.P. Bishop Museum, Honolulu.

Thrum, Thomas G.
1907 Hawaiian Almanac and Annual for 1908. Honolulu.

Tome, Guerin and Robert L. Spear
2012 A*n Archaeological Assessment Report for Four Land Parcels Totaling 6.255-Acres Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu, Hawai`i [TMK: (1) 4-2-083: 074, 075, 077, and 079]*. Scientific Consultant Services, Inc.

Tuggle, H.D.
1994 *Archaeological Research of Areas Proposed for Development of Military Family Housing and Expansion of Military Training at Bellows Air Station, Oahu*. International Archaeological Research Institute Incorporated, Honolulu.

Tulchin, T., D.W. Shideler, H.H. Hammatt
2007 *Archaeological Inventory Survey for a Hekili Street Property, Kailua Ahupua`a, Ko`olaupoko District, O`ahu TMK: [1] 4-2-038:009 & 010.* Cultural Surveys Hawaii, Inc., Kailua. Report on file at the State Historic Preservation Division, Kapolei.

U.S. Geological Survey
1999 *Koko Head Quadrangle, HI* [map]. 1:65,000. Washington D.C.

Waihona `Aina Database
2014 https://www.waihona.com. Accessed February 2014.

Whistler, W.A.
1995 *Wayside Plants of the Islands: A Guide to the Lowland Flora of the Pacific Islands.* Isle Botanica, Honolulu.

Williams, S. S., P.R. Mills, J. Allen
1995 *Archaeological Reconnaissance Survey of Upper Maunawili Valley (TMK: 4-02-10:1), Ko`olaupoko, O`ahu, Hawai`i* Bishop Museum, Honolulu.

Wilcox, C.
1996 *Sugar Water.* University of Hawai`i Press, Honolulu.

APPENDIX A: EXAMPLE LETTER OF INQUIRY

Dear :

In compliance with the State of Hawai‘i Revised Statute (HRS) Chapter 343 Environmental Impact Statements Law, and in accordance with the State of Hawai`i Department of Health's Office of Environmental Quality Control (OEQC) Guidelines for Assessing Cultural Impacts as adopted by the Environmental Council, State of Hawai`i on November 19, 1997, Scientific Consultant Services, Inc. (SCS) is in the process of preparing a Cultural Impact Assessment (CIA) pertaining to the proposed construction of a single-family dwelling and farm located in Kailua Ahupua`a, Ko`olaupoko District, O`ahu, Hawai`i [TMK: (1) 4-2-004:001.] (Figures 1 and 2).

According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control, Nov. 1997):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs…The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural which support such cultural beliefs…

We are asking you for any information that you or other individuals may have which would contribute to the knowledge of traditional cultural activities that were, or are currently, conducted in the vicinity of the subject property. We are also asking for any information pertaining to traditional cultural activities or traditional rights which may be impacted by the proposed construction of a single-family dwelling and farm. The results of the cultural impact assessment are dependent on the response and contributions made by knowledgeable individuals, such as yourself.

Enclosed are maps showing the proposed project areas. Please contact me at the Scientific Consultant Services, Honolulu, office at (808) 597-1182 or via e-mail (cathy@scshawaii.com) with any information or recommendations concerning this Cultural Impact Assessment.

Sincerely yours,

Cathleen Dagher
Senior Archaeologist
Enclosures (2)

cc: Ms. Hinaleimoana K.K. Wong-Kalu, Chair, O`ahu Island Burial Council; Kailua Hawaiian Civic Club; Ms. Nanette Napoleon, community member; Lanikai Canoe Club; Dr. Kamana`opono M. Crabbe, Chief Executive Officer, Office of Hawaiian Affairs; Mr. Aaron Mahi, O`ahu Island Burial Council, Ko`olaupoko District Representative; Mr. Kawika Farm, State Historic Preservation Division, Burial Sites Specialist; Ko`olaupoko Hawaiian Civic Club; Mr. Ricky Bermudez, Kahu and Traditional Cultural Practitioner; Mr. William Ho`ohuli, community member

APPENDIX B: LEGAL NOTICE AND AFFADAVIT

1459

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF
SCS Proj 1459 Legal Notice: Proposed Development
of the Horn Property

STATE OF HAWAII }
} SS.
City and County of Honolulu }

Doc. Date: AUG 22 2013 **# Pages:** 1
Notary Name: Patricia K. Reese First Judicial **Circuit**
Doc. Description: Affidavit of Publication

Notary Signature AUG 22 2013 Date

PATRICIA K. REESE NOTARY PUBLIC State of Hawaii Comm. No. 86-467 STATE OF HAWAII

Information requested by Scientific Consultant Services, Inc. (SCS) on cultural resources and traditional, or on-going, cultural activities on or near the proposed development of the Horn property located in Kailua Ahupua'a, Ko'olaupoko District, O'ahu, Hawai'i [TMK: (1) 4-2-004:001] Please respond within 30 days to Cathleen Dagher at (808) 597-1182.
(SA549340 8/18, 8/21, 8/22/13)

Julie Clark being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser and MidWeek, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the aforementioned newspapers as follows:

Honolulu Star-Advertiser 3 times on:
08/18, 08/21, 08/22/2013

Midweek Wed. 0 times on:

_____ times on:

And that affiant is not a party to or in any way interested in the above entitled matter.

Julie Clark

Subscribed to and sworn before me this 22nd day
of August A.D. 2013

Patricia K. Reese, Notary Public of the First Judicial Circuit, State of Hawaii
My commission expires: Oct 07 2014

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

Ad # 0000549340 LN:_____

Information requested by Scientific Consultant Services, Inc. (SCS) on cultural resources and traditional, or on-going, cultural activities on or near the proposed development of the Horn property located in Kailua Ahupua`a, Ko`olaupoko District, O`ahu, Hawai`i [TMK: (1) 4-2-004:001] Please respond within 30 days to Cathleen Dagher at (808) 597-1182.

APPENDIX C: EXAMPLE FOLLOW-UP LETTER

Dear:

This is our follow-up letter to our September 16, 2013 letter, which was in compliance with the statutory requirements of the State of Hawai‘i Revised Statute (HRS) Chapter 343 Environmental Impact Statements Law, and in accordance with the State of Hawai`i Department of Health's Office of Environmental Quality Control (OEQC) Guidelines for Assessing Cultural Impacts as adopted by the Environmental Council, State of Hawai`i, on November 19, 1997. Scientific Consultant Services, Inc. (SCS) is in the process of preparing a Cultural Impact Assessment (CIA) pertaining to the proposed construction of a single-family dwelling and farm located in Kailua Ahupua`a, Ko`olaupoko District, O`ahu, Hawai`i [TMK: (1) 4-2-004:001].

According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control, Nov. 1997):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs…The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural which support such cultural beliefs…

We are asking you for any information that you or other individuals may have which would contribute to the knowledge of traditional cultural activities that were, or are currently, conducted in the vicinity of the subject property. We are also asking for any information pertaining to traditional cultural activities or traditional rights which may be impacted by the proposed construction of a single-family dwelling and farm. The results of the cultural impact assessment are dependent on the response and contributions made by knowledgeable individuals, such as yourself.

Please contact me at the Scientific Consultant Services, Honolulu, office at (808) 597-1182 or via e-mail (cathy@scshawaii.com) with any information or recommendations concerning this Cultural Impact Assessment.

Sincerely yours,

Cathleen Dagher
Senior Archaeologist

cc: Ms. Hinaleimoana K.K. Wong-Kalu, Chair, O`ahu Island Burial Council; Kailua Hawaiian Civic Club; Ms. Nanette Napoleon, community member; Lanikai Canoe Club; Dr. Kamana`opono M. Crabbe, Chief Executive Officer, Office of Hawaiian Affairs; Mr. Aaron Mahi, O`ahu Island Burial Council, Ko`olaupoko District Representative; Mr. Kawika Farm, State Historic Preservation Division, Burial Sites Specialist; Ko`olaupoko Hawaiian Civic Club; Mr. Ricky Bermudez, Kahu and Traditional Cultural Practitioner; Mr. Skip Byron, community member; Mr. John Leong, community member; Mr. Brian Isaacson; community member; Mr. William Ho`ohuli, community member

Mon, 30 Sep 2013 12:27:45 -0700 (PDT)
Date: Mon, 30 Sep 2013 09:27:45 -1000
Subject: Horn property Kaiwa Ridge sites
From: Brian Isaacson <bisaacso@hawaii.edu>
To: scs@scshawaii.com
X-Nonspam: None
X-Antivirus: avast! (VPS 130930-0, 09/29/2013), Inbound message
X-Antivirus-Status: Clean

Hi, folks, looking over the Koolaupoko Sustainable Communities Plan, it appears that the recently purchased property owned by Dawn Horn is within the Conservation District Boundaries and that the ridge and associated topography may have historic sites on it. The Kaiwa ridge has a significant drainage area, and there are a number of known sites in the general area, so even though I have no personal knowledge of possible sites on the property, information in the plan seems to indicate that they may be there. I'm not sure that the plans that Ms. Horn has for developing the property are in accordance with the KSC plan or are consistent with preserving historic sites. Thank you.

Brian Isaacson
Kailua, HI

APPENDIX D: RESPONSES

Mon, 30 Sep 2013 12:27:45 -0700 (PDT)
Date: Mon, 30 Sep 2013 09:27:45 -1000
Subject: Horn property Kaiwa Ridge sites
From: Brian Isaacson <bisaacso@hawaii.edu>
To: scs@scshawaii.com
X-Nonspam: None
X-Antivirus: avast! (VPS 130930-0, 09/29/2013), Inbound message
X-Antivirus-Status: Clean

Hi, folks, looking over the Koolaupoko Sustainable Communities Plan, it appears that the recently purchased property owned by Dawn Horn is within the Conservation District Boundaries and that the ridge and associated topography may have historic sites on it. The Kaiwa ridge has a significant drainage area, and there are a number of known sites in the general area, so even though I have no personal knowledge of possible sites on the property, information in the plan seems to indicate that they may be there. I'm not sure that the plans that Ms. Horn has for developing the property are in accordance with the KSC plan or are consistent with preserving historic sites. Thank you.

Brian Isaacson
Kailua, HI

Subject: Re: Cultural Impact Assessment for the Horn property (SCS Proj 1459)
From: Leimomi Kekina <leimomikekina@gmail.com>
Date: Thu, December 19, 2013 4:51 pm
To: cathy@scshawaii.com
Cc: Bruce Stewart <brucestewarthi@gmail.com>, Ellen Flaharty <mifflaharty@hotmail.com>

Aloha Cathy,

Thank you for attaching the maps. Greatly appreciate it. I was wondering if you had been in contact with Hawaii Cultural Surveys as well as Halau Mohala Ilima of Kailua and the Kailua Hawaiian Civic Club, Dr. Chuck Burrows, and if they were able to get back to you with any responses? They would be excellent groups to consult with and have a vast historical knowledge of the areas you are referring to.

Me ke aloha,
Leimomi

Subject: Response to Request RE Horn Property
From: jlbyron@hawaii.rr.com
Date: Mon, Sep 30, 2013 10:19 pm
To: cathy@scshawaii.com

Aloha Ms Dagher …

I'm responding to your public request for information regarding "cultural resources and traditional, or ongoing, cultural activities on or near the proposed development of the Horn property located in Kailua Ahupuaʻa, Koʻolaupoko District, Oʻahu, Hawaiʻi [TMK: (1) 4-2- 004:001]."

I recently reviewed the KOOLAUPOKO SUSTAINABLE COMMUNITIES Plan (SCP) and found the following:

• Page 2-8 (Figure 2-2) shows the Kaiwa Ridge within the a Conservation District Boundary
• Page 2-12 (Figure 2-4) shows the Kaiwa Ridge as a prominent land feature
• Page 2-13 (Figure 2-5) shows the Kaiwa Ridge contains Clusters of Historic Sites

The SCP reference indicates the Kaiwa Ridge is a prominent land feature and within the conservation district boundary. I believe the SCP also suggests the Kaiwa Ridge contains clusters of historic sites in an area on or near the Horn property.

Currently, I see trails being cut on the property in what appears to me to be arbitrary without regard for possible historic sites, disturbing the conservation land and scaring the scenic plain of this prominent land feature. I have heard the land owner report at public meetings that she intends to clear old roads across the land as well. I'm concerned the current and planned work on the property appears to be ongoing prior to and without consideration of a Cultural Impact Study.

I'm hopeful this public information helps meet your request.

Aloha!

Skip Byron
Kailua

-------- Original Message --------
Subject: Re: Cultural Impact Assessment for the Horn Property
From: Teresa <tapaka53@aol.com>
Date: Tue, November 05, 2013 8:52 pm
To: cathy@scshawaii.com

Cathy,
Mahalo for the letter and maps. I've studied the maps and am having some difficulty determining the location of the proposed project(s). On the USGS Quad map, the project is indicated to be in the area contained between Kahako Street and Kahako Place, whereas the TMK map indicates the project as being located in the larger portion of this parcel of land. Can you clarify where Ms. Horn is proposing this project and how large the footprint will be?

The larger portion of the parcel is on the highest ground topographically and faces the ocean. There is evidence of cultural practices (possibly a he'iau?) on the higher elevation. Honestly, I am no longer in sufficient physical condition to climb in that region, but I can attest to seeing evidence in past years' hikes in the area.

The smaller portion of the parcel is incredibly rocky and unstable, so I typically avoid it since there are cracks in the ground rock the size to allow a foot and leg to be swallowed or trapped.

As you are able, I would appreciate clarification on the location of the proposed project.

With respect,
Teresa Parsons

APPENDIX E: LAND COMMISSION AWARDS

Document Delivery

Mahele Database Documents

Number: 00044MA

Claim Number:	**00044MA**
Claimant:	**Kalaau**
Other claimant:	
Other name:	
Island:	**Oahu**
District:	**Koolaupoko**
Ahupuaa:	**Kailua**
Ili:	**Kaulu**

Apana:	**1**		Awarded:	**1**
Loi:	**0**		FR:	
Plus:			NR:	
Mala Taro:		0	FT:	
Kula:		0	NT:	
House lot:	**0**		RP:	**8262**
Kihapai/Pakanu:		0	Number of Royal Patents:	**1**
Salt lands:		0	Koele/Poalima:	**No**
Wauke:	**0**		Loko:	**No**
Olona:		0	Lokoia:	**No**
Noni:	**0**		Fishing Rights:	**No**
Hala:		0	Sea/Shore/Dunes:	**No**
Sweet Potatoes:		0	Auwai/Ditch:	**No**
Irish Potatoes:		0	Other Edifice:	**No**
Bananas:	**0**		Spring/Well:	**No**
Breadfruit:	**0**		Pigpen:	**No**
Coconut:		0	Road/Path:	**No**
Coffee:		0	Burial/Graveyard:	**No**
Oranges:		0	Wall/Fence:	**No**
Bitter Melon/Gourd:		0	Stream/Muliwai/River:	**No**
Sugar Cane:		0	Pali:	**No**
Tobacco:		0	Disease:	**No**
Koa/Kou Trees:		0	Claimant Died:	**No**

Other Plants:	0	Other Trees:	0
Other Mammals:	**No**	Miscellaneous:	

No. 44 M.A., Kalaau

No. 5749, Kalaau, Honolulu, 3 February 1848
N.R. 127v5

To the Land Commissioners, Respectful Greetings: I hereby state that I have a share of land from the Mo`i and the Minister of the Interior and the Minister of Finance, of the Independent Kingdom. It is 1/2 of Kaulu 'Ili at Kailua, Koolau Poko, Oahu.
Respectfully,
KALAAU

F.T. 456v10
No. 5749, Kalaau, 2 March 1855

½ Kaulu ili for Kailua in Koolaupoko, Oahu.
I, hereby approve this distribution. It is correct and the ½ land portion written above is for Kalaau. I have given consent that it be presented to the land officers who settle claims.
(sign) Kamehameha
Royal Palace, 2 February 1848
True copy from Mahele Book, S. Spencer

[Award 44 M.A.; Royal Land Patent No. 8262; Kaulu Kailua Koolaupoko; 2 ap.; 204 Acs; No 5749 not awarded]

Number: 04452*O

Claim Number:	**04452*O**
Claimant:	**Kalama, Hazaleleponi**
Other claimant:	Govt
Other name:	
Island:	**Oahu**
District:	**Koolalupoko, Kona**
Ahupuaa:	**Hakipuu,Kailua, Kaneohe**
Ili:	**Beretania, Aienui, Halehala, Waikahalulu, Nuuanu St. (Pamoo)**

Apana:	**10**	Awarded:	**1**
Loi:		FR:	
Plus:		NR:	**603,605v3**
Mala Taro:		FT:	**456,548v3**
Kula:		NT:	**187,358v10,81v16**
House lot:	**1**	RP:	**7213,7427,7482,7530,7983,**
Kihapai/Pakanu:		Number of Royal Patents:	**9**
Salt lands:		Koele/Poalima:	**No**
Wauke:		Loko:	**No**
Olona:		Lokoia:	**No**
Noni:		Fishing Rights:	**No**
Hala:		Sea/Shore/Dunes:	**No**
Sweet Potatoes:		Auwai/Ditch:	**No**
Irish Potatoes:		Other Edifice:	**No**
Bananas:		Spring/Well:	**No**
Breadfruit:		Pigpen:	**No**
Coconut:		Road/Path:	**No**
Coffee:		Burial/Graveyard:	**No**
Oranges:		Wall/Fence:	**No**
Bitter Melon/Gourd:		Stream/Muliwai/River:	**No**
Sugar Cane:		Pali:	**No**
Tobacco:		Disease:	**No**

Koa/Kou Trees:		Claimant Died:	**No**
Other Plants:		Other Trees:	
Other Mammals:	**No**	Miscellaneous:	**claims**

No. 4452*O, [Hazaleleponi Kalama], C. Kanaina (for Kalama) Honolulu, Jan. 19, 1848
N.R. 603-605v3

To the President of the Land Commissioners, William L. Lee, Respectfully: By direction of Queen Hazaleleponi Kalama, I hereby present her claims for house lots which have not previously been given. Therefore I hereby describe her house lots and her right to them.

1. Houselot of Naopala and Kauwila at Kamanuwai in Honolulu. This lot is for H. Kalama. It was originally unused land and her makuakane built the house and made the improvements before sailing with King Liholiho (this was the year 1822). It has been occupied since then, and no one has objected.

2. Lot of Kekai, mauka of Pelekane, in Honolulu. This lot is for H. Kalama. It was formerly unused land until the time of Kaomi, when she and her people made the improvements on it, and since then until the present time no one has objected.

3. Lot of Noi at Kaanaana in Honolulu. This lot was for Timothy Haalilio and it became the King's, who gave it to H. Kalama forever.

4. Lot of Keawehano, beyond Aienui. This lot is mine and Kalama's. It was formerly unused and when we returned here with King Liholiho from Hawaii in the year 1821, we and our people made the improvements on it and from then until this time no one has objected.

5. Lot to Kekukahiko beyond Mokuhinia at Lahaina, Maui, mauka of the Government Road. This lot is for H. Kalama. She and her people made the improvements on it in 1839 and it has been continuously occupied since then with no objections.

6. Lot of Kekai, beyond Mokuhinia at Lahaina, Maui, makai of the Government Road. This lot is for H. Kalama. She and her people made improvements on it in 1839 and it has been continuously occupied since then with no objections.

These are what I have described correctly to you, and on the day you send for me I will be prepared to bring the proper witnesses for the aforesaid claims.
I am, with thanks,
CHARLES KANAINA
P.S. Let it be done soon, after this week. I request that [you] do not defer it for a long time.
Wailuku, Lahaina 6 apana

N.R. 605v3
No. 4452, C. Kanaina, Honolulu, January 19, 1848

To the President of the Land Commissioners, William L. Lee, Respectfully: I hereby state this claim for a house lot of mine in Honolulu. It was an unused place. Before the death of David Kamehameha, I settled my man there and he and I made the improvements on it and he has continued to dwell on it until this time, with no dissent from any one.

I humbly say to you that I will bring the proper witnesses for this claim. I request that it be done soon after this week. Do not defer it. I am, with thanks,
CHARLES KANAINA

F.T. 456-460v3
No. 4452, H. Kalama, from 278 page, 31 March 1853, Counter the Government

C. Kanaina, sworn says, the ili of Waikehalulu was given to Kalama after the death of Kaomi, when Captain Belcher was here, and at the Division of lands in 1848, this ili was given to her again by the King, excepting only such parts of it as are occupied by the Government or by private parties.

This lele of Waikahalulu is bounded:
On Waikiki side by Kaakaukukui & Auwaiolimu
Makai by the sand point
Ewa side by the inner harbor
Mauka by Beretania Street.

This ili was formerly in the possession of Kaiama, a chief under Kamehameha I, from the time of the Battle of Nuuanu until it was given to Kaomi by His present Majesty.

After Kaomi died it was given to Kalama. The stone or coral on this ili was tabooed by Kinau for the government, but I cannot tell the year. But it was not tabooed so that the konohiki, who held the land, could not cut stone on it. No one else could do so however. I cut stone on it in the lifetime of Kaahumanu. No one was allowed to cut stone on it without Kinau's consent. Does not consider that this land belongs to the Government as a part of the harbor.

M. Kekuanaoa, sworn, says he knows the lele of Waikahalulu. Knows that Kinau tabooed the stone on this ili. When Kuakini was Governor he held this ili. After that it was given to Kaomi by the present King and subsequently to Kalama. Kinau tabooed the stone by her own authority. The Government was not organized at that time. If any of the Chiefs wanted to cut stone they had only to ask her, but if any kanaka cut stone there he had to divide [it] with her. I think the government can taboo the stone but not the substratum under it, for that belongs to the land.

A. Paki, sworn, says when I was acting Governor of Oahu, in 1822 perhaps, my father,

Hinau, had charge of Waikahalulu. After we were pau the land was given to Kaiama. In former times, the only taboos on these makai lands, as far as I know, were put on by the several konohikis. By the Organic Acts, the coral reefs were tabooed by the Legislature. But the taboo put on before that for the purpose of preventing the filling up of the Harbor was declared by myself, by order of the Governor of Oahu in 1844. But the soil and all the rights & privileges appertaining to the land belongs to the konohiki nevertheless.

John Young, sworn, says he thinks the mauka part of Waikahalulu belongs to Kalama. By the first laws it was declared that no private individual could take any property or land which the chiefs had set apart for the Government. This was confirmed by the new statues, which declare the coral reefs on all the islands to be Government property. The rights of piscary, however, still remain with the konohikis. I have understood that cutting the stone on this land was tabooed to prevent the Harbor from being filled up, and since I was made Minister of the Interior none of the chiefs have been permitted to cut stone there without the consent of the Privy Council. The government had some idea of selling a part of it at one time, and had it surveyed by Mr. Metcalf. But by advice of Colonel Smith, in 1849, perhaps, they declined to sell it.

Kanaina never mentioned this claim on behalf of the Queen till recently when the N.P.S. Navigation Company applied for a part of the land. The Government has exercised the rights of ownership on it ever since I came to be Minister of the Interior and the taboo on the stone by A. Paki was done in his capacity as Government Agent. The Government has disposed of a part of the land to the N.P.S. N. Company.

L. Haalelea, sworn, says the stone on this land was tabooed by Kinau, who also forbid the women from gathering limu there &c. After her death these restrictions appeared to be discontinued, and the people indiscriminately went there for limu. I heard of the taboo declared by Paki in 1841 to prevent the harbor from being filled up.

G.P. Judd, sworn, When I came to the Islands, the Harbor and the land in question were in the hands of the Governor of Oahu. In the time of Kuakini (Governor of Oahu) the stone began to be tabooed by the Government & so it has been ever since. I never heard that the Queen claimed this makai lele of Waikahalulu till 1850, when her agent, Kanaina, started this claim. As I understand it, this lele belongs to the Government, as a part of the Harbor, and I do not think the Queen or any one else has a right to it. In former times, all the people were allowed indiscriminately to go and take limu there. I do not know that the people of Waikahalulu alone were privileged to take limu. (This is admitted by Kanaina.)

At the Division of lands in 1848, I understood that the mauka part only of this Ili was given to the Queen.

G.P. Kalama, sworn, says he acted as clerk at the Division of lands, in the Palace in 1848. At the Division of the Queen's lands, the ili of Waikahalulu was given to her, that is to say, the mauka part of it only, and it was distinctly stated by Mr. Young, Mr. Judd & others at the time that she did not take the makai lele now in dispute, which is was

understood the Government had previously set apart for its own purposes.

F.T. 548-550v3
No. 4452, H. Kalama, 28 April 1854

Kihei, sworn says, he knows the part of the Pa Moo claimed by the Queen. It is on the southeast side of the King's part.

It is bounded:
On the Waikiki side by J. Pukou's lot
Makai by the Canton Hotel premises
On the Ewa side by the King's part of the Pa Moo
Mauka by S.C. Damon's lot.

The Queen got this lot from His Majesty in the year 1845, since which time I and the other tenants have lived under her.

Wakea, sworn says, he knows this lot and formerly lived on it under the Queen. Confirms in full the testimony given by last witness. Knows also the lot belonging to the Queen in the possession of Keawehano, in Honolulu.

It is bounded:
On the Waikiki side by the lot called Aie Nui
makai by Marin Street
On Ewa side by John Meek's land
Mauka by King Street.

This lot formerly belonged to Kalaimoku and from him it came to C. Kanaina who gave it to the Queen bout the year 1838 and she has held it ever since.

C. Kanaina, sworn says, the Queen got this lot from him about the year 1838. It is an old possession of the family and the Queen's title is undisputed.

Kekai, sworn says, he knows the lot claimed by Kalama in Honolulu, called "Halehala."

It is bounded:
Mauka by land belonging to the King
On Waikiki side by the British Consulate ground
Makai by the King's lot called "Beretane"
On Ewa side by the land called "Kaakopua."

The Queen got this lot from the King about the time of their marriage. It is present[ly] occupied by myself and others under the Queen.

Puliou, sworn says, he knows the house lot claimed by H. Kalama in Kalihi. It is enclosed by a wall.

It is bounded:
On Honolulu side by a fish pond belonging to Liholiho.
Makai by the sea beach
On Ewa side by John Ii
Mauka by the konohiki of Mokauea.

N.T. 187-188v10
No. 4452, Hazaleleponi Kalama

COPY HAZALELEPONI KALAMA'S DIVISION
Kula ahupuaa, Puna, Hawaii
Kapalaalaea ahupuaa, Kona, Hawaii
Kalahuipuaa ili of Waimea, Kohala, Hawaii
Anaehoomalu ili of Waimea, Kohala, Hawaii
Waipio ahupuaa, Hamakua, Hawaii

Kaohe ili for Wailuku, Maui
Puhiawaawa ili for Wailuku, Maui
Lemukee ili of Wailuku, Maui
Puohala, Wailuku, Maui
Manienie, Wailuku, Maui

Waikahalulu, Honolulu, Kona, Oahu
Kailua ahupuaa, Koolaupoko, Oahu
Kaneohe ahupuaa, Koolaupoko, Oahu.
Hakipuu ahupuaa, Koolaupoko, Oahu.

I have approved this land division, the lands listed above are for Hazaleleponi Kalama, and they may be presented to the land officeres.
(Sign) Kamehameha
Copiied by S.P. Kalama (for H. Kalama) Secretary
Royal Palace, 11 February 1848
See page 358

N.T. 358v10
No. 4452, H. Kalama, (from page 187)

COPY
H. Kalama's land distributions.
Kula ahupuaa, Puna, Hawaii
Kapalaalaea ahupuaa, Kona, Hawaii
Kalahuipuaa ili for Waimea, Kohala, Hawaii
Anaehoomalu ili for Waimea, Kohala, Hawaii

Waipio ahupuaa, Hamakua, Hawaii
Kaohe ili for Wailuku Puali, West Hawaii

Puhiawawa, ili for Wailuku, Puali, West Hawaii [sic, Maui]
Lemukee ili for Wailuku, Puali, West Hawaii [sic, Maui]
Manienie, Ili for Wailuku, Puali, West Hawaii [sic, Maui]

Waikahalulu, ili for Honolulu, Kona, Oahu
Kailua ahupuaa, Koolaupoko, Oahu
Kaneohe ahupuaa, Koolaupoko, Oahu
Hakipuu ahupuaa, Koolaupoko, Oahu.

TRUE COPY
A.G. Thruston, Clerk
Interior Department, 26 April 1854

A decision has been made by the Privy Council on this 29th day of Aug. 1850, that all of those lands are for Hazaleleponi Kalama as fee simple without a half division for the government.
A.G. Thruston, Clerk

N.T. 81v16
No. 4452, H. Kalama, 15 May 1854

Kekai, sworn, says he knows the house lots of Queen Kalama, at Lahaina, Maui.

The first lot is in the ahupuaa of Waiokama and is bounded as follows:
Mauka by konohiki's land
Olowalu by Kaheana's land
Makai by public Road
Kaanapali by loko called "Mokuhinia."

Claimant received this lot from the King about the year 1836, and her retainers have occupied it ever since, without dispute.

The second lot is also in Waiokama and is bounded as follows:
Mauka by public road
Olowalu by konohiki's land
Makai by A. Paki's land
Kaanapali by loko called "Mokuhinia."

Claimant received this lot from the king at the same time as the first lot and has held it ever since.

Keawehano, sworn, says he knows these two lots and confirms in full the testimony of

Kekai.

[Award 4452; (Oahu) R.P. 7482; Hakipuu Koolaupoko; 1 ap.; 1165.03 Acs; R.P. 7427; Nuuanu Street (Pamoo)Honolulu Kona; R.P. 7530; Aienui Honolulu Kona; 1 ap.; 28020 sq. ft.; R.P. 7213; Halehala Honolulu Kona; 1 ap.; 3 Acs 20 perches; R.P. 7983; Kailua Koolaupoko, 11885 acres; R.P. 5683 & 7220; R.P. 7984, Kaneohe Koolaupoko, 9500 acres; R.P. 7255 & 7516; Waikahalulu Honolulu Kona; 1 ap.; 1.006 Ac.;(Maui) R.P. 7299 Wailuku; R.P. 7303 Wailuku; R.P.; 7300 Wailuku; 7302 Wailuku; 7301 Wailuku; (Lahaina award no R.P.); (Hawaii) R.P. 7523; Anaehoomalu Waimea S. Kohala; 1 ap.; 866 Acs; R.P. 7529; Waipio Hamakua; R.P. 7522; Kalahuipuaa Waimea S. Kohala; 1 ap.; 359 Acs; R.P. 7483; Puna; Kula & Halekamahina; 3 ap.; 2902 Acs; No R.P.; Kapalaalaea N. Kona; 1 ap; Ahupuaa]