STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
Ka 'Oihana 'Āina Ho'opulapula Hawai'i
P. O. BOX 1879
HONOLULU, HAWAII 96805

February 3, 2025

Ref: PO-25-011

Ms. Mary Alice Evans, Director
State of Hawaii - Office of Planning and Sustainable Development
235 South Beretania Street, Suite 702
Honolulu, HI 96813

SUBJECT: HAWAII REVISED STATUTES (HRS) CHAPTER 343 FINAL ENVIRONMENTAL ASSESSMENT FOR WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT; MAUI ISLAND, HAWAII

Dear Ms. Evans:

With this letter, the State of Hawaii, Department of Hawaiian Home Lands, transmits the Final Environmental Assessment and Finding of No Significant Impact (FEA-FONSI) for the proposed Waiohuli Economic Development Opportunities project on the island of Maui, for review and publication in the next available edition of The Environmental Notice.

In addition to this letter, you will find the online Environmental Review Program (ERP) Publication Form that has been submitted through the ERP website. The online submittal includes one electronic copy of the FEA-FONSI as an Adobe Acrobat PDF file.

Should you have any questions, please contact Ms. Julie-Ann Cachola, Planner V at julie-ann.cachola@hawaii.gov or the DHHL's main phone number at (808) 620-9500.

Aloha,

Kali Watson

Kali Watson, Chairperson
Hawaiian Homes Commission

Enc.

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Monday, February 3, 2025 3:28:16 PM

Action Name

Waiohuli Economic Development Opportunities

Type of Document/Determination

Final environmental assessment and finding of no significant impact (FEA-FONSI)

HRS §343-5(a) Trigger(s)

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

Judicial district

Makawao, Maui

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

(2) 2-2-028:181 (portion); and (2) 2-2-002:014 (portion)

Action type

Applicant

Other required permits and approvals

•Land Use Designation Updates (DHHL); •Grading/Building Permits (Maui County); •Historic Preservation HRS 6E-8 (SHPD); •Chapter 195D, HRS (DOFAW) (DAR); •National Pollutant Discharge Elimination System (NPDES) Permit (DOH); •Community Noise Permit (DOH); •Noise Variance (DOH); •Disability and Communication Access Board (DCAB) Document Review for ADA Compliance (DOH); •National Historic Preservation Act - Section 106 (SHPD) - if a federal nexus is identified; •Endangered Species Act – Section 7 (USFWS, NOAA-NMFS) - if a federal nexus is identified; •National Environmental Policy Act - if a federal nexus is identified

Discretionary consent required

Use of DHHL lands require approval by the Hawaiian Homes Commission

Agency jurisdiction

State of Hawai‘i

Approving agency

Department of Hawaiian Home Lands

Agency contact name

Julie-Ann Cachola

Agency contact email (for info about the action)

julie-ann.cachola@hawaii.gov

Email address for receiving comments

dsimpson@pbrhawaii.com

Agency contact phone

(808) 620-9500

Agency address

P.O. Box 1879
Honolulu, Hawaii 96805
United States
Map It

Applicant

Waiohuli Hawaiian Homesteaders Association, Inc.

Applicant contact name

Perry Artates

Applicant contact email

perryartates@gmail.com

Applicant contact phone

(808) 357-0831

Applicant address

P.O. Box 698
Kula, Hawaii 96790
United States
Map It

Is there a consultant for this action?

Yes

Consultant

PBR HAWAII & Associates, Inc.

Consultant contact name

Dave Simpson

Consultant contact email

dsimpson@pbrhawaii.com

Consultant contact phone

(808) 521-5631

Consultant address

1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813
United States
Map It

Action summary

The project is a public-private collaboration to combine traditional construction of a development plan with community-based job opportunities derived from development of infrastructure, agricultural

cultivation, renewable energy, and water source development to create long-term economic sustainability for the Waiohuli community. While the purpose of the project is to build capacity and economic development for the Waiohuli community, the project has been assessed under a potential full buildout scenario to gain a comprehensive understanding of all possible impacts in compliance with HRS Chapter 343. The potential full buildout includes community training facilities, infrastructure training and implementation sites, agricultural training sites, renewable energy training and implementation sites, water resource development and distribution, community conservation, and roadways.

Reasons supporting determination

The Significance Criteria is provided in detail in Section 7.1 of the FEA

Attached documents (signed agency letter & EA/EIS)

- WE-DO-Final-Environmental-Assessment1.pdf
- WE-DO-FEA-FONSI-Transmittal-Letter.pdf

Shapefile

- The location map for this Final EA is the same as the location map for the associated Draft EA.

Action location map

- Project-Area1.zip

Authorized individual

Dave Simpson

Authorization

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

WE DO.

Waiohuli Economic Development Opportunities

Final Environmental Assessment

Prepared for:
Department of Hawaiian Home Lands

DEPARTMENT OF HAWAIIAN HOME LANDS

Prepared by:

PBR HAWAII
& ASSOCIATES, INC.

FEBRUARY 2025

Waiohuli Economic Development Opportunities

Final Environmental Assessment –
Finding of No Significant Impact
(Submitted Pursuant to Hawai‘i Revised Statutes, Chapter 343)

Prepared for:

Department of Hawaiian Home Lands

Prepared by:

PBR HAWAII
& ASSOCIATES, INC.

February 2025

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SUMMARY

Project Name:	Waiohuli Economic Development Opportunities (Figure 1)
Location:	Waiohuli, Island and County of Maui See Figure 2 and Figure 3
Judicial District:	Makawao
Tax Map Key (TMK):	(2) 2-2-028:181 (portion); and (2) 2-2-002:014 (portion) See Figure 4
Land Area Affected:	Approximately 150 acres
Applicant:	Waiohuli Hawaiian Homesteaders Association, Inc.
Determining Agency:	State of Hawai'i, Department of Hawaiian Home Lands (DHHL)
Landowner:	Department of Hawaiian Home Lands
Existing Development:	Vacant
Proposed Action:	Economic development initiatives, training sites, infrastructure, and roadways
Current Land Use Designations:	*State Land Use:* Agricultural (Figure 5) *DHHL Maui Island Plan:* General Agriculture, and Conservation (Figure 6) *County Zoning*: Agriculture (AG) (Figure 7) *Special Management Area (SMA)*: Not Within SMA
Alternatives Considered:	1. WE DO 2. Alternatives Identified in Maui Island Plan 3. No Action
Potential Impacts and Mitigation Measures:	Any potential adverse impacts would be mitigated as follows: Short-term construction impacts to air quality, noise, solid waste generation, traffic, parking, storm water quality/quantity are anticipated. The Applicant will address these impacts through compliance with County and State rules, regulations, permit, and variance requirements regarding fugitive dust, community noise control, and non-point source discharges. In addition, best

management practices will be implemented which include structural and non-structural controls designed to inhibit run-off, erosion, and fugitive dust.

Long-term impacts are anticipated to be beneficial in that the project will create training sites for development of the lands to support the surrounding community.

Permits & Approvals

- Land Use Designation Updates (DHHL)
- Grading/Building Permits (Maui County)
- Historic Preservation HRS 6E-8 (SHPD)
- Chapter 195D, HRS (DOFAW) (DAR)
- National Pollutant Discharge Elimination System (NPDES) Permit (DOH)
- Community Noise Permit (DOH)
- Noise Variance (DOH)
- Disability and Communication Access Board (DCAB) Document Review for ADA Compliance (DOH)
- National Historic Preservation Act - Section 106 (SHPD); if a federal nexus is identified
- Endangered Species Act – Section 7 (USFWS, NOAA-NMFS); if a federal nexus is identified
- National Environmental Policy Act; if a federal nexus is identified

Anticipated Determination: Finding of No Significant Impact (FONSI)

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LIST OF ACRONYMS & ABBREVIATIONS

ADA	Americans with Disabilities Act
AG	Agriculture District
AIS	Archaeological Inventory Survey
ALISH	Agricultural Lands of Importance to the State of Hawai‘i
amsl	Above mean sea level
ATA	Austin, Tsutsumi & Associates, Inc.
AWUDP	Agricultural Water Use and Development Plan, State of Hawai‘i
BMPs	Best Management Practices
CDP	Census Designated Place
CIA	Cultural Impact Assessment
CWRM	Commission on Water Resource Management, Department of Land and Natural Resources, State of Hawai‘i
CZM	Coastal Zone Management
DAGS	Department of Accounting and General Services, State of Hawai‘i
DAR	Division of Aquatic Resources, Department of Land and Natural Resources, State of Hawai‘i
DBEDT	Department of Business, Economic Development, and Tourism, State of Hawai‘i
DCAB	Disability and Communication Access Board
DHHC	Department of Housing and Human Concerns, County of Maui
DHHL	Department of Hawaiian Home Lands, State of Hawai‘i
DHS	Department of Human Services, State of Hawai‘i
DLIR	Department of Labor and Industrial Relations, State of Hawai‘i
DLNR	Department of Land and Natural Resources, State of Hawai‘i
DOE	Department of Education, State of Hawai‘i
DOFAW	Division of Forestry and Wildlife, Department of Land and Natural Resources, State of Hawai‘i
DOH	Department of Health, State of Hawai‘i
DPR	Department of Parks and Recreation, County of Maui
DWS	Department of Water Supply, County of Maui
EA	Environmental Assessment
EFH	Essential Fish Habitat
EPA	Environmental Policy Act
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
gpm	gallons per minute

gpd	gallons per day
GPS	Global Positioning Systems
HAR	Hawai‘i Administrative Rules
HDOT	Department of Transportation, State of Hawai‘i
HRHP	Hawai‘i Register of Historic Places
HRS	Hawai‘i Revised Statutes
IPAC	Information for Planning and Consultation
IWS	Individual Wastewater System
LEED	Leadership in Energy and Environmental Design
LID	Low Impact Development
LOS	Level of service
LRFI	Archaeological Literature Review and Field Inspection
LSB	Land Study Bureau, University of Hawai‘i
LUC	State of Hawai‘i Land Use Commission
MAV	Moving Average
MCC	Maui County Code
mgd	Million gallons per day
MIP	Maui Island Plan
mph	Miles per hour
msl	Mean Sea Level
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Administration
NPDES	National Pollutant Discharge Elimination Systems
NRCS	Natural Resources Conservation Service, USDA
NRHP	National Register of Historic Places
OPSD	Office of Planning and Sustainable Development, Department of Business, Economic Development, and Tourism, State of Hawai‘i
PacIOOS	Pacific Island Ocean Observing System
PEP	U.S. Census Population Estimates Program
PER	Preliminary Engineering Report
ROW	Right-of-way
SCS	Scientific Consultant Services, Inc.
SDCs	Seismic Design Categories
SIHP	State Inventory of Historic Places
SHPD	State of Hawai‘i Historic Preservation Division
SHWB	Solid and Hazardous Waste Branch, Department of Health, State of Hawai‘i
SLR	Sea Level Rise
SMA	Special Management Area
SWDP	State Water Development Plan

SWPP	State Water Projects Plan
TIAR	Transportation Impact Assessment Report
TMK	Tax Map Key
UIC	Underground Injection Control
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
vog	volcanic gases
WHHA	Waiohuli Hawaiian Homesteaders Association
WUDP	Water Use and Development Plan
WWTF	Wastewater Treatment Facility

1 INTRODUCTION

Waiohuli Hawaiian Homesteaders Association, Inc. (WHHA), in partnership with Pueo Development, is proposing the development of short- and long-term economic opportunities that will foster greater self-sufficiency for the people of upcountry Maui through capacity building and locally-derived job development. The Applicant proposes a public-private collaboration to combine traditional construction of a conceptual plan development with community-based job opportunities derived from development of infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for the Waiohuli community.

The Project Site is located on portions of vacant land parcels identified as TMKs (2) 2-2-028:181 and (2) 2-2-002:014. The cumulative area described is hereinafter referred to as the "Project Site" or "Site."

The Project Site is in the ahupua'a of Waiohuli, and the Judicial District of Makawao. This area is located in the Census Designated Place (CDP) of Kēōkea, which is notable because addresses in Hawai'i typically use CDP place of city, county or ahupua'a and CDP names are often used colloquially to describe places. Therefore, the place may be referred to in conversation as Kēōkea, although it is located within the contemporary ahupua'a of Waiohuli. The Project Site is immediately adjacent to, and could be considered an extension of the subdivision known as Kēōkea-Waiohuli. Area references also include "Kula", a general name for the western uplands of East Maui or "Upcountry" Maui.

The use of State lands or funds triggers the requirement to assess the environmental impacts of the proposed action pursuant to Chapter 343, Hawai'i Revised Statutes (HRS).

1.1 LANDOWNER

The State of Hawai'i, Department of Hawaiian Home Lands (DHHL) is the fee simple landowner and will lease homestead lots to its beneficiaries, homestead associations, and/or other tenants.

1.2 APPLICANT

The Proposing Agency is the Waiohuli Hawaiian Homesteaders Association, Inc.

Contact: Waiohuli Hawaiian Homesteaders Association, Inc.
ATTN: Perry Artates
P.O. Box 698
Kula, Hawai'i 96790
Phone: (808) 357-0831

1.3 DETERMINING AGENCY

The State of Hawai'i, Department of Hawaiian Home Lands (DHHL) will determine the significance of impacts pursuant to Chapter 343-5(b), HRS.

Contact: Department of Hawaiian Home Lands
State of Hawai'i
ATTN: Julie-Ann Cachola
P.O. Box 1879
Honolulu, Hawai'i 96805
Phone: (808) 620-9500

1.4 ENVIRONMENTAL CONSULTANT

PBR HAWAII & Associates, Inc. is the environmental planning consultant.

Contact: PBR HAWAII & Associates, Inc.
ATTN: Dave Simpson, Planner
1001 Bishop Street, Suite 650
Honolulu, HI 96813
Telephone: (808) 521-5631

1.5 COMPLIANCE WITH STATE OF HAWAI'I ENVIRONMENTAL LAWS

Preparation of an EA is being undertaken to meet the applicable requirements of Chapter 343, HRS and Title 11, Chapter 200.1, Hawai'i Administrative Rules (HAR). Section 343-5, HRS establishes nine "triggers" that require the completion of an EA. The proposed Project will involve the use of State or County lands and/or funds, which is one of the triggers listed under §343-5(a)(1). This EA has thus been prepared to consider the impacts of the proposed action on the human and natural environment.

Under the provisions of §343-5 (b), HRS and based on the significance criteria set forth under Section 11-200.1-13(b), HAR, DHHL expects to determine, through its judgment and experience, that the Proposed Action will not have a significant effect and therefore does not require preparation of an Environmental Impact Statement (EIS).

In the event that the Proposed Action uses Federal funds, DHHL will comply with the requirements of the National Environmental Policy Act by a separate document.

1.6 STUDIES CONTRIBUTING TO THIS EA

The information contained in this report has been developed from site visits, consultation with local officials and community members, information available regarding the characteristics of the proposed Project Site and surrounding areas, and technical studies. A full list of references can be found in Section 9 and the appendices to this document include complete technical studies providing more detailed assessment contributing to this report.

2 PROJECT DESCRIPTION

2.1 BACKGROUND INFORMATION

The Waiohuli Economic Development Opportunities (WE DO) Plan is the next step for the WHHA's long range vision and intentional actions toward economic self-sufficiency. This vision, long held by the community, was articulated many years ago with the publication of a development plan for a community center and park complex.

The realization of the community center has been a significant milestone and testament to this community and their abilities. WE DO is a progression of this success. WE DO has been initiated with a Right of Entry agreement between the WHHA and DHHL, and the Project Site has been identified for community development and use. The WE DO vision and aspirations are summarized in a presentation to Hawaiian Homes Commission Presentation (Appendix A).

2.1.1 Location and Property Description

The Project Site is located in the Waiohuli Undivided Interest subdivision, Waiohuli ahupua'a, Makawao District, Island and County of Maui (Figure 2). The Site is approximately 1.75 miles north of the town of Kēōkea abutting the Waiohuli Community Center on the eastern boundary of the property. The Site is comprised of Tax Map Keys (TMK) (2) 2-2-028:181 (portion) and (2) 2-2-002:014 (portion) totaling approximately 150 acres. Upcountry Maui is home to rural areas, and significant agricultural uses. The Waiohuli area features mild climates and moderate temperatures ranging from 46°-85° F. The area receives its comfortable temperatures from prevailing trade winds from a westerly direction.

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LEGEND

A (A-1 to A-2)	Community Support Training Facilities	**± 6 Ac.**
B (B-1 to B-5)	Infrastracture Training Sites	**± 31 Ac**
C (C-1 to C-2)	Agricultural Development Training Sites	**± 42 Ac.**
D	Renewable Energy Development/Training Sites	**± 26 Ac.**
	Natural Drainage Gulch	**± 45 Ac.**
	TOTAL:	**± 150 Ac.**

Figure 1:
Conceptual Land Use Plan

DRAFT: 10/28/2024

WE DO

Waiohuli Hawaiian Homesteaders Association Inc.

Island of Maui

North

Linear Scale (feet)

0 200 400 800

PBR HAWAII & ASSOCIATES, INC.

POTENTIAL FUTURE EXPANSION

POTENTIAL FUTURE EXPANSION

WAIOHULI HOMESTEADS

PUEO DRIVE

GULCH

B-1

B-2

A-2

A-1

C-2

B-5

B-4

B-3

C-1

D

WAIOHULI COMM. CENTER

LAUIE DRIVE

Kulanihakoi Gl

Waipuilani Gl

Waimahaihai

Waiakoa Gl

Kulanihakoi Gl

HIIPALI LOOP

PUEO DR

AHULUA ST

PUUALA ST

LAUIE DR

KULA HWY

KEANUHEA ST

Q:\Maui\Kula Maui PPP\pdf

Legend

- Project Area
- Roadways
- TMK

Source: ESRI online basemap. County of Maui, 2016 & 2021. DLNR DAR, 2008.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 8/1/2024

Figure 2
Regional Location Map

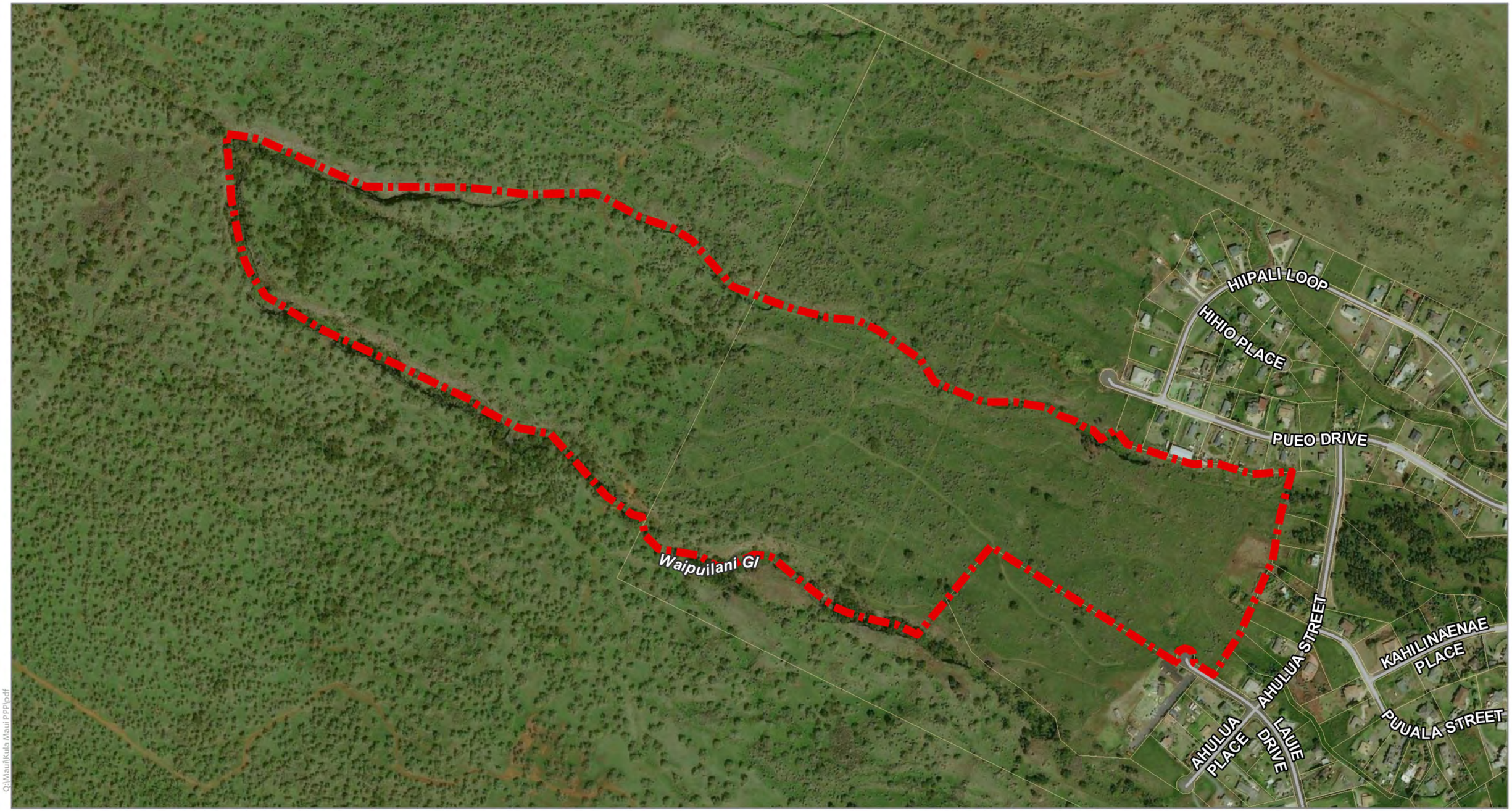
WE DO

North

Linear Scale (Feet)
0 500 1,000 2,000

Island of Maui

PBR HAWAII & ASSOCIATES, INC.



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Legend

- Project Area
- Roadways
- TMK

Source: ESRI online basemap. County of Maui, 2016 & 2021. DLNR DAR, 2008.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 8/1/2024

Figure 3
Aerial Map

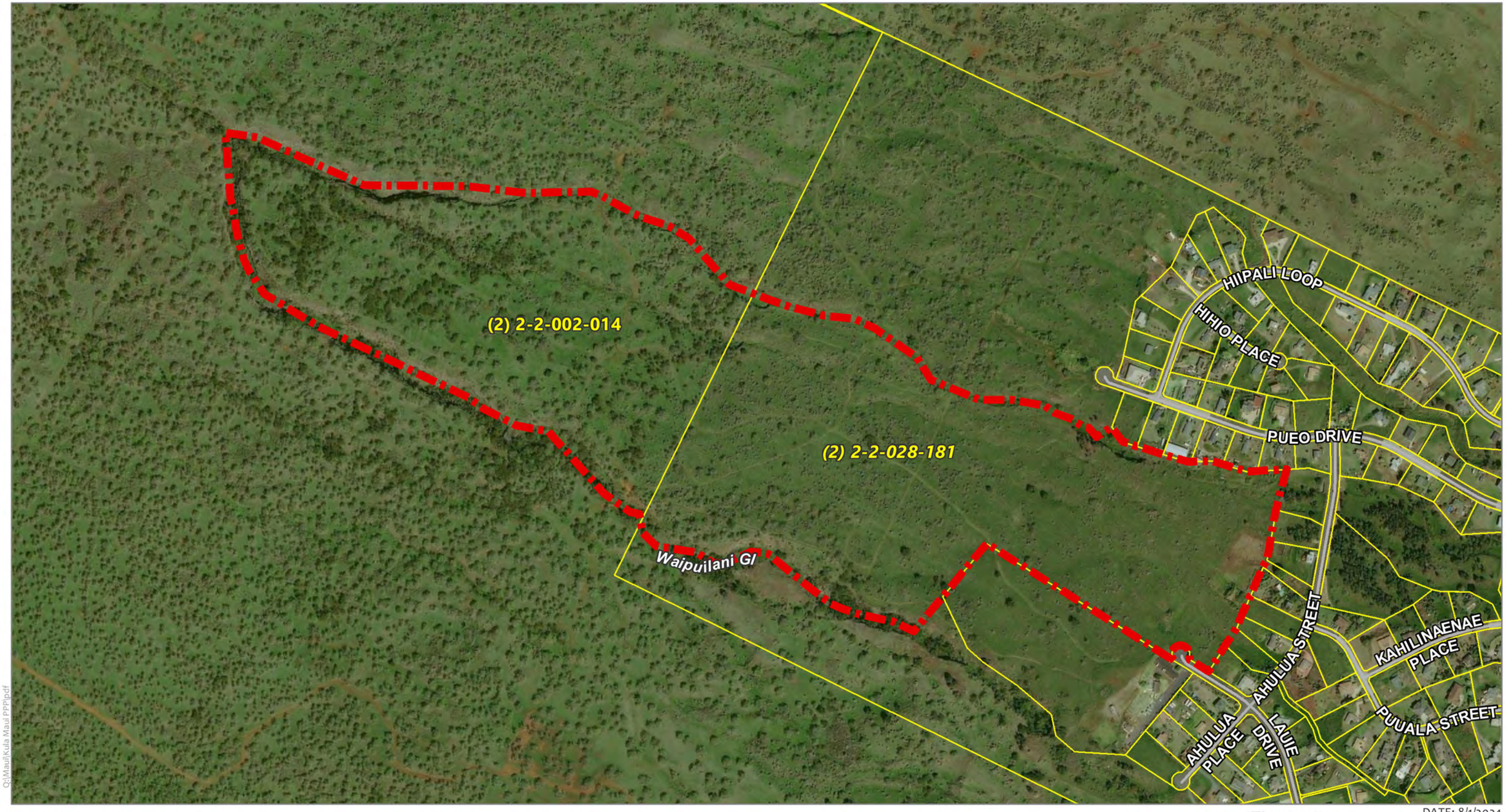
WE DO

North

Linear Scale (Feet)
0 125 250 500

Island of Maui

PBR HAWAII & ASSOCIATES, INC.



Q:\Maui\Kula Maui PPP\pdf

Legend

- Project Area
- Roadways
- TMK

Source: ESRI online basemap. County of Maui, 2016 & 2021. DLNR DAR, 2008.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 8/1/2024

Figure 4
Tax Map Key (TMK)

WE DO

North

Linear Scale (Feet)
0 125 250 500

Island of Maui

PBR HAWAII & ASSOCIATES, INC.

2.1.2 Existing Land Use Designations

Current land use designations for the proposed Project:

- *State Land Use: Agriculture (*Figure 5*)*
- *DHHL Maui Island Plan: General Agriculture, and Conservation (*Figure 6*)*
- *County Zoning: Agriculture (AG) (*Figure 7*)*
- *Special Management Area (SMA): Not Within SMA*

2.1.3 Surrounding Land Uses

The approximately 150-acre Site, identified as portions of TMKs (2) 2-2-002-014 and (2) 2-2-028-181, generally slopes mauka to makai (east to west) from elevation 2,125 feet to elevation 1,490 feet.

The Site is located northwest of the Kēōkea community and borders the existing Waiohuli Community Center and a residential neighborhood to the east and southeast. Lands to the north, south and west of the Site are all vacant with shrubbery and other natural vegetation. Views from the site are expansive. See Figure 8.

See Figure 9 for photographs of the Project Site.

2.2 PURPOSE AND NEED

Pursuant to DHHL's mission[1], the purpose of the project is to build capacity and economic development for the Waiohuli community. Goals for the project include:

- Maximize use of the existing Waiohuli Community Center as a space for job training, business incubation, and production.
- Develop a flexible space (indoor and outdoor) for capacity building in the trades.
- Staff the educational and community facilities with persons trained on site.
- Create career mentoring and employment opportunities in multiple fields of expertise and services.
- Leverage public resources and services to secure deliberate, sustainable private communities and expertise to provide the best, affordable, and timely development solutions possible.
- Propose land uses that are consistent and complimentary with the DHHL's Waiohuli Regional Plan and land use designations.

[1] It is DHHL's mission "to manage the Hawaiian Home Lands trust effectively and to develop and deliver lands to native Hawaiians. We will partner with others towards developing self-sufficient and healthy communities."

2.3 PROJECT DESCRIPTION

The project is a public-private collaboration to combine traditional construction of a development plan with community-based job opportunities derived from development of infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for the Waiohuli community. While the purpose of the project is to build capacity and economic development for the Waiohuli community, the project has been assessed under a potential full buildout scenario to gain a comprehensive understanding of all possible impacts in compliance with Chapter 343, HRS. Figure 1 illustrates the conceptual site plan.

A description of the anticipated land uses follows.

Community Support Training Facilities

An area of the Site designated to the Community Support Training Facilities is proposed to be located near the roadway entrance along both sides of the Lauʻie Drive extension, comprising a total of 6 acres. This component of the plan will complement the existing Waiohuli Community Center abutting these areas to offer community facilities, social services and other resources for the broader Waiohuli region. Potential uses could include recreational spaces, educational and workforce training facilities, multi-purpose functional spaces, as well as health and wellness facilities that feature both traditional Hawaiian healing practices and western medical services. Community support training facilities and concepts will be developed to align with the desired needs of the community and will be invaluable for the Waiohuli region, given the remoteness of the community.

Infrastructure Training Sites

Three segments of the Site, totaling approximately 31 acres, will be utilized as the Infrastructure Training Sites. This includes areas on the far eastern end of the Site near the Lauʻie Drive entrance, a segment in the central portion of the Site, and an area near the far western end of the Site. These areas will primarily serve as a component of the plan that will support job training related to infrastructure construction. Infrastructure development through job training facilities could eventually provide the means for future growth within the Site. Within the Infrastructure Training Sites in the central portion of the Site, a water well capable of 350 gallons per minute (gpm) production is proposed. The proposed yield and pumping capacity were determined based on estimated water demand outlined by a groundwater feasibility study conducted in 2022 to evaluate potential build out of the Site if community development is considered in the future. The segment on the far western end of the Site is being considered to develop wastewater treatment package plant scalable to the proposed uses to serve the community support training facilities and will be designed with capacity to serve potential future growth on the Site if desired by the Waiohuli community.

Agriculture Development Training Sites

The Agriculture Development Training Sites will comprise approximately 42 acres, stretching along the northern and southern portions of the Site, as well as a central portion makai of the existing Waiohuli Community Center. This segment of the Site will primarily provide space for educational facilities and job training in the agricultural industry rooted in indigenous knowledge and traditional Hawaiian farming. Agriculture cultivated in these areas will also be a resource for the community and serve as an opportunity to build on indigenous knowledge cultivating native plants using traditional Hawaiian farming techniques. Agricultural development on the Site will also offer economic opportunities for commercial development to generate revenue streams for the Waiohuli community.

Renewable Energy Development/Training Sites

A large 26.4-acre segment along the western boundary of the Site has been planned as an opportunity to for training focused on renewable energy development that could also support potential future growth on the Site and the neighboring communities.

Natural Drainage Gulch Areas

A contiguous natural green space corridor will be incorporated into the conceptual plan that is designed to follow existing land contours. The green space buffer abutting the gulches will provide ecosystem services by maintaining natural drainage to minimize erosion, facilitate flood control, and preserve natural habitat corridors for wildlife. The green space corridor will also offer a natural buffer between the proposed development areas and the gulches that form the boundaries of the Site as well as providing natural spaces separating plan elements.

2.4 DEVELOPMENT TIMETABLE AND PRELIMINARY COSTS

The project is expected to be completed in phases as funds and capacity are made available, completion of necessary land use approvals, and construction permits. Construction costs are estimated to be approximately $280 million in 2024 dollars.

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Q:\Maui\Kula Maui PPP.pdf

Legend

Project Area

TMK

State Land Use Districts

Agricultural

Rural

Source: ESRI online basemap. County of Maui, 2016 & 2021. DLNR DAR, 2008. State Land Use Commission, 2020.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 8/1/2024

Figure 5
State Land Use Districts

WE DO

Island of Maui

North

Linear Scale (Feet)

0 750 1500

PBR HAWAII & ASSOCIATES, INC.

Kulanihakoi Gl
Waipuilani Gl
Kulanihakoi Gl
Kulanihakoi Gl
HIIPALI LOOP
HIHIO PL
PUEO DR
AHULUA ST
KAHILINAENAE PL
AHULUA PL
PUUALA ST
LAUIE DR
KAUILA'AHA ST
KEANUHEA ST

Q:\Maui\Kula Maui PPP.mxd

Legend

- Project Area
- Roadways
- TMK

DHHL Maui Island Plan

- Community Use
- Conservation
- General Agriculture
- Residential

Source: ESRI online basemap. County of Maui, 2019.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 8/1/2024

Figure 6
DHHL Land Use Designation
(Maui Island Plan, 2019)

WE DO

North

Linear Scale (Feet)
0 500 1,000

Island of Maui

PBR HAWAII & ASSOCIATES, INC.

Q:\Maui\Kula Maui PPP\pdf

Legend

Project Area

Roadways

TMK

Zoning

AG Agriculture

(road)

Source: ESRI online basemap. County of Maui, 2016 & 2021 & 2023. DLNR DAR, 2008.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 8/1/2024

Figure 7
Maui County Zoning

WE DO

North

Linear Scale (Feet)
0 125 250 500

Island of Maui

PBR HAWAII & ASSOCIATES, INC.

Q:\Maui\Kula Maui PPP.pdf

Legend

- Project Area
- Roadways
- TMK

Source: ESRI online basemap. County of Maui, 2016 & 2021. DLNR DAR, 2008.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 8/1/2024

Figure 8
Surrounding Uses Map

WE DO

North

Linear Scale (Feet)
0 500 1,000 2,000

Island of Maui

PBR HAWAII & ASSOCIATES, INC.

View of Project Site from the mauka boundary facing west

View of Project Site from Lau'ie Drive facing northwest

View of mauka portion of the Project Site facing northwest

Wiliwili forest within makai portion of the Project Site

View of gulch along boundary of the Project Site

Figure 9:
Site Photographs

WE DO

Waiohuli Hawaiian Homesteaders Association Inc.

Island of Maui

PBR HAWAII
& ASSOCIATES, INC

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3 DESCRIPTION OF THE NATURAL ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION MEASURES

This section describes existing conditions of the natural environment, potential impacts related to Proposed Project, and mitigation measures to minimize impacts.

3.1 CLIMATE

The climate of Maui varies greatly due to its diverse climate resulting from the range of topography and unique geographic features. The island experiences a tropical climate, characterized by warm temperatures year-round with a wet and dry season. Northeast trade winds typically occur during the day, while winds from the southwest typically occur during the night due to cold air drainage from the mountains (Giambelluca, et al., 2014).

Kēōkea, located in the Upcountry region on the slopes of Haleakalā, has a subtropical highland climate. Sitting at an elevation of around 2,860 feet (870 meters), Kēōkea experiences cooler temperatures compared to coastal areas, typically ranging from 64°F to 72°F (18°C to 20°C). The area receives moderate rainfall averaging a mean annual rainfall of 20.2 inches, contributing to lush vegetation and agricultural activity. Rainfall is more common in the winter months (November to March), while the summer months (April to October) are relatively drier. The cooler temperatures and pleasant climate make Kēōkea a popular destination for those seeking a reprieve from the warmer coastal areas (Giambelluca, et al., 2013).

POTENTIAL IMPACTS AND MITIGATION MEASURES

It is anticipated that the Project will cause no significant impacts to the climate. Any potential impacts during construction will be mitigated to the best degree possible in compliance with all applicable laws. After completion under a potential full build-out scenario, the Project is not anticipated to have a significant impact on the climate.

3.2 GEOLOGY AND TOPOGRAPHY

The island of Maui was built by two major volcanoes, the West Maui Mountains, the older volcano also known as Mauna Kahālāwai, and Haleakalā, the more recently active volcano. The Site is located on the western slope of Haleakalā, a dormant volcano that last erupted around 1790. The approximately 150-acre Site generally slopes mauka to makai (east to west) from elevation 2,125 feet to elevation 1,490 feet (Figure 10).

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed project has been conceptualized in a manner that conforms to Waiohuli's contours. Situated on lands between two gulches, development sites are located on lands with less slope to minimize grading. The renewable energy training sites and the proposed solar farm are located downslope from development training areas and other land uses within the Site at a position to

avoid glint and glare to areas within the Site and other nearby community uses. Nevertheless, site slopes are significant and geotechnical investigation is recommended prior to design and siting of any structures. The conceptual land use plan has been designed to maintain existing topographic features that preserve the natural drainageways within the gulches. A contiguous natural green space corridor will be incorporated into the conceptual plan that is designed to follow existing land contours. The green space buffer abutting the gulches will provide ecosystem services by maintaining natural drainage to minimize erosion. Proposed grading for the project will be in conformance with the Maui County Grading Ordinance and will involve consultation with a civil engineer. To minimize potential impacts, grading will be segmented and appropriate measures will be taken to maintain compliance with Chapter 20.08 (Soil Erosion and Sedimentation Control) of the Maui County Code (MCC).

3.3 SOILS

There are three soil suitability studies prepared for Hawai‘i that illustrate and describe the physical attributes of land and the relative productivity of different land types for agricultural production. These studies are: 1) the U.S. Department of Agriculture (USDA) Natural Resources Conservation Services (NRCS) Soil Survey; 2) the University of Hawai‘i Land Study Bureau (LSB) Detailed Land Classification; and 3) the State of Hawai‘i Department of Agriculture’s Agricultural Lands of Importance to the State of Hawai‘i (ALISH) system.

3.3.1 NRCS Soil Survey

The USDA Natural Resources Conservation Service (NRCS) prepared the *Soil Survey of the Island of Hawai‘i, State of Hawai‘i* in 1973. This survey was patterned after a soil classification procedure adopted for nationwide, uniform application. Soil types are described according to characteristics such as permeability and water capacity, corrosivity, shrink/swell potential, and erosion hazards, as well as their suitability for a variety of commercial crops and agricultural uses.

According to the NRCS survey, all the soil within the Project Site is classified as Kama‘ole Very Stony Silt Loam (KGKC), 3-15% slope (Figure 11).

The Kamaole series consists of well-drained soils on uplands on the island of Maui. These soils developed in volcanic ash and are gently to moderately sloping. Elevations typically range from 1,500 to 2,800 feet. The natural vegetation consists of bermudagrass, castorbean, false mallow, feather fingergrass, and kiawe. These soils have traditionally been used for pasture and wildlife habitat. The surface layer is dark brown and dark reddish-brown silt loam and silty clay loam about 8 inches thick. This soil type has an agricultural capability classification of VIs if non-irrigated (pasture group 3). Runoff is slow to medium with moderate permeability and the erosion hazard is slight to moderate.

Waipuilani Gl

Legend

- Project Area
- TMK
- 20ft Topography

Source: ESRI online basemap. County of Maui, 2016 & 2021. DLNR DAR, 2008.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 10/29/2024

Figure 10
Topography

WE DO

Island of Maui

North

Linear Scale (Feet)
0 125 250 500

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Legend

Project Area

Roadways

TMK

NRCS Soil Classification

KGKC: Kamaole very stony silt loam, 3 to 15 percent slopes

WID2: Waiakoa extremely stony silty clay loam, 3 to 25 percent slopes, eroded, MLRA 157

Source: ESRI online basemap. County of Maui, 2016 & 2021. DLNR DAR, 2008. USDA NRCS, 2020.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 8/1/2024

Figure 11
NRCS Soil Survey

WE DO

North

Linear Scale (Feet)
0 125 250 500

Island of Maui

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3.3.2 LSB Detailed Land Classification

The LSB Detailed Land Classification evaluates the quality or productive capacity of certain lands for selected crops and overall suitability in agricultural use for non-urbanized lands, which was conducted from 1965 through 1972. The study uses a five-class productivity rating system with "A" representing the highest productivity and "E" the lowest. This series of reports were produced with the intention of developing a land inventory and productivity evaluation based on statewide "standards" of crop yields and levels of management.

The Project Site is classified as "C" (Fair) under the LSB system (Figure 12).

3.3.3 Agricultural Lands of Importance to the State of Hawai'i

The Agricultural Lands of Importance to the State of Hawai'i (ALISH) classification system is based primarily, but not exclusively, on soil characteristics, the criteria for classification of lands, and the inventory of prime farm lands that meet the criteria or similar criteria for the respective classes in the national NRCS classification system. The ALISH system identifies and maps three broad classes of agricultural land – Prime, Unique, and Other Important Agricultural Land, as well as Unclassified Land.

The soils within the Project Site are "Other" under the ALISH system (Figure 13).

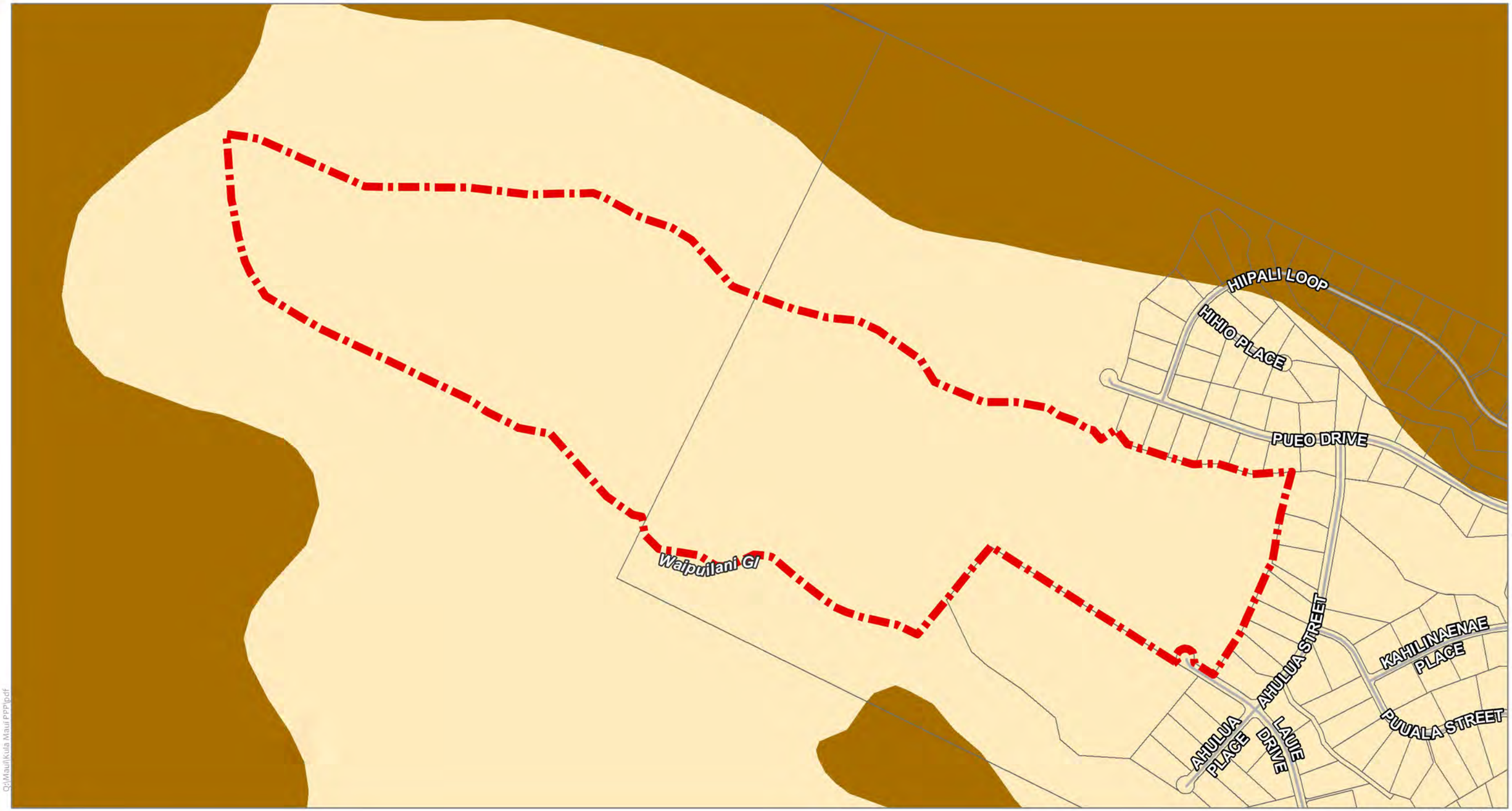
POTENTIAL IMPACTS AND MITIGATION MEASURES

Potential impacts and possible mitigation measures include:

- Agricultural Lands. The Project Site is classified as "fair" and "other" respectively under the LSB and ALISH classification systems, which determines agricultural productivity and/or significant agricultural lands. Implementation of the proposed Project will not significantly reduce the inventory of productive lands available for agricultural uses, and will not have short-term, long-term, direct, or indirect impacts on the inventory of productive agricultural lands available on Maui. The Project also includes opportunities for developing traditional agricultural practices for training facilities and will therefore utilize the productive lands as a means of restoring culturally significant agriculture.
- Construction Impacts. The proposed Project will require land disturbance activities during construction, which has the potential for short-term impacts consistent with construction activities. During construction and grading phases for the Project, there is potential for fugitive dust generation and soil erosion within the Project Site. All construction activities will be done in compliance with applicable Federal, State, and County regulations and rules for strict erosion control measures, including State Water Quality Standards as specified in Chapter 11-54, HAR Water Quality Standards and Chapter 11-55, HAR Water Pollution Control, Department of Health (DOH).

Prior to the issuance of a grading permit by the County of Maui, an erosion control plan and Best Management Practices (BMPs) required for the National Pollutant Discharge Elimination System (NPDES) permit will be prepared describing the implementation of appropriate storm water runoff and/or soil disturbance mitigation and erosion control measures during construction activities. After construction, establishment of landscaping and/or other design features will provide long-term erosion control for unpaved areas. Measures to control erosion during construction and grading may include:

- Minimizing the time of construction;
- Constructing drainage control features early in phasing;
- Using temporary area sprinklers in non-active construction areas when ground cover is removed;
- Providing a water truck on-site during the construction period to provide for immediate sprinkling, as needed;
- Using temporary berms and cut-off ditches, where needed, for erosion control;
- Watering graded areas when construction activity for each day has ceased;
- Grassing or planting all cut and fill slopes immediately after grading work has been completed; and
- Installing silt screens, where appropriate.



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Legend

Project Area

Roadways

TMK

LSB Land Classification

C - Fair

E - Very Poor

Source: ESRI online basemap. County of Maui, 2016 & 2021. DLNR DAR, 2008.University of Hawaii Land Study Bureau, 1967, digitized by State OP, 2012.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 8/1/2024

Figure 12
LSB Detailed Land Classification

WE DO

North

Linear Scale (Feet)
0 125 250 500

Island of Maui

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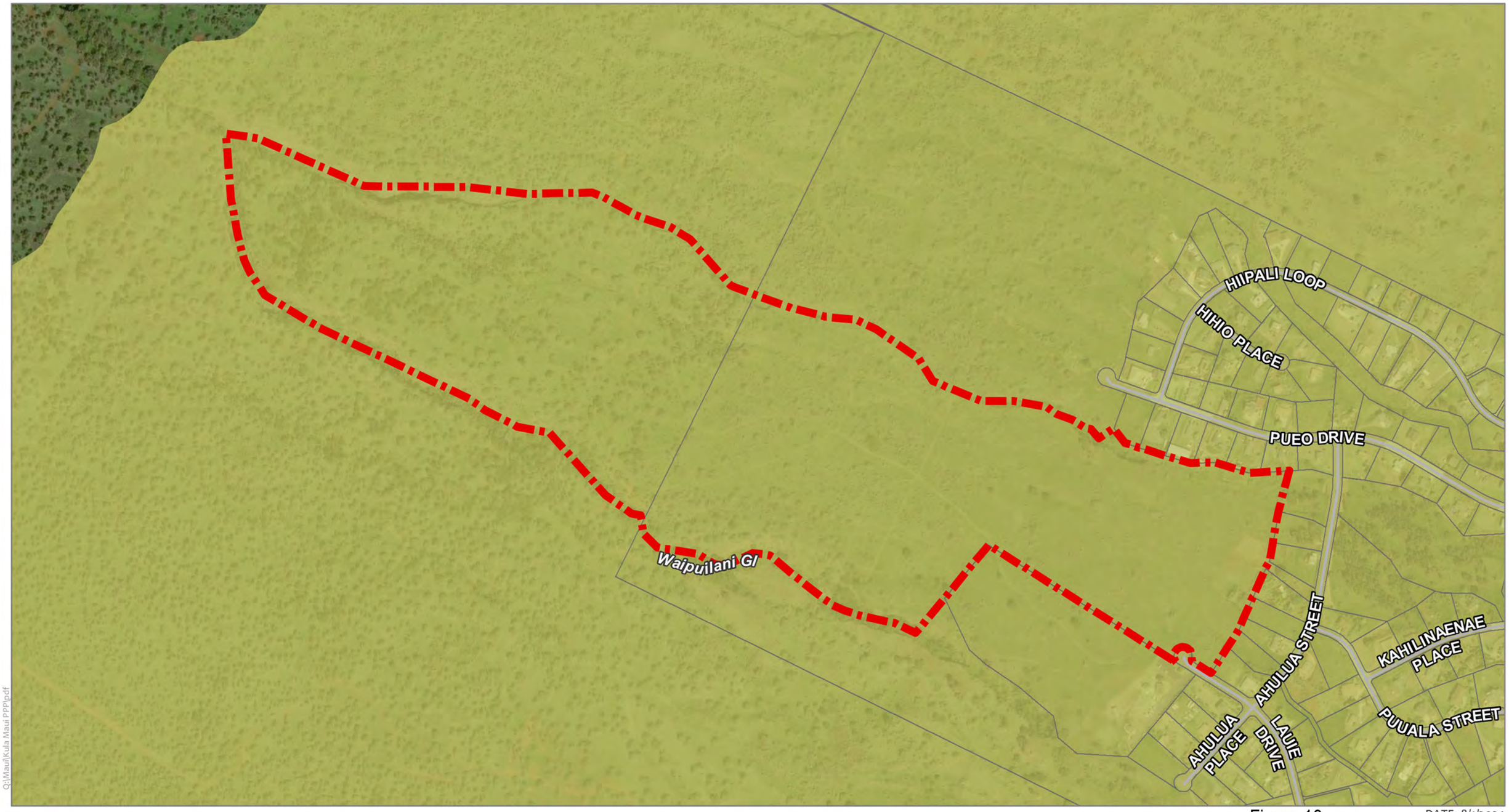

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Legend

- Project Area
- Roadways
- TMK
- ALISH
- Other ALISH

Source: ESRI online basemap. County of Maui, 2016 & 2021. DLNR DAR, 2008.State Department of Agriculture, 1977, digitized by OP.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 8/1/2024

Figure 13
Agricultural Lands of Importance to the State of Hawaii

WE DO

North

Linear Scale (Feet)
0 125 250 500

Island of Maui

PBR HAWAII & ASSOCIATES, INC.

3.4 HYDROLOGY AND DRAINAGE

Ground Water

Maui County contains five major water systems, all of which are operated by the Department of Water Supply (DWS): Central Maui, Upcountry Maui, West Maui, East Maui, and Moloka‘i. Water sources consist of streams (surface water) and aquifers (groundwater). The majority of the water supplied by DWS comes from groundwater as it is typically reliable and abundant and less expensive to purify that surface water (County of Maui, 2010).

The Maui Island Water Use and Development Plan (WUDP) provides a plan for the management, use, and protection of water resources on Maui by all water users over a 20-year period. As a component to the statewide Hawai‘i Water Plan, each county prepares a WUDP. The Draft Maui WUDP Update was prepared by DWS. The Update was approved by the Board of Water Supply in January 2019 and was submitted to the Maui County Council for adoption by ordinance in March 2019.

The State of Hawai‘i, Department of Agriculture oversees and promotes diversified agriculture and state-owned irrigation systems. The 2004 Agricultural Water Use and Development Plan (AWUDP) projected demand to 2020 on lands served by major irrigation systems which include the East Maui and Upcountry Maui irrigation Systems.

To identify and describe these aquifers, the DOH classifies groundwater under an aquifer coding system. According to the WUDP, the Site is located within the Central Aquifer Sector.

To protect the quality of Hawai‘i’s underground drinking water sources from physical, chemical, radioactive, and/or biological contamination that could originate from injection well activity, the DOH Safe Drinking Water Branch administers the Underground Injection Control (UIC) program. DOH Administrative Rules, Title 11, Chapter 23 provides conditions governing the location, construction, and operation of injection wells so that injected fluids do not migrate and pollute underground sources of drinking water. The boundary between exempted aquifers and underground sources of drinking water is generally referred to as the UIC Line. Restrictions on injection wells differ, depending on whether the area is mauka or makai of the UIC line.

Surface Water and Wetlands

There are no wetlands on or near the Site, according to the National Wetlands Inventory (U.S. Fish and Wildlife Service, 2022). The southwestern boundary of the Project Site abuts the Waipu‘ilani Gulch, which is a non-perennial stream that is dry for most of the year and serves as an important stormwater drainageway in South Maui during heavy rain events. The Site’s western (makai) boundary is located approximately five miles from the nearest coastline. This coastline is classified as Class A water. According to the DOH Water Quality Standards, “It is the objective of class A waters that their use for recreational purposes and aesthetic enjoyment be

permitted as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters" (§11-54-03, HAR).

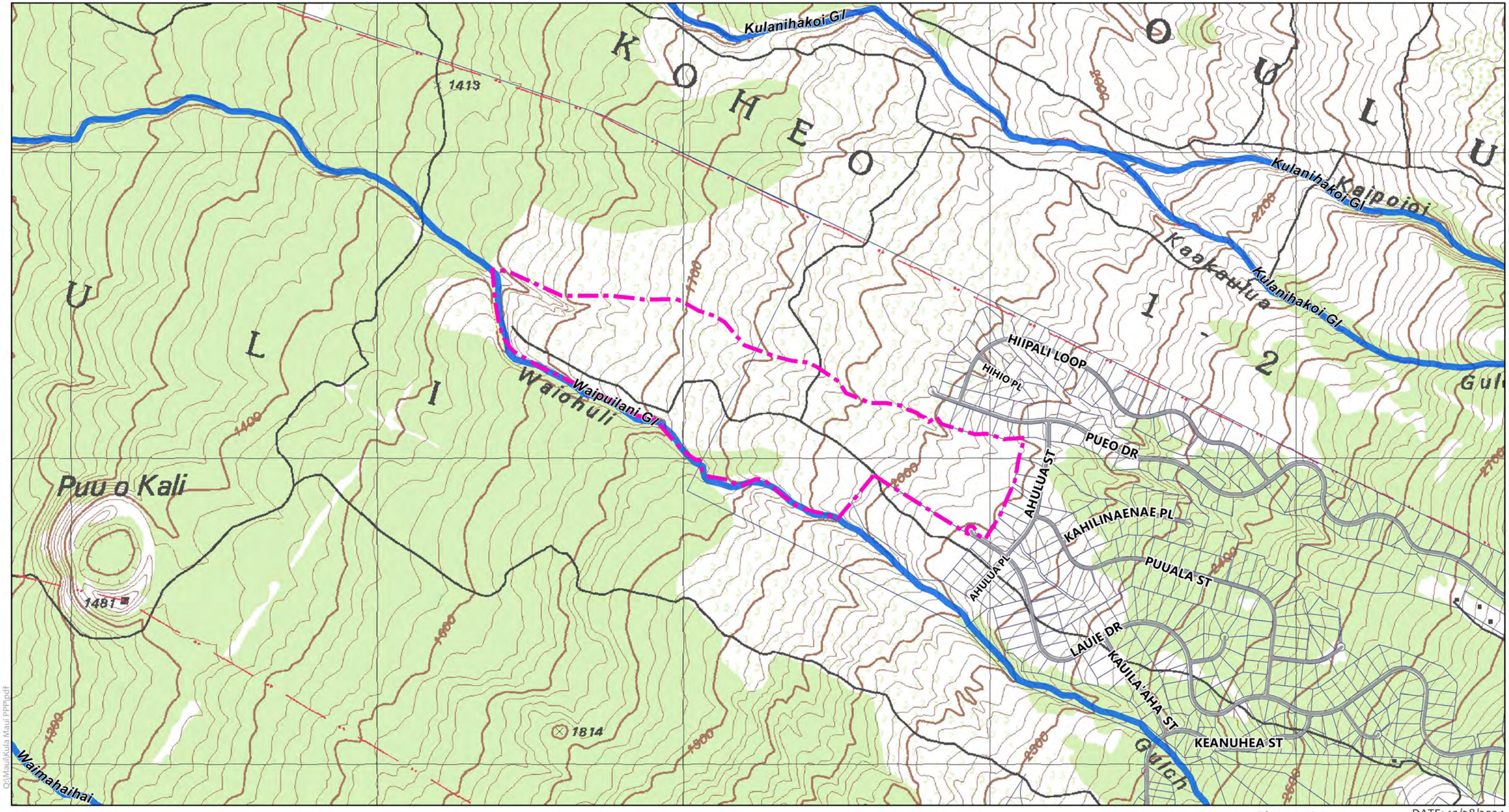
The State of Hawai'i's General Policy of Water Quality Antidegradation (§11-54-1.1, HAR) states that the level of water quality necessary to protect existing uses shall be maintained and protected. In the case that water quality exceeds levels necessary to protect aquatic habitats, water quality may not be degraded without director approval.

All discharges related to construction and/or operation activities within the Site must comply with the Water Quality Standards, specified in Chapter 11-54, HAR and/or permitting requirements, specified in Chapter 11-55, HAR.

See Figure 14 for a map of surface water and wetlands near the Project Site.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Under the potential full buildout scenario, the Project will increase the existing stormwater runoff due to addition of impervious surfaces such as building roofs, pavement and concrete walkways. While the Project will increase runoff, it is not anticipated to generate any adverse drainage effects on downstream properties and/or roadways. A contiguous natural green space corridor will be incorporated into the conceptual plan that is designed to follow existing land contours. The green space buffer abutting the gulches will provide ecosystem services by maintaining natural drainage to minimize erosion, facilitate flood control, and preserve natural habitat corridors for wildlife. The proposed drainage improvements will also include a series of drain inlets with accompanying drain lines to collect and convey the increased stormwater runoff into the gulches surrounding the Project Site. Please see Section 4.8 for more details on proposed drainage improvements.



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Legend

- Project Area
- Roadways
- TMK

Stream

- Non-Perennial

Source: USGS Map. County of Maui, 2016 & 2021. DLNR DAR, 2008.

Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 10/28/2024

Figure 14
Surface Water and Wetlands

WE DO

Island of Maui

North

Linear Scale (Feet)
0 500 1,000

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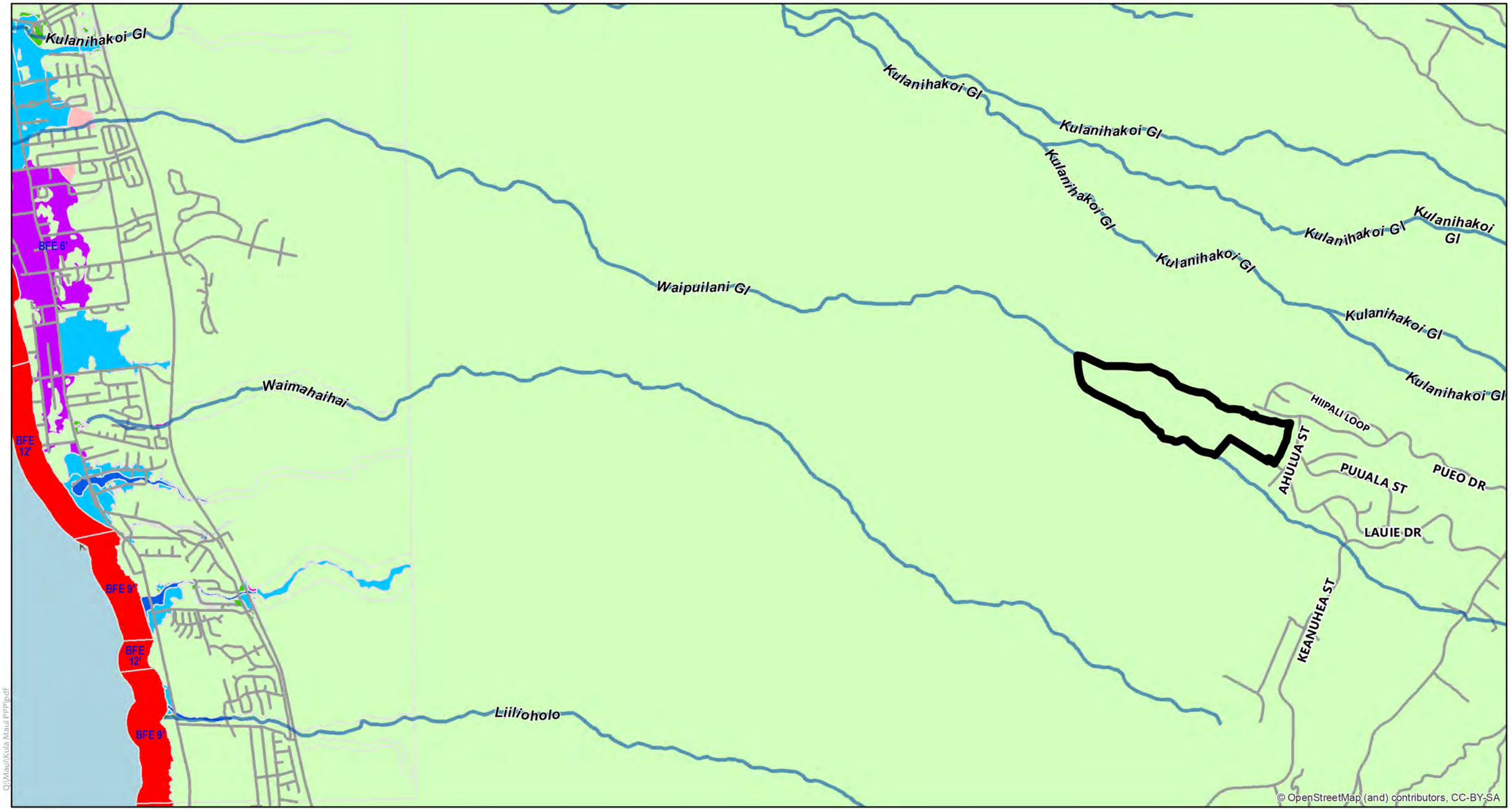

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DATE: 8/1/2024

Legend

- Project Area
- Stream
- Roadways

Flood Hazard Areas

- A: 1%-Annual-Chance Flood, no BFE
- AE: 1%-Annual-Chance Flood, with BFE
- AH: 1%-Annual-Chance Flood, Flood Depths of 1-3ft, with BFE
- AO: 1%-Annual-Chance Flood, Flood Depths of 1-3ft, Average Depths Determined
- VE: 1%-Annual-Chance Coastal Flood, with BFE
- AEF: Floodway Areas in AE
- XS: 0.2%-Annual-Chance Flood
- X: Outside 0.2%-Annual-Chance Floodplain

Source: ESRI online basemap. County of Maui, 2016 & 2021. DLNR DAR, 2008. FEMA Flood Map Service Center, 2021.
Disclaimer: This graphic has been prepared for general planning purposes only.

Figure 15
Flood Insurance Rate Map (FIRM)

WE DO

North

Linear Scale (Feet)
0 1,250 2,500

Island of Maui

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3.5 NATURAL HAZARDS

Maui is susceptible to natural hazards, such as flooding, tsunamis, hurricanes, earthquakes, and wildfires. This section provides an analysis of the Project Site's vulnerability to such hazards.

3.5.1 Flooding

The Federal Emergency Management Agency (FEMA) publishes flood information through the National Flood Insurance Program (NFIP) in the form of Flood Insurance Rate Maps (FIRM). These maps are used by government and insurance agencies to determine the relative potential for damage during flood events. According to the FIRM Panel 1500030595E, effective September 24, 2009, prepared by FEMA NFIP, the Site is located within Zone X. Zone X indicates an area of minimal flood hazard with a less than 1 percent chance flood event. See Figure 15.

The State of Hawai'i, Department of Land and Natural Resources (DLNR) Engineering Division was provided with an opportunity to comment during pre-consultation and provided a response on November 28, 2023. The agency provided information on the rules and regulations under the NFIP and other recommendations to mitigate flood hazard risks. During the Draft EA public comment period, the DLNR Engineering Division noted there were no additional comments on the project.

3.5.2 Tsunami

The Project Site is located at a very high elevation and is therefore not located within the tsunami evacuation zone. There is no threat of tsunami hazards and the Site is far away from any evacuation routes.

3.5.3 Hurricanes

The Hawaiian Islands are seasonally affected by Pacific hurricanes from the late summer to early winter months. During hurricanes and storm conditions, high winds cause strong uplift forces on structures, particularly on roofs. Wind-driven materials and debris can attain high velocity and cause devastating property damage and harm to life and limb. It is difficult to predict these natural occurrences, but it is reasonable to assume that future events will occur. While direct hits from hurricanes are not common, the vulnerability of Maui to potential hurricane impacts is possible. Due to the higher elevation, the Project Site could be vulnerable to wind patterns that would be especially dangerous in the unlikely event of a direct hit from a powerful storm. The possibility of extreme hurricane may increase as climate change drives more unpredictable weather patterns in the future.

3.5.4 Earthquakes

In Hawai'i, most earthquakes are linked to volcanic activity, unlike in other places where a shift in tectonic plates is often the cause of an earthquake. Each year, thousands of earthquakes occur in Hawai'i, but the vast majority are so small they are detectable only with highly sensitive

instruments. However, moderate and disastrous earthquakes have occurred in the islands, particularly on Hawai'i Island, due to its geologically active nature.

The Project Site is subject to a minimal level of seismic risk although some minor impacts may result under a potential significant event on the neighboring island of Hawai'i. FEMA identifies earthquake hazards using seismic design categories (SDCs) that range from A (lowest risk) to E (highest risk). According to FEMA earthquake hazard maps, the Project Site is not identified as a significant risk (FEMA, 2020).

3.5.5 Volcanic Hazards

Volcanic hazards include lava flows and emission of volcanic gases (vog). The island of Maui has not experienced lava flows in over a century and the island's volcanoes are considered to be dormant. Volcanic gases, which are visible as a fog known as vog, are emitted during all types of eruptions on neighboring Hawai'i Island. Any hazard posed by volcanic gases is greatest immediately downwind from active vents; the concentration of such gases diminishes quickly as they mix with air and are carried by winds away from the source (USGS, 1997). The prevailing northeasterly trade wind flow tends to push vog and airborne particulates away from Maui. However, the amount of vog and other airborne particulates can significantly increase during periods when the winds are from the southwest.

3.5.6 Wildfires

The Maui wildfires that occurred in August of 2023 are one of the deadliest wildfire events to impact the United States in recent years. Hurricane winds and dry grasslands intensified the fires across multiple locations on the island, including Olinda, Kula, Pūlehu, and Lahaina. The wildfires devastated Lahaina, leaving 98 people dead, 2,100 acres burned, and 2,142 structures damaged or destroyed. The estimated cost to rebuild Lahaina is projected to be almost 6 billion dollars (Pacific Disaster Center, 2023).

The wildfires in Kula impacted an area makai of the Project Site, burning 678 acres of land and destroying 19 homes (County of Maui, 2023). Nonnative, fire-prone grasses and shrubs create a significant hazard as they can become fuel that may amplify the risk under drought conditions (Hawai'i Wildfire Management Organization, 2014).

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed project has been designed to mitigate potential flooding-related impacts to the Project Site by preserving the natural drainageways formed by the gulches along the boundaries of the property. In addition, the proposed design includes green spaces buffers as well along the boundary to further protect the existing drainageways.

Tsunami and hurricane hazards are unlikely to have an impact on the Project Site due to the distance from coastal areas, and therefore will not require any specific mitigation measures.

While the project will not contribute to the risk factors associated with wildfires, the recent history related to these hazards may require additional protocols for implementing efficient evacuation routes under the potential full-buildout scenario. The Project provides an opportunity to revegetate the Site with native plants and trees to support watershed health and reduce the risk of wildfires. The Applicant will work with local officials to mitigate the risks associated with wildfire hazards.

3.6 CLIMATE CHANGE

Climatic trends which include rising air temperatures, decreasing prevailing northeasterly trade winds, increasing temperatures, and decreasing precipitation. Research also indicates that while Hawai‘i may see an overall decline in rainfall, it will occur with heavier rainfall events (UH Sea Grant, 2014). The effects of climate change include impacts to stream base flows which in turn, are predicted to adversely affect aquifer recharge and freshwater availability (University of Hawai‘i Sea Grant, 2014). Additionally, scientists have observed that all of the Hawaiian Islands have seen longer periods of drought in recent years. While models predict a variety of effects from changing rainfall patterns, if drought events increase in duration or frequency, there is a likelihood of increased stress to aquifers and increased risk of wildfire. Localized changes in precipitation and temperature, increased storm frequency and intensity, and marine water inundation due to sea level rise (SLR), is projected to affect Hawai‘i over the coming decades.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Due to the location of the Project Site, the climate change impacts such as drought, wildfire, and severe storms are more likely to affect the proposed project than climate change impacts such as SLR.

To minimize risk of adverse effects to life and property, the proposed project is designed to preserve natural drainage conditions at the exiting gulches bounding the property. Impacts related to climate change in the form of heavy rain events and flooding are mitigated by providing drainage improvements and preserving natural buffers with the design of green spaces along the boundary with the existing gulches to reduce localized flooding. The addition of buffers at the gulches also serve to provide fire breaks to help protect the community in the event of wildfire.

In an effort to mitigate future climate change, the project aims to provide a self-sufficient community and alternative energy sources with renewable solar technology.

3.7 FLORA AND FAUNA

A natural resources assessment was conducted in February 2024, documenting the current plant and animal species within the project area (Appendix B). The assessment included plant and animal surveys conducted over three days with focus on the areas with habitat that had a higher probability of encountering natives. This report includes recommendations and mitigations for

native species located within the project area that could possibly be utilizing the habitats in and around the project area. See Figure 16 for a map of critical habitats near the Project Site.

In addition to the natural resources assessment, the archaeological literature review prepared for evaluation of historic resources provides information about site vegetation prior to human disturbance (Appendix C). The native vegetation before human impact would likely have been lowland dry and mesic forest, woodland, and shrubland and the site is near the transition to montane dry and mesic forest and woodland ecosystem at higher elevation.

A pre-assessment consultation was conducted from December 2023 through August 2024 with DLNR Division of Forestry and Wildlife (DOFAW) and Division of Aquatic Resources (DAR). The purpose of the pre-assessment consultation was to identify potential project impacts on plant and animal species. Consultation with these agencies provided mitigation measures for protection of potential plant and animal species within the project area.

3.7.1 Flora

There are three main vegetation types found within the project area; panicum-cactus grassland occurs in the upper elevation areas; disturbed dryland forest in the lower elevation areas, and gulch vegetation. The Project Site has experienced disturbances to the natural native habitat over the past couple centuries. Non-native species have been introduced over time, which now dominate much of the area.

The dominant species in the upper grassland areas are non-native Guinea grass and buffelgrass. The mauka portion of the Project Site is particularly dominated by non-native species and the native plant habitat identified during the survey were highly impacted by human activities, non-native ungulates, and introduced non-native plants. In the disturbed dryland forest, wiliwili is the dominant tree species, and occur in extensive groves. The ground in this area does not appear to have been as disturbed as in the mauka areas of the site. Understory is dominated by non-native grasses. The gulches are rocky and in places up to 100 feet deep. A variety of tree species are found on the gulch sides, and some natives were observed. A total of 80 nonnative species were identified on the Site. Ten native indigenous species were documented as follows: *Dorypoteris decipiens, Erythrina sandwicensis,* and *Sicyos pachycarpus*. Indigeous species found were *Pellaea ternifolia, Ipomoea indica, Sida fallax, Oxalis corniculata, Plumbago zeylanica, Dodonaea viscosa,* and *Waltheria indica*. An inventory of the plant species encountered, including their distributional status in the Hawaiian Islands (endemic, indigenous, or naturalized exotics) is found within the Natural Resources Assessment (Appendix B). There were no species documented within the survey area that are listed as endangered or threatened under the federal or State of Hawai‘i endangered species statues.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The Project Site is not within the United States Fish and Wildlife Service (USFWS) designated critical habitat for plants (Figure 16). The biological evaluation concluded that no threatened or endangered botanical resources will be impacted by the project. It is recommended that the makai portion of the project site be utilized as a preserve for the wiliwili forest and possibly an

outplanting site for other native dryland species. The Project will incorporate these recommendations and design the renewable energy solar farm site to preserve the existing wiliwili trees located near the western end of the Project Site. The Project is anticipated to include landscaping that incorporates drought-tolerant native plants under the potential full buildout scenario.

During construction, the applicant will coordinate with the Maui Invasive Species Committee to develop mitigation measures to prevent the spread of Rapid ʻŌhiʻa Death. All equipment, materials, and personnel will be cleaned of excess soil and debris to minimize the risk of spreading invasive species. Gear that may contain soil, such as work boots and vehicles, will be thoroughly cleaned with water and sprayed with 70% alcohol solution to prevent the spread of Rapid ʻŌhiʻa Death and other harmful fungal pathogens.

3.7.2 Fauna

Avian Species

A total of 14 avian species were identified during the biological evaluation. Among those observed, only one native bird species was identified: the koaʻe kea (*Phaethon lepturus*). However, it is probable that other native bird species may utilize the habitats within the Project Site, such as the Pacific Golden-plover or kōlea (*Pluvialis fulva*) and Hawaiian Short-eared owl or pueo (*Asio flammeus sandwichensis*).

The most prevalent birds were Zebra Dove (*Geopelia striata*), Common Myna (*Acridotheris tristis*), house finch (*Haemorhous mexicanus*), and scalybreasted munia (*Lonchura punctulata*).

None of the extant endemic endangered waterbird species were recorded on site as there is no habitat that any of the waterbird species would utilize for foraging or nesting in the project area.

Hawaiian Short-Eared Owl

Pueo are active during the day and are commonly seen hovering or soaring over open areas. Although there is limited information regarding the breeding of this species, nests have been found throughout the year. There were no pueo observed during the biological evaluation.

Hawaiian Goose

Although the Hawaiian Goose or Nēnē (*Branta sanvicensis)* were not observed in the project area and the sites habitat is not conducive for foraging and/or loafing, most human impacts to the species revolve around vehicular interactions or human feeding and disturbance.

Hawaiian Seabirds

Hawaiian seabirds may traverse the Project Site at night during the breeding, nesting, and fledging seasons (March 1 through December 15). Seabird fallout primarily occurs during the fledging season (September 15 through December 15) as chicks will fledge from their nests and use the moonlight to guide them to the ocean. Artificial lights, including those used during nighttime construction, can disorient seabirds and cause them to fall to the ground from exhaustion. While grounded, the birds are at increased risk of being attacked by predators, hit by automobiles, or starvation.

Mammalian Resources

There were no native terrestrial species identified during the biological evaluation. Non-native terrestrial species include, axis deer (*Axis axis*) and Feral pigs (*Sus scrofa*), Domestic dogs (*Canis familiaris*), cats (*Felis catus*), Small Indian mongoose (*Urva auropunctata*), roof rat (*Rattus rattus*), brown rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans hawaiiensis*), and European house mouse (*Mus musculus domesticus*).

Although the Hawaiian Hoary bat (ʻōpeʻapeʻa) was not detected during the survey, the native bat species is known to occur in this area. The Hawaiian horary bat can be found in trees or shrubs 15 feet high or taller and will forage for insects from three to 500 feet above the ground. They are known to forage and roost in a wide range of habitats including forest.

POTENTIAL IMPACTS AND MITIGATION MEASURES

While the makai portion of the Project Site is within the USFWS designated critical habitat for animals and insects (Figure 16), the biological evaluation did not identify any significant impacts on endangered or native species from the project. Although the project is unlikely to impact native species, the following avoidance and minimization measures will be implemented.

To mitigate against seabird fallout, nighttime construction will be avoided. Automatic motion sensors switches and controls on all permanent outdoor lighting should be turned off when human activity is not occurring in the area.

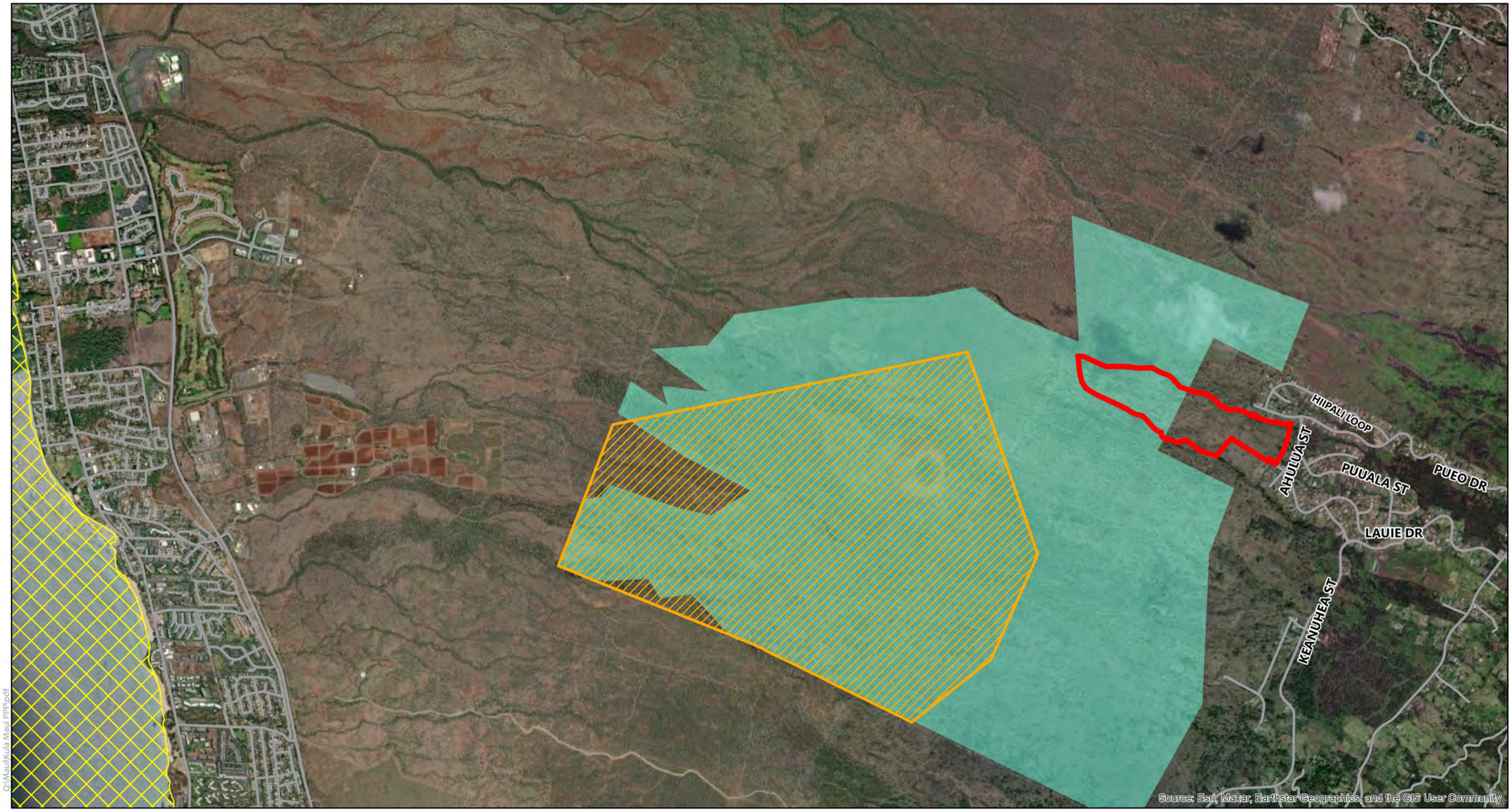
While it is unlikely that the proposed project will have an impact on pueo, mitigation measures will be implemented during construction to ensure that potential habitats are not disturbed, especially during pueo breeding season. If a pueo nest is discovered, DOFAW staff will be notified and a minimum buffer distance of 100 meters will be established from the nest until chicks are capable of flight.

To avoid impacts to the Hawaiian hoary bat, woody vegetation taller than 15 feet will not be cleared during the bat pupping season between June 1 and September 15. Barbed wire will not be used within the project site.

To minimize impacts to the Hawaiian Goose, the following measures will be taken:

- Don’t feed birds especially if they approach for handouts.
- Secure all food rubbish in close trash receptacles.
- Establish a 15 mile per hour speed limit within the site.

The applicant will coordinate with the Maui Island Branch DOFAW office to determine BMPs to be conducted during construction to ensure plant removals do not disturb any potential Blackburn’s Sphinx Moth species inhabiting the site.



Legend

- Project Area
- Roadways
- NOAA Hawaiian Monk Seal Critical Habitat
- USFWS Plants Critical Habitat
- USFWS Animals and Insects Critical Habitats

Source: ESRI online basemap. County of Maui, 2013 & 2016 & 2021. DLNR DAR, 2008. Noaa, 2022. USFWS, 2023.
Disclaimer: This graphic has been prepared for general planning purposes only.

DATE: 10/28/2024

Figure 16
Critical Habitat

WE DO

Island of Maui

North

Linear Scale (Feet)
0 1,250 2,500

PBR HAWAII & ASSOCIATES, INC.

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4 DESCRIPTION OF THE HUMAN ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION MEASURES

This section describes the existing conditions of the human environment, preliminary potential impacts of the proposed Project, and preliminary mitigation measures to minimize any impacts.

4.1 HISTORIC RESOURCES

An Archaeological Literature Review and Field Inspection (LRFI) was conducted by Scientific Consultant Services, Inc. (SCS) in June 2024 (Appendix C). Its purpose is to provide in brief a history of relevant archaeological inventories in the ahupua‘a. The literature review documents prior archaeological reports pertaining to the project area and the vicinity, so as to determine what type of archaeological sites have been documented. It is also intended to gain an understanding of what archaeological features or sites are likely to be documented on the site or nearby the site. The field inspection was conducted by pedestrian survey to identify and surface archaeological features and to investigate the potential to impacts from the proposed project on those features. The LRFI also makes recommendations for future investigative work.

The LRFI provides historical setting, including traditional political boundaries; a description of traditional economy and political systems; and how settlement, economy, land management, and political systems changed through early contact with western explorers and later settlement.

The LRFI documents archaeological surveys conducted in the project area since the 1980’s, noting earlier studies going back to the early 1900’s. The LRFI reports that a site map prepared with a 1989 survey suggests that at least six historic properties fall within the project area (see Appendix C, Figure 8). It is noted in the LRFI that because of technological limitations carried out by efforts at a time without Global Positioning Systems (GPS), it is difficult to correlate locations with high confidence.

The field inspection included a pedestrian survey with the intention of relocating or identifying any new surface archaeological features. Only one archaeological feature was documented. This feature was identified as a Post-Contact cattle wall located along a portion of the northern boundary of the Project Site. The observed wall is constructed of basalt cobbles and incorporated bedrock outcrops within its alignment. The report opines that this feature may be one that was previously documented in 1987 and 1989 surveys or that it may be a newly identified historic property. The report notes that known heiau in the region have been located or confirmed as destroyed and based on the patterns of previous studies finding ritual sites or burials is relatively unlikely. However, it is more likely that there could be additional historic properties associated with ranching and dryland farming, although none were found during field inspection. Archaeological Inventory Survey (AIS) is recommended for the project area.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed project includes opportunities for housing, job creation, and power generation through development of the site. It is assumed that development of the site will involve ground disturbance which could impact previously recorded or yet to be inventoried archaeological features. To avoid, minimize, or mitigate (as needed) impacts to archaeological resources, the project proponents must maintain compliance with State of Hawai‘i laws and regulations that protect such resources (Chapter 6E, HRS). DHHL and future project proponents will consult with the State Historic Preservation Division (SHPD) to determine the appropriate path forward to investigate the site for archaeological features for further evaluation of impacts and necessary mitigations in compliance with the law.

4.2 CULTURAL PRACTICES

A cultural impact assessment (CIA) was conducted by Nohopapa Hawai‘i, LLC to identify cultural practices that may occur in the area and any potential effects the project may have on these practices (Appendix D).

EXISTING CONDITIONS

The Project Site is located within the uplands of Waiohuli ahupua‘a, in the moku (traditional district) of Kula, known today as the district of Makawao. The Project Site is situated on the lower slopes of Haleakalā, known in Hawaiian traditions as the “House of the sun”. Waiohuli is described by historians as a “land division, gulch, and village” whose literal translation is said to mean “water of change,” although this contrasts with the current arid conditions of the Kula region. (Handy, Handy, and Pukui 1972:510,511). Many kama‘āina assert that long ago, a thriving river flowed through the ahupua‘a. Despite the present scarcity of water, numerous accounts recognize Waiohuli as a wahi kūpuna historically cultivated for ‘uala (sweet potato). The mo‘olelo (stories) of Waiohuli’s cultivated uplands reveal how they provided essential resources for the community to thrive in such a dry environment. The agricultural lands, alongside various wahi kūpuna, including heiau (religious sites), emphasize the cultural significance and interconnectivity of the Project Site to its surrounding landscape.

The location of the Kula Moku and the Waiohuli Ahupua‘a is featured on some of the earliest Hawaiian maps depicting traditional land divisions like moku and ahupua‘a. The Kula Moku appears on both the 1837 and 1838 maps of the pae ‘āina (archipelago), engraved by Kalama at Lahainaluna Seminary, Maui. Primarily, the Kula lands were dedicated to agriculture, with dryland farming being especially suited to the area’s climate (Handy, Handy, and Pukui 1972:272). While kalo was cultivated here, ‘uala was the most prevalent crop, thriving in the local terrain and environment.

During the Great Māhele of 1848, approximately ‘āpana, or parcels of kuleana lands in the Waiohuli Ahupua‘a, were awarded to thirteen individuals: Eeka, Hoopiopio, Kahulukaai, Keawe,

Kekeleiaku, Konoia, Luheluhe, Ohai, Paele, Palekai, Puana, Uli, and Wahinealii. The Māhele records indicate that most of these parcels were described as "kula" or open pastoral lands. The LCA (No. 6738) granted to Luheluhe included three ʻāpana, with the first being a one-acre parcel located in the ʻili ʻāina (division of ahupuaʻa) of Kahilinaenae, noted as a kula parcel with a pāhale (house dwelling). Luheluhe's third ʻāpana is found in the ʻili ʻāina of Pueo, described as an "uala liilii," covering 2.25 acres. Here, ʻuala liʻiliʻi could refer to a small patch where sweet potatoes were grown. Ohai received three ʻāpana under LCA (No. 6705), with the second being a 0.43-acre parcel located in the ʻili ʻāina of Luakini, described as a pāhale. It is evident that these lands have historically served primarily for farming and housing.

Settlement, land use, and commerce in the nineteenth century in Waiohuli and the adjacent ahupuaʻa of Kēōkea were heavily influenced by the growth of the Pacific whaling industry, the California gold rush, and the establishment of the sugar industry. From 1825 to 1870, Native Hawaiians and other Pacific Islanders played a pivotal role in the whaling trade (LaCroix 2019:69). In Kula, including the area of Waiohuli and the Project Site, the whaling industry spurred the establishment of agricultural industries focused on producing potatoes and other goods in demand by foreigners (Clark 1989:47; La Croix 2019:102). "The arrival of whalers in the 1840s created significant demand for Irish and sweet potatoes, which were sold from Lahaina aboard ships" (Department of Hawaiian Home Lands 2010:11). Primarily Hakka Chinese immigrants from Kwangtung Province settled in Kula, influencing land use and settlement patterns around Waiohuli. In the 1840s and 1850s, these Chinese farmers subleased Hawaiian Government Crown Lands in Kula from Hawaiian or haole (foreigner) ranchers to grow Irish potatoes for export to California, especially during the Gold Rush, earning Kula the nickname "Nu Kaleponi" (New California) (Mark 1975:1-3). By the 1880s, Kula Crown Lands, including Waiohuli, transitioned into cattle ranches and pasturelands. Following the illegal overthrow of the Hawaiian Kingdom by the United States, Curtis Piehu Iaukea's 1894 Biennial Report of the Commissioners of Crown Lands described the combined 6003 acres of Waihouli and Kēōkea Ahupuaʻa as "the choicest land in this district" and "the most valuable" Crown Lands on Maui.

Throughout the mid to late 1800s, much of Kula was leased for cattle grazing and ranching. Following World War I, in 1911, Kula lands, which had predominantly been leased by Hawaiian and Chinese families, were opened for purchase by the Territorial Government of Hawaiʻi. This shift, compounded by severe drought, led to the out-migration of many Chinese families and an influx of new settlers into the community (Mark 1975:34).

Today, ranching continues to be a vital activity in Kula and the surrounding area. Kaʻonoʻulu Ranch, Haleakalā Ranch, and Ulupalakua Ranch currently operate in the Kula Moku and border the Waiohuli area. As ranch lands transitioned into homesteads, 6,112 acres of the Waiohuli hupuaʻa were designated as home lands under DHHL. The DHHL Waiohuli Homestead lots are located ma kai of the Kula Highway, forming a significant part of the upper Kula community where many Native Hawaiian families now call Waiohuli home.

Nohopapa Hawai‘i’s ethnographic interview conducted with Kekai Kapu, Perry Artates, Napua Silva, Edward Lokomaika‘i Palenapa Brown, and Clifford Santos Jr. included invaluable community insights, highlighting the following:

a) Shared deep-rooted connections to Waiohuli and Kēōkea, with Kekai emphasizing his family's generational ties to Lahaina and Waiohuli as pivotal to his identity and future plans. Each participant reflected a strong sense of place, underscoring the significance of their ancestral lands for their families.

b) All interviewees highlighted the importance of self-sufficiency in their communities. Perry described Kēōkea as a rural area where multicultural residents relied on local resources due to the distance of stores, fostering a sustainable lifestyle. Clifford echoed this sentiment by sharing his experience of cultivating kalo and other native foods on his homestead.

c) Cultural practices and traditions were central to the discussions. Napua, as a kumu hula, and Clifford, as a cultural practitioner, both expressed the importance of passing down knowledge and practices to future generations, ensuring the continuity of their heritage.

d) The significance of the landscape and natural resources in Waiohuli was a recurring theme. Napua highlighted the area's historical connection to water sources, while Lokomaika‘i noted the spiritual and historical importance of the land, referring to his ancestors’ efforts to protect it.

e) Each participant expressed a commitment to caring for Waiohuli and its cultural sites. Kekai's family has worked with state and federal agencies to protect archaeological findings, while Clifford and Lokomaika‘i actively maintain the area, showcasing a shared responsibility toward the land and its history.

f) The interviewees emphasized the vital role of community and family ties in their connection to the land. They articulated a collective responsibility to mālama (care for) the ‘āina, ensuring that future generations can thrive in Waiohuli and continue the traditions that define their identity.

The vision for Waiohuli Economic Development Opportunities heavily invests in fostering self-sufficiency and sustainability, as articulated in the collaborative project, which combines traditional master planning with community-based job opportunities in infrastructure, agricultural cultivation, renewable energy, and water source development.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Based on evidence provided in the cultural impact assessment, Nohopapa Hawai'i, LLC determined that the Project will not have significant impacts on wahi kūpuna and other cultural resources and practices as a result of the proposed activities. The findings based on consultation with cultural practitioners found that they did not have any specific recommendations to make regarding the Project. The consultation determined that the Project could have a positive impact on cultural practices and community sustainability through the integration of resource management and land stewardship. The integration of traditional agricultural practices and resource management proposed with the Project would foster more robust cultural significance for the Project Site. Implementation of this integration of cultural practices and land stewardship is recommended to further the growth of the Native Hawaiian community and residents of Waiohuli.

4.3 NOISE

Ambient noise in the Project Site is consistent with natural sounds associated with undeveloped lands in Upcountry Maui. Within the portion of the Project Site abutting the existing community center and nearby residential properties there is also low-grade noise connected to human activity and marginal traffic sounds from the nearby parking area and roadways.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Under a potential full-buildout scenario, the project is expected to generate moderate noise impacts typically associated with community uses. The noise impact is anticipated to include human activity and other related noises, such as automobile uses and commercial activity. These noise impacts are expected to be nominal and will be fairly consistent with land uses in the surrounding residential area and abutting community center.

During construction, the proposed action may result in short-term noise impacts generated by construction activities. In the long-term, noise will be consistent with conditions common in a rural community district, including motor vehicle traffic, human interactions, recreational uses and other activities related to proposed community uses.

The project will comply with all permissible community noise standards in accordance with the State DOH Administrative Rules, Title 11, Chapter 46 "Community Noise Control" regulations. Increased noise activity due to construction will be mostly limited to daytime hours and will be confined to the construction period, however, nighttime construction may be required as well. The use of pile drivers, hoe rams, jack hammers 25 pounds or heavier, and high-pressure sprayers may be required during certain construction phases. However, this will be restricted to 7:00 AM to 3:00 PM, Monday through Friday to the best degree possible. Construction equipment and on-site vehicles or devices requiring exhaust of gas or air must be equipped with mufflers. In addition, construction activities must satisfy DOH's vehicle noise requirement.

4.4 AIR QUALITY

Air quality on Maui is impacted by emissions from motor vehicles, industrial uses, and natural sources. Comparatively, the air quality in Upcountry Maui is less impacted by adverse human-induced emissions from these sources. The main source of industrial-based emissions are power plants fueled by oil, which emit SO_2, nitrogen oxides, and particulate matter into the atmosphere. Oil-based automobiles emit CO, nitrogen oxides and hydrocarbons (an ozone precursor), as well as smaller amounts of other pollutants including particulates. Natural volcanic emissions of sulfur dioxide also impact air quality, which convert into particulate sulfate and causes volcanic haze (vog) in the area during occasional episodes of southerly Kona winds. Vog concentrations are primarily dependent on the amount of volcanic emissions, the distance from the source vents, and the wind direction and speed on a given day. When trade winds are absent, which occurs most often during the winter months, East Hawai‘i, the entire island or the entire state can be impacted by vog.

The State maintains one air monitoring station on the island of Maui, located at Hale Pi‘ilani Park in Kīhei. According to DOH ambient air quality data, the quality of air on Maui is considered to be “Good.” The prevailing northeasterly trade winds tend to disperse pollutants away Upcountry Maui decreasing the concentration of pollution in the area. However, the amount of particulates and other air pollutants can significantly increase during periods when the winds shift to a southwesterly direction. Overall, the air quality within the Project Site and the surrounding area is generally considered to be good.

The DOH Clean Air Branch was provided with an opportunity to comment during pre-consultation and provided a response on November 29, 2023. DOH Clean Air Branch provided recommendations on mitigation measures and permit requirements related to air quality control. During the Draft EA public comment period, DOH Clean Air Branch reiterated standard agency comments on mitigation measures and permit requirements. There were no project-specific comments related to air quality.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed project is not anticipated to have a significant impact on air quality locally or in the broader region. There may be some temporary impacts during construction but these are anticipated to be minimal and will be mitigated with BMPs. The Applicant will comply with all applicable regulations related to air quality control and will coordinate with relevant agencies including the DOH to ensure compliance and obtain the pertinent air pollution control permits prior to construction.

To minimize fugitive dust impacts during construction, all construction activities will comply with all applicable provisions of Title 11, Chapter 59, HAR related to Ambient Air Quality Standards and HAR §11-60.1-33, related to Fugitive Dust. Long-term negative impacts related to air quality

are not anticipated as construction equipment will utilize technology and standards which meet State and Federal air quality requirements.

The proposed project has the potential for residential development in the future under the potential full buildout scenario. Under this scenario, the proposed project may result in a moderate population increase for the community by providing new homesteading opportunities for native Hawaiians on the Maui homestead waitlist. However, any increase in air pollution as a result of the proposed project will be negligible.

4.5 SOLID WASTE

The DOH Solid and Hazardous Waste Branch (SHWB) was provided with an opportunity to comment during pre-consultation and provided a response on November 17, 2023. DOH SHWB provided recommendations on mitigation measures and permit requirements related to solid and hazardous waste. The DOH Environmental Health Services Division was provided with an opportunity to comment during pre-consultation as well and provided a response on November 29, 2023, stating that they did not have any comments to offer. During the Draft EA public comment period, DOH SHWB reiterated standard agency comments on mitigation measures and permit requirements. There were no project-specific comments related to solid waste.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The applicant will ensure that any solid waste generated both during construction and after completion will be properly delivered to permitted solid waste management facilities. During construction, all solid waste materials will be properly handled, and contractors will follow all applicable requirements to submit disposal receipts and invoices to ensure proper disposal of wastes. Under the potential full buildout scenario, the project will create adequate accommodations to manage solid waste generated within the site and facilitate disposal in compliance with applicable laws and regulations. After completion, the project will encourage the reduction of waste generation, reuse of discarded materials, and the recycling of solid waste within the site and will evaluate opportunities to integrate participation in waste diversion programs.

The Applicant will comply with all applicable provisions under HAR §11-280.1 related to underground storage tanks that may be implemented under the potential full buildout scenario and will coordinate with relevant agencies. The Applicant will comply with all applicable provisions under HAR §11-260.1 to 11-279.1 related to hazardous waste and will coordinate with relevant agencies.

4.6 VISUAL RESOURCES

The Project Site is located on the westerly slopes of Haleakalā, this region falls within the County's Makawao-Pukalani-Kula Community Plan region. The Kēōkea/Waiohuli area boasts extensive open space and rolling green hills, with the summit of Haleakalā rising above to the east. To the west, there are views of the ocean and the West Maui Mountains, while coastal and ocean views are also visible to the north and south (State of Hawai'i, Department of Hawaiian Home Lands, 2004). In addition to the expansive views from the site, the lower portions of the site contain extensive groves of wiliwili trees.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Under the potential full buildout scenario, the Project will include new buildings and facilities to what is now a site vacant of development. However, the Project is anticipated to have minimal impacts on visual resources and views to the mountains and ocean due to its topography. While the potential full buildout scenario would transform the area with the construction of the Project, the land uses have been designed to preserve natural topography to the best degree possible and will also include sufficient buffers along the boundaries of the gulches. Any structures and buildings constructed under the potential full buildout will be designed to conform with existing communities in the Waiohuli area. To protect the groves of wiliwili trees, it is recommended that the makai portion of the project site be utilized as a preserve for the wiliwili forest and possibly an outplanting site for other native dryland species.

4.7 TRANSPORTATION

The State of Hawai'i Department of Transportation (HDOT) was provided with an opportunity to comment during pre-consultation and provided a response on December 1, 2023. HDOT provided the following comments:

1. *The upcoming Draft Environmental Assessment (DEA) should confirm where the proposed access points will be if there are more than one.*
2. *An evaluation should be provided in the upcoming DEA which determines if the proposed land use, typical trip patterns and activities will have any direct or local impacts on the nearby Kula Highway. If relevant, a Traffic Assessment shall be included and prepared by a traffic engineer licensed in the State of Hawaii. The study should also include any recommendations for mitigation measures to be implemented by the development*

During the Draft EA public comment period, HDOT provided the following comments:

1. *Thank you for addressing our early consultation comments in STP 8.3684, dated December 1, 2023, in the DEA.*
2. *HDOT concurs with the findings and recommendations in the Traffic Impact Assessment Report (TIAR) dated April 30, 2024. The report identifies potential adverse impacts on the*

traffic conditions of Kula Highway. The applicant shall mitigate the transportation impacts as recommended in the TIAR, subject to HDOT's approval.

Mitigation for direct impacts to state roadways shall be provided at no cost to the HDOT. The applicant shall dedicate right-of-way for recommended transportation mitigation improvements, as required and approved by the HDOT.

3. *The HDOT appreciates the strategies proposed in Section 3.6 of the DEA that would reduce carbon emissions such as the use of alternative energy sources with renewable solar technologies.*

   The HDOT suggests the following carbon emissions reduction strategies:
   - *Incorporate elements that encourage and enhance the use of multiple types of transportation to reduce carbon emissions.*
   - *Implement the use of energy-efficient technologies and practices, such as light-emitting diode lighting.*
   - *Use sustainable, recycled, or low-emission materials in construction and manufacturing.*

4.7.1 Roadways and Traffic

A Traffic Impact Analysis Report (TIAR) was conducted by Austin, Tsutsumi & Associates, Inc. (ATA) to analyze the potential impacts of the proposed project to the surrounding transportation system, including roadways, traffic patterns, and pedestrian and bicycle facilities (see Appendix E). Manual transportation volume turning movement counts and observations were conducted in April 2024.

EXISTING CONDITIONS

Roadway Conditions

The weekday AM and PM peak hours of traffic were determined to occur between 6:45-7:45 AM and 3:30 PM-4:30 PM, during both peak hours intersections operated acceptably at Level of Service (LOS) B or better. The Project Site is comprised of seven roadways, below are brief descriptions of each roadway.

Ka'amana Street is a two-way, two-lane roadway that provides connection to residences in the study area. This roadway begins to the west with its intersection with Keanuhea Street and continues eastward until its intersection with Kula Highway.

Kekaulike Avenue is a two-way, two-lane roadway that begins to the southwest at its intersection with Kula Highway and extends northeast until at its intersection with Haleakalā Highway, where the roadway continues northward as Haleakalā Highway.

Kula Highway is generally a north-south, two-way, two-lane roadway. This roadway begins to the south near Ulupalakua School & Ranch (where it transitions from Pi'ilani Highway) and extends northward until it transitions to Haleakalā Highway north of its intersection with Makaena Place.

Lauʻie Drive is a two-way, two-lane roadway that begins to the east at its intersection with Kula Highway and extends westward until it ends in a cul-de-sac near the Waiohuli Community Center.

Polipoli Road is a two-way, two-lane unstriped roadway that begins to the west at its intersection with Polipoli Road and extends to the southeast until it ends in a cul-de-sac to the southeast of its intersection with Middle Road.

Pueo Drive is a two-way, two-lane roadway that begins to the east at its intersection with Kula Highway and extends westward until it ends in a cul-de-sac to the west of its intersection with Hiʻipali Loop.

Thompson Road is generally a two-way, two-lane roadway that begins to the north at its intersection with Kula Highway and extends southward until it transitions to Kēōkea Place, which ultimately provides access to Kula Hospital & Clinic and loops around to connect back to Kula Highway. The posted speed limit is 15 in the vicinity of the Project.

Bicycle and Pedestrian Facilities

There are no existing sidewalks within the Project Site and no sidewalks along Kula Highway or Lauʻie Drive.

There are no existing bicycle facilities within the Project Site as the land is vacant. There are also no existing bicycle facilities in the surrounding community other than the shared roadway signage along Kekaulike Avenue between Haleakalā Crater Road and Kula Highway. Under current conditions, bicyclists must share the roadway with vehicular traffic. A proposed shared roadway sign is proposed along Kula Highway between Kekaulike Avenue/Haleakalā Highway and Piʻilani Highway.

Transit

Maui Bus is the County of Maui's primary form of public transit that offers fixed-route transit in the Maui area. The Project Site is served by the Kula Islander (Route 39), which provides service between Kula Hospital and the transit hub at Queen Kaʻahumanu Shopping Center in Kahului. The nearest existing stop to the Project is the Lauʻie Drive/Ahulua Street stop.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The TIAR evaluated potential conditions under the potential full buildout scenario, if selected by the community. The Site will have direct access to Lauʻie Drive along the southeastern boundary where it terminates near the existing Waiohuli Community Center. The proposed conceptual design includes an extension of Lauʻie Drive into the Site, which will ultimately offer vehicular access to Kula Highway to the east, Kēōkea homestead lots and Keanuhea Place beyond them to the north, with Kaʻamana Street running between the parcels.

Projections for Base Year 2024 were based upon the Maui Regional Travel Demand Model. As a result of the development in the area, the annual growth rate along Kula Highway was 0.64% per

year and the traffic along Kula Highway is projected to significantly increase to 215-415 trips in each direction.

Projected impacts under a future year of 2044 with a potential full buildout of the site and anticipated that the project would generate approximately 252 trips during AM peak hours and approximately 392 trips during PM peak hours.

Within the Project Site all intersections are anticipated to operate at LOS D during peak hours, except for eastbound left turn traffic at Kula Highway/Lauʻie Drive intersection, which is projected to operate at LOS E. Some of the minor stop-controlled approaches at the Kula Highway intersections with Kekaulike Avenue and Pueo Drive are anticipated to operate at LOS E/F, however all movements are anticipated to operate under capacity.

Due to the high volume of left-turns from Kula Highway/Lauʻie Drive intersection onto Kula Highway, it is recommended that a traffic signal or median refuge lane be considered. Installing a traffic signal can improve the LOS at the intersection to a B and with a median refuge lane traffic is projected to operate at LOS C or better across both peak hours. When considering traffic signal or median refuge, design parameters such as laneage, right of way (ROW) should be considered. The applicant will mitigate the transportation impacts identified in the TIAR and will coordinate with HDOT for approval of the planned mitigation measures recommended. The mitigation measures with direct impacts on state roadways will not require HDOT to incur any costs. The applicant will coordinate with HDOT for relevant approval and dedication of ROW improvements necessary to accommodate the proposed project.

Under the potential full buildout scenario, the proposed project will offer pedestrian pathways throughout the Site as a means to encourage alternative transportation modes. The Project will include Complete Streets Design elements for a safe pedestrian network such as wide sidewalks, crosswalks, green buffers, speed bumps, pedestrian refuge islands, curb extensions, and walkway trails within the proposed greenways as an alternative transportation mode to reduce carbon emissions. The applicant will consider additional elements to encourage multi modal transportation opportunities during the final design of the project. The applicant will also evaluate implementing energy-efficient technologies and practices as well as use of sustainable, recycled and/or low-emission materials for construction of the project.

4.7.2 Airports

The Project Site is located approximately 11.5 miles geographically from Kahului Airport.

POTENTIAL IMPACTS AND MITIGATION MEASURES

There are no anticipated impacts expected from the proposed project to the Kahului Airport.

4.8 INFRASTRUCTURE AND UTILITIES

R. T. Tanaka Engineers, Inc. (Tanaka) prepared a Preliminary Engineering Report (PER) for the proposed Project. The evaluation of the Project was based on a potential full buildout scenario, if selected by the Waiohuli community. The findings of the report are summarized in the sections below. See Appendix F for the full engineering report.

4.8.1 Water System

The DWS has a water system in the vicinity of the Site, which is part of the Upper Kula Water System. The existing water system closest to the Site comprises a single 8-inch water line located at the end of Lauʻie Drive, abutting the Site on the eastern end near the Waiohuli Community Center.

To investigate the feasibility of a viable private water supply for the Project, a water engineering consultant was contracted to evaluate an onsite test well and to research information from the DLNR Commission on Water Resource Management (CWRM). The onsite test well (Well No. 6-4422-001) has been instructive to determine the feasibility of developing a groundwater source to service the Project. According to the *Groundwater Resources Feasibility Study for the Waiohuli Hawaiian Homesteaders Association Community Economic Plan* prepared by INTERA in 2019 (Appendix G), the Site is located on the Kamaʻole Aquifer, State Aquifer Code 60304 of East Maui. This aquifer has a sustainable yield of 11 million gallons per day (mgd), which was established by the CWRM and the 2021 12-month moving average (MAV) pumpage was approximately 3 mgd. There are 181 drilled wells, dug wells, and tunnels in the aquifer, with the majority of the wells drilled near the coast. The primary groundwater resource is basal. Groundwater basal aquifers are the most important sources of freshwater supply in Hawaiʻi.

DWS was provided with an opportunity to comment during pre-consultation and provided a response on December 1, 2023. DWS provided the following comments:

For the upcoming EA, please include the following information:

1. *What is the quantity of potable water use anticipated?*
2. *What is the quantity of non-potable water use anticipated?*
3. *What sources will be utilized?*
4. *What water conservation strategies will be implemented?*
5. *Will water reuse strategies be implemented?*

During the Draft EA public comment period, CWRM provided the following comments:

1. *We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information*
2. *We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan*

3. *We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EAP as having high water efficiency can be found at http://www.epa.gov/watersense.*
4. *We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://planning.hawaii.gov/czm/initiatives/low-impact-development/*
5. *We recommend the use of alternative water sources, wherever practicable.*
6. *We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program.*
7. *We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf.*
8. *There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.*
9. *A Well Construction Permit(s) is (are) are required before the commencement of any well construction work. We will include you in future correspondence regarding updates on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.*
10. *A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.*
11. *The proposed project is within the Keokea/Waiohuli tract of the State Water Projects Plan (SWPP). At the time of the 2017 SWPP report non-potable water allocation for agricultural areas was 0.578 MGD. It is recommended to check the SWPP and remaining allocations for potable water demand.*

POTENTIAL IMPACTS AND MITIGATION MEASURES

Analysis of water availability for the Project can be found in Appendix F: Preliminary Engineering Report and Appendix G: Groundwater Resources Feasibility Report. Based on available

groundwater assessed in the groundwater resources feasibility study, there is adequate water supply to meet the maximum water demand of the proposed Project with possible residential development under a potential full buildout scenario (Appendix G).

Under the full buildout scenario, the project will not exceed available water resources of the Kama‘ole Aquifer. The CWRM established the Sustainable Yield of the aquifer of 11 mgd and the 2021 12-month moving average pumpage was approximately 3 mgd. The proposed water demand for both potable and non-potable water under a potential full buildout scenario is estimated at an average of 357,610 gallons per day (gpd) for domestic use with a maximum daily demand of 536,415 gpd. The maximum fire flow demand to service the Project is anticipated to be 2,000 gpm. The combined water demand based on maximum daily demand and fire flow is anticipated to be 2,386 gpm under the potential full buildout scenario.

To access water for the Project, a new well is required. The 2017 SWPP Update was focused on the water needs of DHHL and provides a summary of water demand by DHHL tract, including Waiohuli and Kēōkea. The SWPP notes that a new water system will be needed to serve DHHL’s planned residential and community uses in this tract (State of Hawai‘i, Commission on Water Resource Management, 2017). The SWPP notes the exploratory well (Well No. 6-4422-001) which is also discussed in the Project’s Preliminary Engineering Report and Groundwater Resources Feasibility Reports (Appendix F and Appendix G). All three documents note the need for a new well to meet water demand for the Project. A single well will provide sufficient capacity for the proposed demand, however, due to the possibility of pump failure, either emergency cross connection with the DWS system or a second well may be required.

With respect to water quality, the feasibility study (Appendix G) further found that there are no known organic contaminants or detected sources of contamination near the Site. However, new development upgradient and close to the Site could impact groundwater quality and an investigation of nitrate levels is recommended before developing the source due to sewage disposal systems in the area. The aquifer underlying the Site provides a sufficient yield at an acceptable water quality level for potable purposes under current conditions. However, additional land development that relies on groundwater pumping could impact groundwater levels in the aquifer and contribute to groundwater level declines underling the Site. WHHA will work with local developers and planners in the area to minimize potential impacts from groundwater development to ensure groundwater quality is not impacted and groundwater levels do not decline. The applicant will coordinate with the DOH to ensure that water quality standards are maintained throughout the project site and appropriate mitigation measures are implemented to prevent water degradation and/or contamination.

Improvements to meet water requirements for the proposed Project include:

1. Investigate nitrate levels before developing the source.
2. Install new well with a pump (secondary well may be required for contingency)
3. Construct a storage tank or reservoir with capacity to meet maximum daily demand

4. Install waterline infrastructure (including laterals, fire hydrants and transmission lines to storage tanks)
5. Develop offsite water system (including storage tanks and transmission lines)

The applicant will comply with all necessary requirements to acquire a well construction permit and pump installation permit prior to the construction of the proposed groundwater well to serve the project under the potential full buildout scenario. The Project is anticipated to utilize best practices for water conservation throughout the Site, including landscaping that incorporates drought-tolerant native plants and other water efficient landscape design techniques. Various water conservation technology and design should be implemented in the development and construction of community support training facilities such as rainwater catchment systems, non-potable water use, water-efficient fixtures and monitoring systems to track water use. While specific water reuse strategies are not named in the plans at this time, water reuse may be considered as plans are being finalized.

For fire-fighting purposes, fire hydrants will be designed and spaced based on DWS standards to offer sufficient fire protection for the Project. See Figure 17 for a map of the proposed water system.

With respect to non-potable water needs and available supply, the 2017 State Water Projects Plan notes that an agricultural water system was in the process of construction, but that the Department of Agriculture did not have sufficient funds to provide transmission to DHHL tracts, including Waiohuli. The AWUDP, most recently updated in 2021 notes that the Upcountry Maui Irrigation System will eventually serve the agricultural lands including DHHL's lands (State of Hawai'i, Commission on Water Resource Management, 2021). Although this Environmental Assessment evaluates a potential full buildout scenario, a calculation of potential non potable water demands is provided, should the areas designated for Agricultural Development Training Sites (42 acres) be utilized exclusively for agriculture. Based on the County's Water System Standards, the proposed water demand for non-potable water if 42 acres of land were developed for agricultural uses is estimated at an average of 210,000 gpd (County of Maui Department of Water Supply, 2002). In this case, the anticipated non-potable water demand for the Site would remain within the allocation for agricultural areas within the Keokea/Waiohuli tract of the State Water Projects Plan. With funding for a non-potable transmission line uncertain, DHHL may need to prioritize development of residential and community uses ahead of agricultural uses, or utilize more traditional means of water collection and distribution for agricultural uses.

4.8.2 Wastewater System

There is no existing wastewater infrastructure in the vicinity of the Project Site.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Under a potential full buildout scenario, the total anticipated wastewater flow would be approximately 102,765 gpd. To meet the wastewater capacity required, the Project will consider

three wastewater improvement options recommended in the PER to support the projected demand under the potential full buildout. The options include:

1. Installation of Individual Wastewater System (IWS) facilities
2. Installation of a new Wastewater Treatment Facility (WWTF) at the western end of the Site with gravity sewer lines to collect and convey wastewater flows
3. Develop pre-manufactured package plant facilities to treat wastewater in small communities to accommodate

At a minimum, the proposed Project will require the installation of IWS facilities to support the proposed training facilities and the potential for residential development on the Site. The IWS will conform to all requirements under Chapter 11-62 of the DOH's Administrative Rules regarding wastewater. The preliminary estimated cost to install the recommended wastewater system under a potential full build out is approximately $10,481,675. See Figure 18 for a map of the proposed wastewater system.

4.8.3 Drainage System

Stormwater runoff generated from the Project Site sheet-flows downhill in a westerly direction and into the Waiohuli Gulch. There is no existing drainage system or retention system onsite as the land is vacant undeveloped naturally occurring conditions. The Project Site is not impacted by offsite stormwater runoff from adjacent properties as runoff collecting on the existing mauka single family lots are collected by drainage swales and grated drain inlets and then conveyed to existing gulches north and south of the Site.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed Project under the potential full buildout scenario will increase the existing stormwater runoff due to addition of impervious surfaces such as building roofs, pavements, and concrete walkways. While the Project will increase runoff, it is not anticipated to generate any adverse drainage effects on downstream properties and roadways.

Drainage improvements recommended by the PER include retention of runoff volume generated by the Project to reduce stormwater runoff into the downstream properties. Retention basins will also mitigate the potential for sediments contained in the runoff from impacting downstream properties and eventually the ocean. Additionally, a drainage system will include a series of grated drain inlets with drain lines to collect and convey surface stormwater into the gulches surrounding the Site. A contiguous natural green space corridor will also be incorporated into the Project that is designed to follow existing land contours. The green space buffer abutting the gulches will provide ecosystem services by maintaining natural drainage to minimize erosion, facilitate flood control, and preserve natural habitat corridors for wildlife. The green space corridor will also offer a natural buffer between the proposed development areas and the gulches that form the boundaries of the Site as well as providing natural spaces separating various master plan elements.

The onsite drainage system and surface retention basins incorporated in the Project will be based on Maui County Drainage Standards with capacity to manage stormwater flows equal to the 50-year, 1-hour runoff volume increase based on projected generation from the impervious surfaces proposed by the Project. See Figure 19 for a map of the proposed drainage system

4.8.4 Electrical and Telecommunication Utilities

Utilities in the vicinity of the Project Site include existing overhead electrical and telephone facilities along the mauka portion of Hawaiian Home Lands (Kula Residence Lots Subdivision) near the eastern boundary of the Site. These existing facilities currently service adjacent and nearby existing developments.

POTENTIAL IMPACTS AND MITIGATION MEASURES

Under the potential full buildout scenario, the Project is anticipated to utilize connections to the existing overhead facilities currently servicing the neighboring residential lots. Within the Project Site, electrical and telecommunications facilities may include underground installation for onsite utilities.

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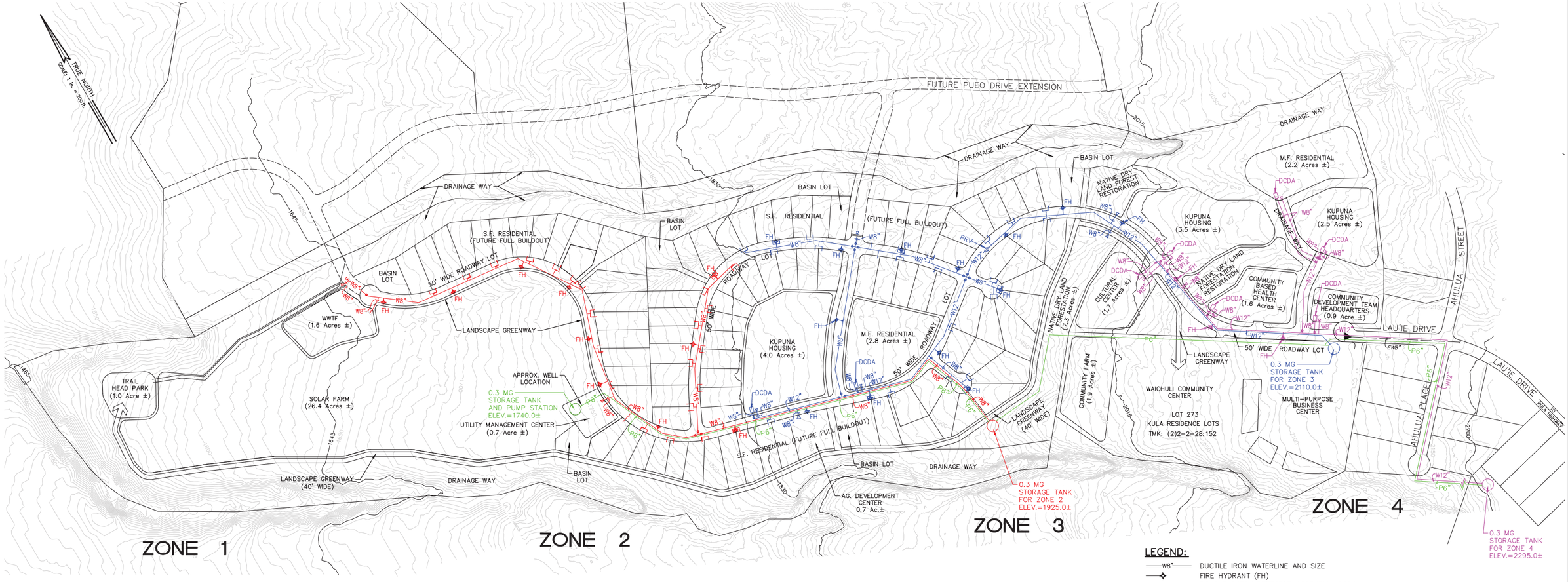


LEGEND:

- W8" — DUCTILE IRON WATERLINE AND SIZE
- FH — FIRE HYDRANT (FH)
- DCDA — DOUBLE CHECK DETECTOR ASSEMBLY (DCDA)
- PRV — PRESSURE REDUCING VALVE WITH MANHOLE (PRV)
- GV — GATE VALVE WITH S.V.B. & COVER (GV)
- SL — SERVICE LATERAL (COMMERCIAL)
- EW8" — EXISTING WATERLINE AND SIZE
- ZONE 2 – SINGLE SERVICE LATERAL (RESIDENTIAL)
- ZONE 2 – DOUBLE SERVICE LATERAL (RESIDENTIAL)
- ZONE 3 – SINGLE SERVICE LATERAL (RESIDENTIAL)
- ZONE 3 – DOUBLE SERVICE LATERAL (RESIDENTIAL)
- ZONE 4 – SINGLE SERVICE LATERAL (RESIDENTIAL)
- ZONE 4 – DOUBLE SERVICE LATERAL (RESIDENTIAL)
- P6" — PUMP WATERLINE AND SIZE

CONCEPTUAL WATER SYSTEM SITE PLAN

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)

"POTENTIAL FULL BUILDOUT" (TOTAL AREA= 150 ACRES ±)

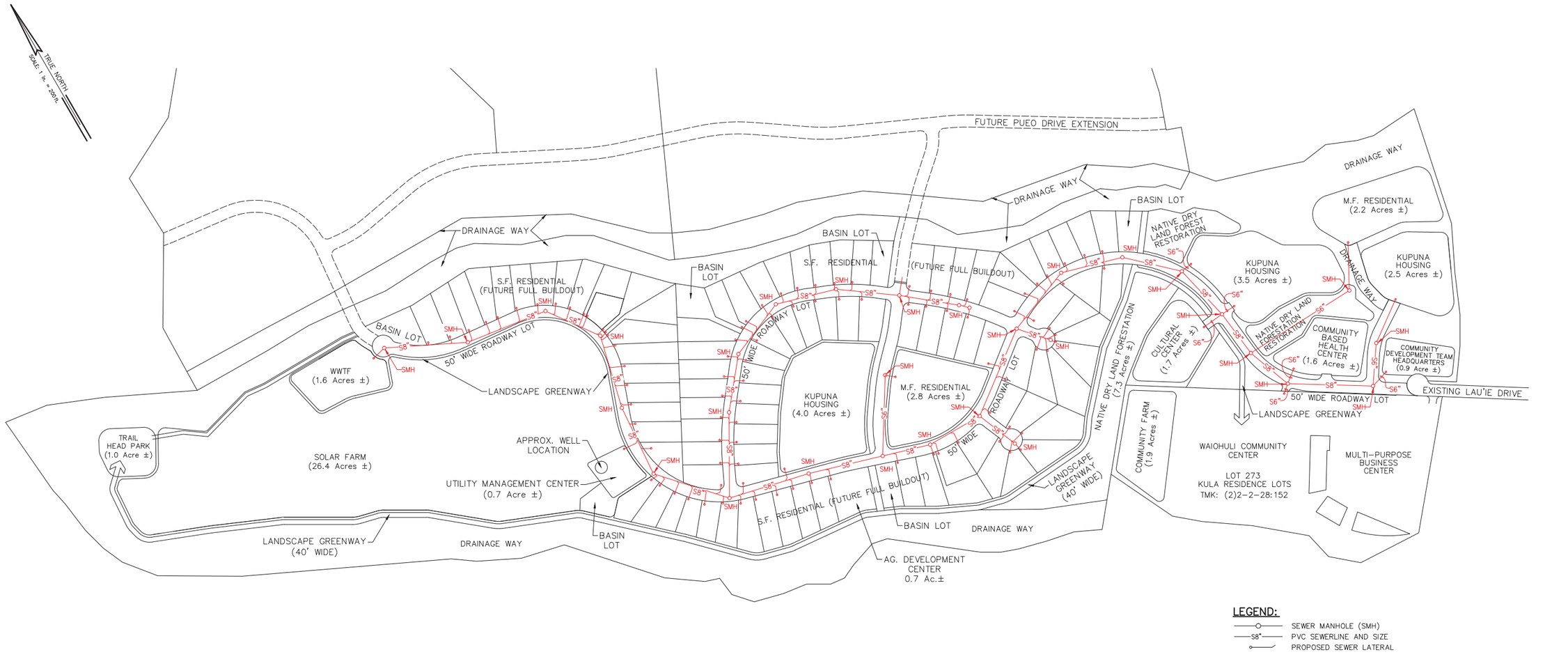
200 100 0 200 400
GRAPHIC SCALE IN FEET

Figure 17

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO: 24-005



CONCEPTUAL SEWER SYSTEM SITE PLAN

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)

"POTENTIAL FULL BUILDOUT" (TOTAL AREA= 150 ACRES ±)

LEGEND:

- SMH — SEWER MANHOLE (SMH)
- S8" — PVC SEWERLINE AND SIZE
- PROPOSED SEWER LATERAL

200 100 0 200 400
GRAPHIC SCALE IN FEET

Figure 18

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO: 24-005

LEGEND:

- GRATED DRAIN INLET (GDI)
- D24" HDPE DRAINLINE AND SIZE
- DRAIN OUTLET (FLAIRED END SECTION)
- DRAIN MANHOLE (DMH)
- DRAINAGE FLOW
- 2100 EXISTING CONTOUR

CONCEPTUAL DRAINAGE HYDROLOGY SITE PLAN

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)

"POTENTIAL FULL BUILDOUT" (TOTAL AREA= 150 ACRES ±)

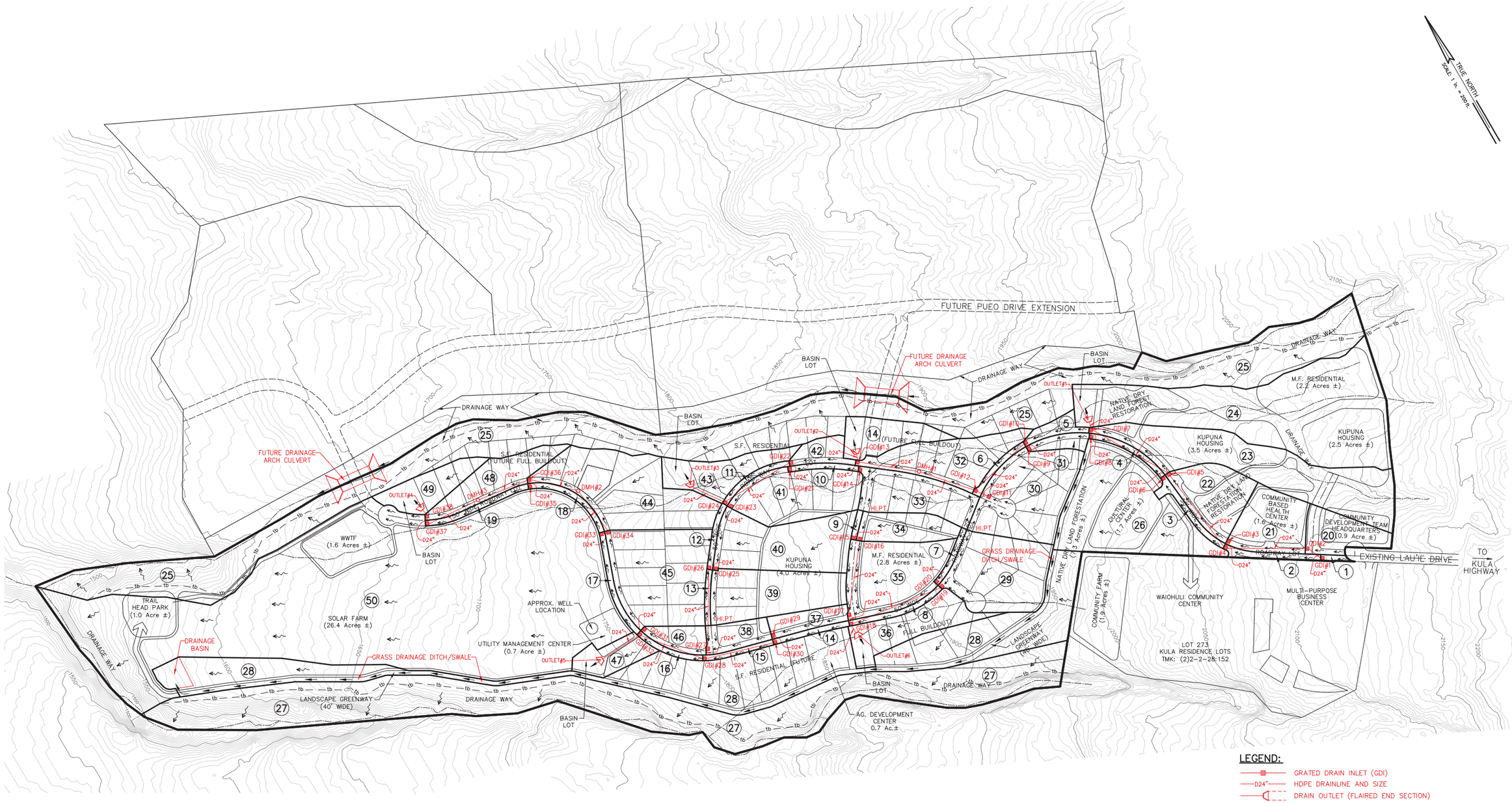
200 100 0 200 400
GRAPHIC SCALE IN FEET

Figure 19

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO: 24-005



LEGEND:

- GRATED DRAIN INLET (GDI)
- D24" HDPE DRAINLINE AND SIZE
- DRAIN OUTLET (FLAIRED END SECTION)
- DRAIN MANHOLE (DMH)
- DRAINAGE FLOW
- 2100 EXISTING CONTOUR
- (27) DRAINAGE AREA NUMBER

CONCEPTUAL DRAINAGE SYSTEM AND FINISHED HYDROLOGY SITE PLAN

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)

"POTENTIAL FULL BUILDOUT" (TOTAL AREA= 150 ACRES ±)

200 100 0 200 400

GRAPHIC SCALE IN FEET

Figure 20

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO: 24-005

4.9 SOCIO-ECONOMIC CHARACTERISTICS

The County of Maui has experienced steady population growth in recent decades, increasing 6.4% between the decennial US Census counts in 2010 and 2020. Over this period, the county's population increased from 154,930 in 2010 to a total of 164,836 in 2020. This growth almost neared the State's overall population change, which increased by 7% over the same timeframe. The County of Maui has also continued steady growth based on US Census estimates for 2022 while the State has experienced a slight population decrease during these years. Based on the 2020 Census, the Kēōkea CDP maintained a total population of 2,645, which was is an 89% increase from the 1,394 recorded in 2010 and represents roughly 1.6% of the total population for the county. The Kēōkea CDP also has a relatively dense population with 824 people per square mile, which is significantly more concentrated compared to the county-wide 140.5 people per square mile reflected in the 2020 Census. The average household size for Kēōkea is roughly 3.86 persons per household, slightly more than the 3 persons in the County of Maui. In addition to the decennial census counts, population data estimates are provided for the vintage year 2022 from the U.S. Census Population Estimates Program (PEP) Quick Facts portal and the American Community Survey 5-Year Estimates (2017-2021) shown in Table 4-1 below.

Table 4-1: Population Data

Characteristic	Kēōkea CDP	County of Maui	State of Hawai'i
Total population (2021)	2,645	164,568	1,453,498
% of population under 18	25.90%	21.70%	21.40%
% of population 65 years and over	14.70%	18.60%	18.50%
Total Population (2021)	2,645	164,568	1,453,498
Households (2017-2021)	686	53,919	478,413
Persons per household, (2017-2021)	3.86	3	2.95
Total Housing Units (2017-2021)	731	71,318	556,937
Owner Occupied Housing Unit Rate (2017-2021)	85.30%	63.90%	61.0%
Population per square mile (2020)	824.0	140.5	226.6
Mean travel time to work (minutes) (2017-2021)	35.1	21.9	26.8

DHHL's Kēōkea-Waiohuli Tract is the largest of three DHHL holdings within the Maui Island Plan's Upcountry planning region. This tract consists of 6,112 acres of the 6,154.0-acre Upcountry holdings (State of Hawai'i Department of Hawaiian Home Lands, 2004).

DHHL's Kēōkea-Waiohuli Tract offers tremendous economic development and community capacity building opportunities. Currently, three homestead areas are under phased

development: 1) the Kula Residence Lots subdivision; 2) the Kēōkea Farm Lots; and 3) the Waiohuli Undivided Interest subdivision. The DHHL Kēōkea-Waiohuli Tract has the potential to be the largest homestead region on Maui.

Agencies at both the State and County level were provided with an opportunity to comment during preconsultation.

The County of Maui, Department of Housing and Human Concerns (DHHC) provided a response on November 14, 2023. DHHC provided the following comments:

No comments. Project is exempt from residential workforce housing agreement.

The State of Hawai'i Department of Human Services (DHS) was provided with an opportunity to comment during pre-consultation and provided a response on December 1, 2023. DHS provided the following comments:

DHS has reviewed the Waiohuli Economic Development Opportunities project and the map of the area. At this time, DHS has no comments.

The State of Hawai'i, Department of Business, Economic Development, and Tourism (DBEDT), Office of Planning and Sustainable Development (OPSD) was provided with an opportunity to comment during pre-consultation and provided a response on December 5, 2023. OPSD provided the following comments:

1. *Although the project is framed as an economic development and job training venture, future permanent development features appear to be anticipated once the training is complete, e.g., community facilities, potable water supply and wastewater treatment facilities, commercial agriculture, and renewable energy facilities. The Environmental Assessment (EA) should disclose the location and amount of the site designated for each use to be used for job training and to be set aside for permanent facilities.*
2. *The EA should identify the entity(s) anticipated to conduct the job training, their qualifications, the source of trainees (Waiohuli Homestead beneficiaries, DHHL beneficiaries in general, or others), and training hours and duration. The training will likely result in impacts to the land that may need mitigation in the short- and long-term. The proposed mitigation should be described.*
3. *The EA should also discuss the potential expansion of the Waiohuli Homesteads with residential and agricultural lots in the project area as this is implied in the description of the training sites.*

During the Draft EA public comment period, OPSD provided the following comments:

The Office of Planning and Sustainable Development has reviewed the DEA-AFONSI and has no further comments for the Final EA.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed project has the potential for residential development on the Site in the future if desired by the Waiohuli community. In addition, the project is anticipated to provide community-

based job opportunities derived from development of infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for Waiohuli. These economic development opportunities, and specifically capacity building opportunities, are proposed to be realized through both construction and operation of the development phases. Training opportunities will be sought throughout the construction and operations of the community and its component elements.

The DHHL Beneficiary demand for additional housing in upcountry Maui and development under the potential full buildout scenario will help to satisfy a portion of this demand. The proposed project is not expected to significantly impact population growth in the broader region and will not create additional strain on other area facilities as a direct impact of the project. However, under a full-build out scenario, the Project may result in a moderate population increase for the community by providing new homesteading opportunities for native Hawaiians on the Maui homestead waitlist.

4.10 PUBLIC SERVICES AND FACILITIES

4.10.1 Public Schools

The only public school under the jurisdiction of the State of Hawai'i Department of Education (DOE) within the vicinity of the Project Site is Kula Elementary School. The DOE was provided with an opportunity to comment during pre-consultation and provided a response on December 1, 2023. The DOE provided the following comments:

Based on the information provided, the proposed project will not impact Hawaii State Department of Education Facilities.

During the Draft EA public comment period, DOE provided the following comments:

Based on the information provided for this project, we currently do not have any comments to provide at this time.

POTENTIAL IMPACTS AND MITIGATION MEASURES

No significant impacts are anticipated. While the project does include opportunities for residential development in the future, the proposed development will not increase the number of school-aged children in the region in the short term. During construction, the project will generate noise and may generate dust and appropriate measures will be taken to minimize these potential impacts to schools in the area. However, the closest school to the Project Site is approximately 2.6 miles away and impacts to public schools are not expected during construction.

4.10.2 Police, Fire and Medical Services

Police Protection

The Project Site is located in the Wailuku District and the closest police station is located approximately 21.5 miles away in Wailuku. The County of Maui Police Department was provided with an opportunity to comment during pre-consultation and provided a response on November 20, 2023. The Police Department stated they have no objections to the project and provided the following comments:

In review of the submitted documents, we have no objections to the upcoming construction project if it meets the minimal standards set forth by county codes and state laws. Efforts should be made to minimize noise, dust, and debris so not to inhibit those whose health and well-being may be affected. We suggest utilizing adequate traffic control devices and/or personnel to minimize the impacts to pedestrian and vehicular movement by heavy construction equipment/vehicles traveling in and out of the area. If the roads will be temporarily closed due to alternating traffic, we recommend the project manager utilize flag men to conduct traffic control and to have proper signage posted along the routes during construction. Lastly, we recommend using proper and adequate lighting during evening, late night, and early morning hours during construction until completion.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The project will comply with all applicable County codes and State laws during construction. During construction, the project will generate noise and may generate dust, however, appropriate measures will be taken to minimize these potential impacts to the surrounding area. Appropriate measures will also be taken to mitigate the impacts during construction as recommended for traffic control and lighting. After completion of the Project under the potential full buildout scenario, the Project Site will be designed to facilitate emergency services, including appropriate roadway design for access throughout the Site

Fire Protection

The Project Site is located in the Kula District and the closest fire station in the Kula Fire Station, located approximately 4.2 miles away in Kula. The County of Maui Fire Department was provided with an opportunity to comment during pre-consultation and provided a response on December 20, 2023. The Fire Department provided the following comments:

1. *Water supply for fire protection shall be provided prior to the location and construction of buildings. Water supply for fire protection shall have a minimum flow of 2000 gallons per minute for a two-hour duration with hydrant spacing a maximum of 250 feet between hydrants. Dead-ends shall have a hydrant within 125 feet. Once construction of buildings are planned, there shall be at least one hydrant within 400 feet of any building to be constructed.*

2. *Service roads to proposed properties shall have a clear width of 20 feet, with an all-weather surface relative to grade. Any dead-end roads if greater than 150 feet in length, shall be provided with an approved fire apparatus turn-around. All turns and required turnarounds shall have an outside turning radius of 40.5 feet. The maximum grade for the service roads shall meet Dept of Public Works standards. Service roads with a width of 20 to 27 feet require No Parking signs on both sides of the street. Service roads with a width of 28 to 34 feet, parking is allowed on only one side of the street. Service roads with a width of 36 feet or larger, parking is allowed on both sides of the street.*

POTENTIAL IMPACTS AND MITIGATION MEASURES

After completion of the Project under the potential full buildout scenario, the Project Site will be designed to support fire protection services, including adequate roadway design for access throughout the Site and adequate spacing for turnaround necessary to accommodate emergency vehicles. The project will meet all requirements for roadway width, turnaround, grade, and signage for all proposed internal roads.

The proposed water system will include accommodation for fire protection and fire hydrants will be designed and spaced based on DWS standards to offer sufficient fire protection across the Site. Fire hydrants will be designed and spaced based on requisite standards to offer sufficient fire protection across the Site with at least one hydrant within 400 feet of any building. The maximum fire flow demand to service the Project under the potential full buildout scenario is anticipated to be 2,000 gpm.

Medical Services

The Project Site is located approximately 3.1 miles from Kula Hospital.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The proposed conceptual plan also includes a community-based health center to provide both traditional Hawaiian healing practices and western medical services.

4.10.3 Recreational Facilities

There are no existing recreational facilities as the land is undeveloped, vacant land. The County of Maui Department of Parks and Recreation (DPR) was provided with an opportunity to comment during pre-consultation and provided a response on November 28, 2023. DPR provided the following comments:

Thank you for the opportunity to review and comment on the subject project. In accordance with Maui County Code 18. 16. 320 Parks and Playgrounds, this project is exempt from park assessment fees. The Department of Parks and Recreation has no further comments at this time.

POTENTIAL IMPACTS AND MITIGATION MEASURES

The Project is not anticipated to have a significant impact on parks or other recreational facilities in the surrounding area. Recreational spaces within the Project will include walking paths and green space along the southern boundary of the Site. Recreational green spaces and the proposed greenway trails will also connect to the proposed trailhead at the western end of the Site where a small one-acre park is proposed.

5 LAND USE CONFORMANCE

The State of Hawai‘i, Department of Hawaiian Home Lands (DHHL) and County of Maui land use plans, policies, and ordinances relevant to the Proposed Project are described below.

5.1 DHHL PLANNING SYSTEM

The Hawaiian Homes Commission Act (Sections 204 and 206), which has been incorporated into Article XII of the Hawai‘i State Constitution, vests DHHL with exclusive authority to control its lands, and the anticipated land uses are generally consistent with the Department’s existing Maui Island Plan (MIP).

In 2004, DHHL adopted the (DHHL) MIP which examined all DHHL land in terms of development constraints and opportunities and other criteria, in order to assign appropriate Land Use Designations to each parcel (State of Hawai‘i, Department of Hawaiian Home Lands, 2004).

Across the islands, kuleana lands slowly disappeared since the days of the Māhele. In 1940, only 35% of these lands survived, and by 1980, only 19% remained. Areas that were impacted the most included plantation districts where large-scale farms slowly surrounded and impeded natural resources.

In 1992, the Federal Government reallocated money and additional lands to the Hawaiian Home Lands program “as compensation for the state’s improper or unauthorized use or transfer of 30,000 acres of Hawaiian home lands since statehood in 1959”. This process resulted in $13.8 million “set aside for DHHL to develop more homes and agricultural lots for native Hawaiians,”.

DHHL provides long-term and comprehensive land use planning for the trust holdings in support of the Hawaiian Homes Commission, the Department, and its beneficiaries in realizing the agency’s mission, goals, and objectives. The planning system includes three tiers: a General Plan that identifies long term goals, articulates vision, and organizes priorities; Island Plans, such as the MIP referenced throughout this document, which focus on island-specific land use projections; and Regional Plans and Area Development Plans which address issues and opportunities relative to existing homestead communities.

5.1.1 Hawai‘i Administrative Rules Chapter 10-7

In 2019, new Administrative Rules were adopted allowing rentals on Hawaiian Home Lands. The new rules offer opportunities for beneficiaries who are waiting for homesteads, or those who otherwise could not afford or may desire other housing types. The rental housing rules allow for housing types such as multi-family rental housing, kupuna housing, and transitional or supportive housing (State of Hawai‘i, 2019).

5.1.2 DHHL General Plan

DHHL's General Plan was updated in 2022 (State of Hawai'i, Department of Hawaiian Home Lands, 2022). The updated plan identifies new policies, land use designations, and proposes a new approach to land use designations with updated criteria. The updated designations in the General Plan include 13 designations in total. The new designations include:

- DHHL Kuleana
- Stewardship
- Community Agriculture
- Renewable Energy

During the General Plan creation process, DHHL beneficiary consultation resulted in the suggestion of removing the "General Agriculture" designation from the 2002 Plan and replace it with a land use designation that better describes its intent. Previously, lands designated as General Agriculture were undeveloped lands that were not slated for immediate development but were in need of an interim use designation until higher and better uses were identified. In its stead, a new land use designation called "DHHL Kuleana" homestead lots was suggested during beneficiary consultation (see table below for description) for homestead use.

The added criteria in determining the most fitting land use designation includes climate change hazards, critical habitats, archaeological sites, flood risk, and State and County Land Use Designations.

Homestead Uses	Description
Residential	Residential lot subdivisions built to County standards in areas close to existing infrastructure. Subdistricts may be established for multi-generational and single-family housing types.
Subsistence Agriculture	Small lot agriculture in areas close to existing infrastructure. Lifestyle areas intended to allow for home consumption of agricultural products.
Supplemental Agriculture	Large lot agriculture intended to provide opportunities for agricultural production for supplemental income and home use. Agricultural plan required.
Pastoral	Large lot agriculture specifically for pastoral uses. Ranch plan and fencing required.
DHHL Kuleana (new)	Raw (without infrastructure) lots intended for "off-grid" subsistence lifestyles to allow for more choices as to how lessees wish to develop their lots. Must participate in maintenance of the right-of-way to the Kuleana Homestead tract.

Non-Homestead Uses	Description
Community Use	Common areas for community uses and public facilities. Includes space for parks and recreation, cultural activities, community based economic development, utilities, and other public facilities and amenities.
Community Agriculture (new)	Common areas used for the cultivation of fruits, vegetables, plants, flowers, or herbs by multiple users. The land must be served by a water supply sufficient to support the cultivation practices used on the site.
Commercial	Lands suitable for a concentration of commercial activities.
Industrial	Lands suitable for processing, construction, manufacturing, transportation, wholesale, warehousing, and other industrial activities.
Renewable Energy (new)	Lands suitable for siting projects for the generation and transmission of renewable energy.
Stewardship (new)	Land not currently used for homesteading. Allow uses that maintain or enhance the value and condition of the land to the benefit of beneficiaries and the Trust. May serve as an interim use until opportunities for higher and better uses become available.
Conservation	Environmentally sensitive areas. Lands with watersheds, endangered species, critical habitats, sensitive historic and cultural sites, other environmental factors. Very limited uses.
Special District	Areas requiring special attention because of unusual opportunities and/or constraints. *Subdistricts include: hazard areas, open spaces/greenways, cultural resources.*

5.1.3 DHHL Maui Island Plan

The Maui Island Plan (MIP), like all DHHL Island Plans asserts the Hawaiian Homes Commission's authority to designate land uses for Hawaiian Home Lands. The MIP identifies priority areas for homestead development based upon homestead applicant preferences and site analysis to identify lands most suitable for development.

The MIP was prepared in 2004. It has not yet been updated to reflect the new land use designations that were established with the General Plan update of 2023. Thus, the DHHL land use designations for the Project Site in Figure 6 are outdated, but until changed, remain the official designations for the site.

Kēōkea/Waiohuli is discussed within the MIP as a strategic opportunity to meet the housing needs of DHHL beneficiaries.

According to a beneficiary survey conducted at the time, a majority (39.2%) expressed a preference for the Upcountry region, indicating a pressing demand for approximately 1,111 additional residential units. Among the DHHL inventory, Kēōkea/Waiohuli stands out as the most suitable site for developing these residential homesteads, leveraging existing infrastructure to support future growth.

The MIP identifies that current infrastructure, including the Kula Residential Lots Unit 1 and the planned Unit 2 in-fill, as well as the proposed Kēōkea Farm Lots subdivisions allows for shared infrastructure, including access points from Kula Highway and existing water and electric systems, which will significantly reduce overall development costs.

Two alternative development scenarios were presented in the 2004 MIP for Kēōkea/Waiohuli. Both alternatives promoted the development of 1,111 residential lots, mixed with community use areas and subsistence and general agriculture, consistent with DHHL Land Use Designations at the time. The primary difference between the two scenarios in the MIP was the lot size for low-density residential housing set at either a one-half acre (MIP Alternative 1) or an acre (MIP Alternative 2). To achieve the larger lot sizes in the second scenario, the land area dedicated to residential development was expanded and the overall land area dedicated to development was doubled in size. The MIP ultimately recommends the one-half acre lot size development scenario because the less land-intensive layout would mean lower development costs.

5.1.4 Chapter 343, HRS

Compliance with Chapter 343, HRS is required as described in Section 1.5.

5.1.5 State Land Use Law, Chapter 205, HRS

The State Land Use Law (Chapter 205, HRS), establishes the State Land Use Commission (LUC) and authorizes this body to designate all lands in the state into one of four Districts: Urban, Rural, Agricultural, or Conservation. The Project Site is located within the Agricultural District (Figure 5).

The LUC was provided with an opportunity to comment during pre-consultation and provided a response on November 14, 2023. The LUC provided the following comments:

After review of the State Land Use District Maps, it is determined that the proposed project is within the State Agricultural District, and since the project is above 15 acres, the Department of Hawaiian Home Lands should petition the LUC for a land use designation change to prevent future confusion. When the environmental assessment is being completed ensure that all acreage being used is included, this includes access roads.

When compiling the environmental assessment for the Project, please include an explanation of who the accepting authority is and the justification for choosing the accepting authority. Also,

please be sure the applicable laws and criteria set forth in HAR §11-200.1 are met in the environmental assessment.

As discussed previously, the Hawaiian Homes Commission Act (Sections 204 and 206), which has been incorporated into Article XII of the Hawai'i State Constitution, vests DHHL with exclusive authority to control its lands. The accepting authority for the proposed project is the Department of Hawaiian Home Lands. See Section 7.1 for more detailed information on compliance with the significance criteria set forth under HAR §11-200.1.

5.1.6 Coastal Zone Management Act, Chapter 205A, Hawai'i Revised Statutes

All lands in Hawai'i are located in the Coastal Zone as defined by the U.S. government. The U.S. Congress enacted the Coastal Zone Management (CZM) Act to assist states in better managing coastal and estuarine environments. The act provides grants to states that develop and implement federally-approved CZM plans. The State of Hawai'i's CZM Act Program was enacted pursuant to Chapter 205A, HRS. The program outlines management objectives centered around ten areas: 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 in Coastal Management; 9) Beach Protection; and 10) Marine Resources. All lands within the State of Hawai'i fall within the CZM area.

Table 5-1: Hawai'i Coastal Zone Management Program, Chapter 205A, HRS

COASTAL ZONE MANAGEMENT ACT, CHAPTER 205A, HRS (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
Recreational Resources			
Objective: (A) Provide coastal recreational opportunities accessible to the public.			
Policies:			
• Improve coordination and funding of coastal recreational planning and management; and			**X**
• Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:			**X**
a. Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;			**X**
b. Requiring restoration of coastal resources that have significant recreational and ecosystem value, including but not limited to coral reefs, surfing sites, fishponds, sand beaches, and coastal dunes, when these resources will be unavoidably damaged by development; or requiring monetary compensation to the State for recreation when restoration is not feasible or desirable;			**X**
c. Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;			**X**
d. Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;			**X**
e. Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;			**X**

COASTAL ZONE MANAGEMENT ACT, CHAPTER 205A, HRS (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
f. Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;	**X**		
g. Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and			**X**
h. Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as it will ensure that all discharges related to construction and/or operation activities within the Site comply with Water Quality Standards.			
Historic Resources			
Objective: (A) Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.			
Policies:			
(1) Identify and analyze significant archaeological resources;	**X**		
(2) Maximize information retention through preservation of remains and artifacts or salvage operations; and	**X**		
(3) Support state goals for protection, restoration, interpretation, and display of historic resources.	**X**		
Discussion: Archaeological surveys have previously been conducted on the lands, identifying historic resources primarily on the western portions of the Site. Information gained from prior reports have been mapped and the proper archaeological team will be present when any ground-disturbing activity takes place. DHHL and its contractors will comply with all State and County laws and rules regarding the preservation of archaeological and historic sites. If any undocumented historic sites such as walls, platforms, pavements and mounds, or remains such as artifacts, burials, concentrations of shell or charcoal or artifacts are inadvertently encountered during construction activities, work will cease immediately in the vicinity of the find and the find will be protected. The contractor(s) will immediately contact the State Historic Preservation Division, which will assess the significance of the find and recommend appropriate mitigation measures, if necessary.			
Scenic and Open Space Resources			
Objective: (A) Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.			
Policies:			
(1) Identify valued scenic resources in the coastal zone management area;			**X**
(2) Ensure that new developments are compatible with their visual environment by designing and locating those developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;	**X**		
(3) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and	**X**		
(4) Encourage those developments that are not coastal dependent to locate in inland areas.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the project site and proposed facilities have been conceptualized in a manner that conforms to Waiohuli's contours. Situated on lands between two gulches, development sites are located on lands with less slope to minimize grading and alteration of natural landforms.			
Coastal Ecosystems			
Objective: (A) Protect valuable coastal ecosystems, including reefs, beaches, and coastal dunes, from disruption and minimize adverse impacts on all coastal ecosystems.			

COASTAL ZONE MANAGEMENT ACT, CHAPTER 205A, HRS (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
Policies:			
(1) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;			**X**
(2) Improve the technical basis for natural resource management;			**X**
(3) Preserve valuable coastal ecosystems of significant biological or economic importance, including reefs, beaches, and dunes;			**X**
(4) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and			**X**
(5) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as the green space buffer along the gulches will provide natural drainage to improve water quality for stormwater discharge from the Project Site.			
Economic Uses			
Objective: (A) Provide public or private facilities and improvements important to the State's economy in suitable locations.			
Policies:			
(1) Concentrate coastal dependent development in appropriate areas;			**X**
(2) Ensure that coastal dependent development and coastal related development are located, designed, and constructed to minimize exposure to coastal hazards and adverse social, visual, and environmental impacts in the coastal zone management area; and			**X**
(3) Direct the location and expansion of coastal development to areas designated and used for that development and permit reasonable long-term growth at those areas, and permit coastal development outside of designated areas when:			**X**
a. Use of designated locations is not feasible;			**X**
b. Adverse environmental effects and risks from coastal hazards are minimized; and			**X**
c. The development is important to the State's economy.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as its primary goal is to create community based economic opportunities derived from development of infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for the Waiohuli community.			
Coastal Hazards			
Objective: (A) Reduce hazard to life and property from coastal hazards.			
Policies:			
(1) Develop and communicate adequate information about the risks of coastal hazards;			**X**
(2) Control development, including planning and zoning control, in areas subject to coastal hazards;			**X**
(3) Ensure that developments comply with requirements of the National Flood Insurance Program; and			**X**
(4) Prevent coastal flooding from inland projects.			**X**
Discussion: N/A			
Managing Development			
Objective: (A) Improve the development review process, communication, and public participation in the management of coastal resources and hazards.			

COASTAL ZONE MANAGEMENT ACT, CHAPTER 205A, HRS (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
Policies:			
(1) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;			**X**
(2) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and			**X**
(3) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.			**X**
Discussion: N/A			
Public Participation			
Objective: (A) Stimulate public awareness, education, and participation in coastal management.			
Policies:			
(1) Promote public involvement in coastal zone management processes;			**X**
(2) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and			**X**
(3) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.			**X**
Discussion: N/A			
Beach and Coastal Dune Protection			
Objectives: (A) Protect beaches and coastal dunes for: i. Public use and recreation; ii. The benefit of coastal ecosystems; and iii. Use as natural buffers against coastal hazards; and (B) Coordinate and fund beach management and protection.			
Policies:			
(1) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;			**X**
(2) Prohibit construction of private shoreline hardening structures, including seawalls and revetments, at sites having sand beaches and at sites where shoreline hardening structures interfere with existing recreational and waterline activities;			**X**
(3) Minimize the construction of public shoreline hardening structures, including seawalls and revetments, at sites having sand beaches and at sites where shoreline hardening structures interfere with existing recreational and waterline activities;			**X**
(4) Minimize grading of and damage to coastal dunes;			**X**
(5) Prohibit private property owners from creating a public nuisance by inducing or cultivating the private property owner's vegetation in a beach transit corridor; and			**X**
(6) Prohibit private property owners from creating a public nuisance by allowing the private property owner's unmaintained vegetation to interfere or encroach upon a beach transit corridor; and			**X**
Discussion: N/A			
Marine and Coastal Resources			
Objective: (A) Promote the protection, use, and development of marine and coastal resources to assure their sustainability.			
Policies:			
(1) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;			**X**

COASTAL ZONE MANAGEMENT ACT, CHAPTER 205A, HRS (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(2) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;			**X**
(3) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;			**X**
(4) Promote research, study, and understanding of ocean and coastal processes, impacts of climate change and sea level rise, marine life, and other ocean resources to acquire and inventory information necessary to understand how coastal development activities relate to and impact ocean and coastal resources; and			**X**
(5) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.			**X**
Discussion: N/A			

5.1.7 Hawai‘i State Plan, Chapter 226, HRS

The Hawai‘i State Plan directs State agencies to prepare functional plans for their respective program areas. There are 14 State Functional Plans that serve as the primary implementing vehicle for the goals, objectives, and policies of the Hawai‘i State Plan.

Table 5-2: Hawai‘i State Plan, Chapter 226, HRS

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
HRS § 226-1: Findings and Purpose			
HRS § 226-2: Definitions			
HRS § 226-3: Overall Theme			
HRS § 226-4: State Goals. In order to guarantee, for the present and future generations, those elements of choice and mobility that insure that individuals and groups may approach their desired levels of self-reliance and self-determination, it shall be the goal of the State to achieve: (1) A strong, viable economy, characterized by stability, diversity and growth that enables fulfillment of the needs and expectations of Hawaii's present and future generations.	**X**		
(2) 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.	**X**		
(3) Physical, social and economic well-being, for individuals and families in Hawaii, that nourishes a sense of community responsibility, of caring and of participation in community life.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, creating a desired physical environment to promote the physical, social, and economic well-being of the community. The proposed project will provide short- and long-term economic opportunities that will foster greater self-sufficiency for the people of upcountry Maui through capacity building and jobs homegrown at the Project Site.			
HRS § 226-5: Objectives and policies for population.			
Objective: It shall be the objective in planning for the State's population to guide population growth to be consistent with the achievement of physical, economic and social objectives contained in this chapter.			

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
Policies:			
(1) Manage population growth statewide in a manner that provides increased opportunities for Hawaii's people to pursue their physical, social and economic aspirations while recognizing the unique needs of each County.	**X**		
(2) Encourage an increase in economic activities and employment opportunities on the neighbor islands consistent with community needs and desires.	**X**		
(3) Promote increased opportunities for Hawaii's people to pursue their socio-economic aspirations throughout the islands.	**X**		
(4) Encourage research activities and public awareness programs to foster an understanding of Hawaii's limited capacity to accommodate population needs and to address concerns resulting from an increase in Hawaii's population.			**X**
(5) Encourage federal actions and coordination among major governmental agencies to promote a more balanced distribution of immigrants among the states, provided that such actions do not prevent the reunion of immediate family members.			**X**
(6) Pursue an increase in federal assistance for states with a greater proportion of foreign immigrants relative to their state's population.			**X**
(7) Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographic area.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as it will offer local economic and community capacity building opportunities to ensure that residents are able to raise their families in Hawai'i.			
HRS § 226-6: Objectives and policies for the economy in general.			
Objectives: Planning for the State's economy in general shall be directed toward achievement of the following objectives:			
(1) Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawaii's people, while at the same time stimulating the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited.	**X**		
(2) A steadily growing and diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands.	**X**		
Policies:			
(1) Promote and encourage entrepreneurship within Hawaii by residents and nonresidents of the State.	**X**		
(2) Expand Hawaii's national and international marketing, communication, and organizational ties, to increase the State's capacity to adjust to and capitalize upon economic changes and opportunities occurring outside the State.			**X**
(3) Promote Hawaii as an attractive market for environmentally and socially sound investment activities that benefit Hawaii's people.	**X**		
(4) Transform and maintain Hawaii as a place that welcomes and facilitates innovative activity that may lead to commercial opportunities.	**X**		
(5) Promote innovative activity that may pose initial risks, but ultimately contribute to the economy of Hawaii	**X**		
(6) Seek broader outlets for new or expanded Hawaii business investments.			**X**
(7) Expand existing markets and penetrate new markets for Hawaii's products and services.			**X**

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(8) Assure that the basic economic needs of Hawaii's people are maintained in the event of disruptions in overseas transportation.	**X**		
(9) Strive to achieve a level of construction activity responsive to, and consistent with, state growth objectives.	**X**		
(10) Encourage the formation of cooperatives and other favorable marketing arrangements at the local or regional level to assist Hawaii's small scale producers, manufacturers, and distributors.	**X**		
(11) Encourage labor-intensive activities that are economically satisfying and which offer opportunities for upward mobility.	**X**		
(12) Encourage innovative activities that may not be labor-intensive, but may otherwise contribute to the economy of Hawaii.	**X**		
(13) Foster greater cooperation and coordination between the government and private sectors in developing Hawaii's employment and economic growth opportunities.	**X**		
(14) Stimulate the development and expansion of economic activities which will benefit areas with substantial or expected employment problems.	**X**		
(15) Maintain acceptable working conditions and standards for Hawaii's workers.	**X**		
(16) Provide equal employment opportunities for all segments of Hawaii's population through affirmative action and nondiscrimination measures.	**X**		
(17) Stimulate the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited.			**X**
(18) Encourage businesses that have favorable financial multiplier effects within Hawaii's economy, particularly with respect to emerging industries in science and technology.			**X**
(19) Promote and protect intangible resources in Hawaii, such as scenic beauty and the aloha spirit, which are vital to a healthy economy.	**X**		
(20) Increase effective communication between the educational community and the private sector to develop relevant curricula and training programs to meet future employment needs in general, and requirements of new or innovative potential growth industries in particular.	**X**		
(21) Foster a business climate in Hawaii--including attitudes, tax and regulatory policies, and financial and technical assistance programs--that is conducive to the expansion of existing enterprises and the creation and attraction of new business and industry.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the vision for WE DO is to provide community-based job opportunities derived from development of infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for the Waiohuli community.			
HRS § 226-7: Objectives and policies for the economy - agriculture			
Objectives: Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:			
(1) Viability of Hawaii's sugar and pineapple industries.			**X**
(2) Growth and development of diversified agriculture throughout the State.	**X**		
(3) An agriculture industry that continues to constitute a dynamic and essential component of Hawaii's strategic, economic, and social well-being.	**X**		
Policies:			
(1) Establish a clear direction for Hawaii's agriculture through stakeholder commitment and advocacy.	**X**		
(2) Encourage agriculture by making best use of natural resources.	**X**		

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(3) Provide the governor and the legislature with information and options needed for prudent decision making for the development of agriculture.			**X**
(4) Establish strong relationships between the agricultural and visitor industries for mutual marketing benefits.			**X**
(5) Foster increased public awareness and understanding of the contributions and benefits of agriculture as a major sector of Hawaii's economy.	**X**		
(6) Seek the enactment and retention of federal and state legislation that benefits Hawaii's agricultural industries.			**X**
(7) Strengthen diversified agriculture by developing an effective promotion, marketing, and distribution system between Hawaii's producers and consumer markets locally, on the continental United States, and internationally.	**X**		
(8) Support research and development activities that provide greater efficiency and economic productivity in agriculture.			**X**
(9) Enhance agricultural growth by providing public incentives and encouraging private initiatives.			**X**
(10) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.	**X**		
(11) Increase the attractiveness and opportunities for an agricultural education and livelihood.	**X**		
(12) Expand Hawaii's agricultural base by promoting growth and development of flowers, tropical fruits and plants, livestock, feed grains, forestry, food crops, aquaculture, and other potential enterprises.	**X**		
(13) Promote economically competitive activities that increase Hawaii's agricultural self-sufficiency.	**X**		
(14) Promote and assist in the establishment of sound financial programs for diversified agriculture.	**X**		
(15) Institute and support programs and activities to assist the entry of displaced agricultural workers into alternative agricultural or other employment.	**X**		
(16) Facilitate the transition of agricultural lands in economically nonfeasible agricultural production to economically viable agricultural uses.	**X**		
(17) Perpetuate, promote, and increase use of traditional Hawaiian farming systems, such as the use of loko ia, mala, and irrigated loi, and growth of traditional Hawaiian crops, such as kalo, uala, and ulu.	**X**		
(18) Increase and develop small-scale farms.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as the 42 acres of agriculture development training sites will provide space for educational facilities and job training in the agricultural industry rooted in indigenous knowledge and traditional Hawaiian farming. Agricultural development on the Site will also offer economic opportunities for commercial development to generate revenue streams for the Waiohuli community.			
HRS § 226-8: Objectives and policies for the economy – visitor industry			
Objectives: Planning for the State's economy with regard to the visitor industry shall be directed towards the achievement of the objective of a visitor industry that constitutes a major component of steady growth for Hawaii's economy.			
Policies:			
(1) Support and assist in the promotion of Hawaii's visitor attractions and facilities.			**X**
(2) Ensure that visitor industry activities are in keeping with the social, economic, and physical needs and aspirations of Hawaii's people.			**X**
(3) Improve the quality of existing visitor destination areas.			**X**

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(4) Encourage cooperation and coordination between the government and private sectors in developing and maintaining well-designed, adequately serviced visitor industry and related developments which are sensitive to neighboring communities and activities.			**X**
(5) Develop the industry in a manner that will continue to provide new job opportunities and steady employment for Hawaii's people.			**X**
(6) Provide opportunities for Hawaii's people to obtain job training and education that will allow for upward mobility within the visitor industry.			**X**
(7) Foster a recognition of the contribution of the visitor industry to Hawaii's economy and the need to perpetuate the aloha spirit.			**X**
(8) Foster an understanding by visitors of the aloha spirit and of the unique and sensitive character of Hawaii's cultures and values.			**X**
Discussion: N/A			
HRS § 226-9: Objective and policies for the economy – federal expenditures			
Objective: Planning for the State's economy with regard to federal expenditures shall be directed towards achievement of the objective of a stable federal investment base as an integral component of Hawaii's economy.			
Policies:			
(1) Encourage the sustained flow of federal expenditures in Hawaii that generates long-term government civilian employment.			**X**
(2) Promote Hawaii's supportive role in national defense.			**X**
(3) Promote the development of federally supported activities in Hawaii that respect statewide economic concerns, are sensitive to community needs, and minimize adverse impacts on Hawaii's environment.			**X**
(4) Increase opportunities for entry and advancement of Hawaii's people into federal government service.			**X**
(5) Promote federal use of local commodities, services, and facilities available in Hawaii.			**X**
(6) Strengthen federal-state-county communication and coordination in all federal activities that affect Hawaii.			**X**
(7) Pursue the return of federally controlled lands in Hawaii that are not required for either the defense of the nation or for other purposes of national importance, and promote the mutually beneficial exchanges of land between federal agencies, the State, and the counties.			**X**
Discussion: N/A			
HRS § 226-10: Objectives and policies for the economy – potential growth and innovative activities.			
Objective: Planning for the State's economy with regard to potential growth activities shall be directed towards achievement of the objective of development and expansion of potential growth activities that serve to increase and diversify Hawaii's economic base.			
Policies:			
(1) Facilitate investment and employment growth in economic activities that have the potential to expand and diversify Hawaii's economy, including but not limited to diversified agriculture, aquaculture, renewable energy development, creative media, health care, and science and technology-based sectors.	**X**		
(2) Facilitate investment in innovative activity that may pose risks or be less labor-intensive than other traditional business activity, but if successful, will generate revenue in Hawaii through the export of services or products or substitution of imported services or products;			**X**

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(3) Encourage entrepreneurship in innovative activity by academic researchers and instructors who may not have the background, skill, or initial inclination to commercially exploit their discoveries or achievements.			**X**
(4) Recognize that innovative activity is not exclusively dependent upon individuals with advanced formal education, but that many self-taught, motivated individuals are able, willing, sufficiently knowledgeable, and equipped with the attitude necessary to undertake innovative activity.	**X**		
(5) Increase the opportunities for investors in innovative activity and talent engaged in innovative activity to personally meet and interact at cultural, art, entertainment, culinary, athletic, or visitor-oriented events without a business focus;	**X**		
(6) Expand Hawaii's capacity to attract and service international programs and activities that generate employment for Hawaii's people.	**X**		
(7) Enhance and promote Hawaii's role as a center for international relations, trade, finance, services, technology, education, culture, and the arts.	**X**		
(8) Accelerate research and development of new energy-related industries based on wind, solar, ocean, underground resources, and solid waste.	**X**		
(9) Promote Hawaii's geographic, environmental, social, and technological advantages to attract new or innovative economic activities into the State.	**X**		
(10) Provide public incentives and encourage private initiative to attract new or innovative industries that best support Hawaii's social, economic, physical, and environmental objectives.	**X**		
(11) Increase research and the development of ocean-related economic activities such as mining, food production, and scientific research.	**X**		
(12) Develop, promote, and support research and educational and training programs that will enhance Hawaii's ability to attract and develop economic activities of benefit to Hawaii.	**X**		
(13) Foster a broader public recognition and understanding of the potential benefits of new or innovative growth-oriented industry in Hawaii.	**X**		
(14) Encourage the development and implementation of joint federal and state initiatives to attract federal programs and projects that will support Hawaii's social, economic, physical, and environmental objectives.	**X**		
(15) Increase research and development of businesses and services in the telecommunications and information industries.			**X**
(16) Foster the research and development of non-fossil fuel and energy efficient modes of transportation.			**X**
(17) Recognize and promote health care and health care information technology as growth industries.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the educational and workforce training facilities have the potential to diversify Hawai'i's economy and workforce in infrastructure, agricultural cultivation, community services, renewable energy, and water source development.			
HRS § 226-10.5: Objectives and policies for the economy – information industry			
Objective: Planning for the State's economy with regard to telecommunications and information technology shall be directed toward recognizing that broadband and wireless communication capability and infrastructure are foundations for an innovative economy and positioning Hawaii as a leader in broadband and wireless communications and applications in the Pacific Region.			
Policies:			
(1) Encourage the continued development and expansion of the telecommunications infrastructure serving Hawaii to accommodate future growth in the information industry;			**X**

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(2) Facilitate the development of new business and service ventures in the information industry which will provide employment opportunities for the people of Hawaii;			**X**
(3) Encourage greater cooperation between the public and private sectors in developing and maintaining a well- designed information industry;			**X**
(4) Ensure that the development of new businesses and services in the industry are in keeping with the social, economic, and physical needs and aspirations of Hawaii's people;			**X**
(5) Provide opportunities for Hawaii's people to obtain job training and education that will allow for upward mobility within the information industry;			**X**
(6) Foster a recognition of the contribution of the information industry to Hawaii's economy; and			**X**
(7) Assist in the promotion of Hawaii as a broker, creator, and processor of information in the Pacific.			**X**
Discussion: N/A			
HRS § 226-11: Objectives and policies for the physical environment – land-based, shoreline, and marine resources.			
Objectives: Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaii's scenic assets, natural beauty, and multi-cultural/historical resources.			
(1) Prudent use of Hawaii's land-based, shoreline, and marine resources.	**X**		
(2) Effective protection of Hawaii's unique and fragile environmental resources.	**X**		
Policies:			
(1) Exrcise an overall conservation ethic in the use of Hawaii's natural resources.	**X**		
(2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.	**X**		
(3) Take into account the physical attributes of areas when planning and designing activities and facilities.	**X**		
(4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.	**X**		
(5) Consider multiple uses in watershed areas, provided such uses do not detrimentally affect water quality and recharge functions.	**X**		
(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.	**X**		
(7) Provide public incentives that encourage private actions to protect significant natural resources from degradation or unnecessary depletion.			**X**
(8) Pursue compatible relationships among activities, facilities, and natural resources.	**X**		
(9) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as the project site and proposed facilities have been conceptualized in a manner that conforms to Waiohuli's contours to minimize grading and alteration of natural landforms. In addition, the landscaping of the site will include native plants and trees that support watershed health.			
HRS § 226-12: Objectives and policies for the physical environment – scenic, natural beauty, and historic resources.			
Objective: Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaii's scenic assets, natural beauty, and multi-cultural/historical resources.			
Policies:			
(1) Promote the preservation and restoration of significant natural and historic resources.	**X**		

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(2) Provide incentives to maintain and enhance historic, cultural, and scenic amenities.	**X**		
(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.	**X**		
(4) Protect those special areas, structures, and elements that are an integral and functional part of Hawaii's ethnic and cultural heritage.	**X**		
(5) Encourage the design of developments and activities that complement the natural beauty of the islands.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as the project aims to preserve Hawai'i's culture along with any significant natural or historic resources.			
HRS § 226-13: Objectives and policies for the physical environment – land, air, and water quality.			
Objectives: Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives:			
(1) Maintenance and pursuit of improved quality in Hawaii's land, air, and water resources.	**X**		
(2) Greater public awareness and appreciation of Hawaii's environmental resources.	**X**		
Policies:			
(1) Foster educational activities that promote a better understanding of Hawaii's limited environmental resources.	**X**		
(2) Promote the proper management of Hawaii's land and water resources.	**X**		
(3) Promote effective measures to achieve desired quality in Hawaii's surface, ground, and coastal waters.	**X**		
(4) Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawaii's people.			**X**
(5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.	**X**		
(6) Encourage design and construction practices that enhance the physical qualities of Hawaii's communities.	**X**		
(7) Encourage urban developments in close proximity to existing services and facilities.			**X**
(8) Foster recognition of the importance and value of the land, air, and water resources to Hawaii's people, their cultures and visitors.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as the project will protect and maintain water quality by reducing the sediment and other non-point source pollutants to downstream coastal waters. In addition, to minimize as much as possible the extraction of water from the groundwater system, the WE DO plan conceptualizes using best practices for water conservation throughout the Site, including landscaping that incorporates drought-tolerant native plants and other water-efficient landscape design techniques. Water conservation technology and design should be implemented in the development and construction of the community support training facilities such as rainwater catchment systems, non-potable water use, water-efficient fixtures and monitoring systems to track water use. The green space buffer abutting the gulches will provide ecosystem services by maintaining natural drainage to minimize erosion, facilitate flood control, and preserve natural habitat corridors for wildlife.			
HRS § 226-14: Objective and policies for facility systems – in general			
Objective: Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.			
Policies:			
(1) Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.			**X**

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(2) Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.			**X**
(3) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.			**X**
(4) Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction, and maintenance of facility systems.			**X**
Discussion: N/A			
HRS § 226-15: Objectives and policies for facility systems – solid and liquid wastes.			
Objectives: Planning for the State's facility systems with regard to solid and liquid wastes shall be directed towards the achievement of the following objectives:			
(1) Maintenance of basic public health and sanitation standards relating to treatment and disposal of solid and liquid wastes.	**X**		
(2) Provision of adequate sewerage facilities for physical and economic activities that alleviate problems in housing, employment, mobility, and other areas.	**X**		
Policies:			
(1) Encourage the adequate development of sewerage facilities that complement planned growth.	**X**		
(2) Promote re-use and recycling to reduce solid and liquid wastes and employ a conservation ethic.			**X**
(3) Promote research to develop more efficient and economical treatment and disposal of solid and liquid wastes.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as WE DO is considering developing a wastewater treatment package plant to serve the community support training facilities and will be designed with capacity to serve potential future growth on the Site if desired by the Waiohuli community.			
HRS § 226-16: Objectives and policies for facility systems – water.			
Objective: Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.			
Policies:			
(1) Coordinate development of land use activities with existing and potential water supply.	**X**		
(2) Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.	**X**		
(3) Reclaim and encourage the productive use of runoff water and wastewater discharges.			**X**
(4) Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.	**X**		
(5) Support water supply services to areas experiencing critical water problems.			**X**
(6) Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above , as the WE DO plan conceptualizes using best practices for water conservation throughout the Site, including landscaping that incorporates drought-tolerant native plants and other water efficient landscape design techniques to minimize as much as possible the extraction of water from the groundwater system. Water conservation technology and design will be implemented in the development and construction of the community support training facilities such as rainwater catchment systems, non-potable water use, water-efficient fixtures, and monitoring systems to track water use.			

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At a minimum, the proposed project will require the installation of IWS facilities to support the proposed community support training facilities and the potential for residential development on the Site in the future if desired by the Waiohuli community.			
HRS § 226-17: Objectives and policies for facility systems – transportation.			
Objective: Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:			
(1) An integrated multi-modal transportation system that services statewide needs and promotes the efficient, economical, safe, and convenient movement of people and goods.			**X**
(2) A statewide transportation system that is consistent with and will accommodate planned growth objectives throughout the State.			**X**
Policies:			
(1) Design, program, and develop a multi-modal system in conformance with desired growth and physical development as stated in this chapter;			**X**
(2) Coordinate state, county, federal, and private transportation activities and programs toward the achievement of statewide objectives;			**X**
(3) Encourage a reasonable distribution of financial responsibilities for transportation among participating governmental and private parties;			**X**
(4) Provide for improved accessibility to shipping, docking, and storage facilities;			**X**
(5) Promote a reasonable level and variety of mass transportation services that adequately meet statewide and community needs;			**X**
(6) Encourage transportation systems that serve to accommodate present and future development needs of communities;			**X**
(7) Encourage a variety of carriers to offer increased opportunities and advantages to interisland movement of people and goods;			**X**
(8) Increase the capacities of airport and harbor systems and support facilities to effectively accommodate transshipment and storage needs;			**X**
(9) Encourage the development of transportation systems and programs which would assist statewide economic growth and diversification;			**X**
(10) Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawaii's natural environment;			**X**
(11) Encourage safe and convenient use of low-cost, energy-efficient, non-polluting means of transportation;			**X**
(12) Coordinate intergovernmental land use and transportation planning activities to ensure the timely delivery of supporting transportation infrastructure in order to accommodate planned growth objectives; and			**X**
(13) Encourage diversification of transportation modes and infrastructure to promote alternate fuels and energy efficiency.			**X**
Discussion: N/A			
HRS § 226-18: Objectives and policies for facility systems – energy.			
Objectives: Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:			
(1) Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;	**X**		
(2) Increased energy security and self-sufficiency through the reduction and ultimate elimination of Hawaii's dependence on imported fuels for electrical generation and ground transportation;			**X**

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(3) Greater diversification of energy generation in the face of threats to Hawaii's energy supplies and systems;			**X**
(4) Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use; and			**X**
(5) Utility models that make the social and financial interests of Hawaii's utility customers a priority.			**X**
Policies:			
(1) Support research and development as well as promote the use of renewable energy sources;	**X**		
(2) Ensure that the combination of energy supplies and energy-saving systems is sufficient to support the demands of growth;			**X**
(3) Base decisions of least-cost supply-side and demand-side energy resource options on a comparison of their total costs and benefits when a least-cost is determined by a reasonably comprehensive, quantitative, and qualitative accounting of their long-term, direct and indirect economic, environmental, social, cultural, and public health costs and benefits;			**X**
(4) Promote all cost-effective conservation of power and fuel supplies through measures including:			**X**
(A) Development of cost-effective demand-side management programs;			**X**
(B) Education;			**X**
(C) Adoption of energy-efficient practices and technologies; and	**X**		
(D) Increasing energy efficiency and decreasing energy use in public infrastructure;	**X**		
(5) Ensure, to the extent that new supply-side resources are needed, that the development or expansion of energy systems utilizes the least-cost energy supply option and maximizes efficient technologies;			**X**
(6) Support research, development, demonstration, and use of energy efficiency, load management, and other demand-side management programs, practices, and technologies;			**X**
(7) Promote alternate fuels and transportation energy efficiency;			**X**
(8) Support actions that reduce, avoid, or sequester greenhouse gases in utility, transportation, and industrial sector applications;			**X**
(9) Support actions that reduce, avoid, or sequester Hawaii's greenhouse gas emissions through agriculture and forestry initiatives;	**X**		
(10) Provide priority handling and processing for all state and county permits required for renewable energy projects;			**X**
(11) Ensure that liquefied natural gas is used only as a cost-effective transitional, limited-term replacement of petroleum for electricity generation and does not impede the development and use of other cost-effective renewable energy sources; and			**X**
(12) Promote the development of indigenous geothermal energy resources that are located on public trust land as an affordable and reliable source of firm power for Hawaii.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above , as a large 26.4-acre segment of the Site is planned to be a renewable energy solar farm that could also support potential future growth on the Site and the neighboring communities.			

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HRS § 226-18.5: Objectives and policies for facility systems—telecommunications.			
Objective: Planning for the State's telecommunications facility systems shall be directed towards the achievement of dependable, efficient, and economical statewide telecommunications systems capable of supporting the needs of the people.			
Policies:			
(1) Facilitate research and development of telecommunications systems and resources;			**X**
(2) Encourage public and private sector efforts to develop means for adequate, ongoing telecommunications planning;			**X**
(3) Promote efficient management and use of existing telecommunications systems and services; and			**X**
(4) Facilitate the development of education and training of telecommunications personnel.			**X**
Discussion: N/A			
HRS § 226-19: Objectives and policies for socio-cultural advancement – housing.			
Objectives: Planning for the State's socio-cultural advancement with regard to housing shall be directed toward the achievement of the following objectives:			
(1) Greater opportunities for Hawaii's people to secure reasonably priced, safe, sanitary, and livable homes, located in suitable environments that satisfactorily accommodate the needs and desires of families and individuals, through collaboration and cooperation between government and nonprofit and for-profit developers to ensure that more affordable housing is made available to very low-, low- and moderate-income segments of Hawaii's population.			**X**
(2) The orderly development of residential areas sensitive to community needs and other land uses.	**X**		
(3) The development and provision of affordable rental housing by the State to meet the housing needs of Hawaii's people.			**X**
Policies:			
(1) Effectively accommodate the housing needs of Hawaii's people.			**X**
(2) Stimulate and promote feasible approaches that increase housing choices for low-income, moderate-income, and gap-group households.			**X**
(3) Increase homeownership and rental opportunities and choices in terms of quality, location, cost, densities, style, and size of housing.			**X**
(4) Promote appropriate improvement, rehabilitation, and maintenance of existing housing units and residential areas.			**X**
(5) Promote design and location of housing developments taking into account the physical setting, accessibility to public facilities and services, and other concerns of existing communities and surrounding areas.			**X**
(6) Facilitate the use of available vacant, developable, and underutilized urban lands for housing.			**X**
(7) Foster a variety of lifestyles traditional to Hawaii through the design and maintenance of neighborhoods that reflect the culture and values of the community.	**X**		
(8) Promote research and development of methods to reduce the cost of housing construction in Hawaii.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the community support training facilities will foster lifestyles traditional to Hawai'i and will reflect the cultural values of the community. If desired by the Waiohuli community there is potential for residential development.			

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HRS § 226-20: Objectives and policies for socio-cultural advancement – health			
Objectives: Planning for the State's socio-cultural advancement with regard to health shall be directed towards achievement of the following objectives:			
(1) Fulfillment of basic individual health needs of the general public.	**X**		
(2) Maintenance of sanitary and environmentally healthful conditions in Hawaii's communities.	**X**		
Policies:			
(1) Provide adequate and accessible services and facilities for prevention and treatment of physical and mental health problems, including substance abuse.			**X**
(2) Encourage improved cooperation among public and private sectors in the provision of health care to accommodate the total health needs of individuals throughout the State.			**X**
(3) Encourage public and private efforts to develop and promote statewide and local strategies to reduce health care and related insurance costs.			**X**
(4) Foster an awareness of the need for personal health maintenance and preventive health care through education and other measures.			**X**
(5) Provide programs, services, and activities that ensure environmentally healthful and sanitary conditions.			**X**
(6) Improve the State's capabilities in preventing contamination by pesticides and other potentially hazardous substances through increased coordination, education, monitoring, and enforcement.			**X**
(7) Prioritize programs, services, interventions, and activities that address identified social determinants of health to improve native Hawaiian health and well-being consistent with the United States Congress' declaration of policy as codified in title 42 United States Code section 11702, and to reduce health disparities of disproportionately affected demographics, including native Hawaiians, other Pacific Islanders, and Filipinos. The prioritization of affected demographic groups other than native Hawaiians may be reviewed every ten years and revised based on the best available epidemiological and public health data.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the community support training facilities has the potential to expand into a community-based health center that features kūpuna services along with both traditional Hawaiian healing practices and western medical services.			
HRS § 226-21: Objectives and policies for socio-cultural advancement – education.			
Objectives: Planning for the State's socio-cultural advancement with regard to education shall be directed towards achievement of the objective of the provision of a variety of educational opportunities to enable individuals to fulfill their needs, responsibilities, and aspirations.			
Policies:			
(1) Support educational programs and activities that enhance personal development, physical fitness, recreation, and cultural pursuits of all groups.	**X**		
(2) Ensure the provision of adequate and accessible educational services and facilities that are designed to meet individual and community needs.	**X**		
(3) Provide appropriate educational opportunities for groups with special needs.			**X**
(4) Promote educational programs which enhance understanding of Hawaii's cultural heritage.	**X**		
(5) Provide higher educational opportunities that enable Hawaii's people to adapt to changing employment demands.	**X**		
(6) Assist individuals, especially those experiencing critical employment problems or barriers, or undergoing employment transitions, by providing appropriate employment training programs and other related educational opportunities.	**X**		

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(7) Promote programs and activities that facilitate the acquisition of basic skills, such as reading, writing, computing, listening, speaking, and reasoning.	**X**		
(8) Emphasize quality educational programs in Hawaii's institutions to promote academic excellence.	**X**		
(9) Support research programs and activities that enhance the education programs of the State.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the community support training facilities and concepts will be developed to align with the desired needs of the community and will be invaluable for the Waiohuli region, given the remoteness of the community. In addition, the training facilities will create community-based job opportunities derived from development of infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for the Waiohuli community.			
HRS § 226-22: Objective and policies for socio-cultural advancement – social services			
Objective: Planning for the State's socio-cultural advancement with regard to social services shall be directed towards the achievement of the objective of improved public and private social services and activities that enable individuals, families, and groups to become more self-reliant and confident to improve their well-being.			
Policies:			
(1) Assist individuals, especially those in need of attaining a minimally adequate standard of living and those confronted by social and economic hardship conditions, through social services and activities within the State's fiscal capacities.	**X**		
(2) Promote coordination and integrative approaches among public and private agencies and programs to jointly address social problems that will enable individuals, families, and groups to deal effectively with social problems and to enhance their participation in society.			**X**
(3) Facilitate the adjustment of new residents, especially recently arrived immigrants, into Hawaii's communities.			**X**
(4) Promote alternatives to institutional care in the provision of long-term care for elder and disabled populations.	**X**		
(5) Support public and private efforts to prevent domestic abuse and child molestation, and assist victims of abuse and neglect.			**X**
(6) Promote programs which assist people in need of family planning services to enable them to meet their needs.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the community support training facilities has the potential to expand into a community-based health center that features kūpuna services, social services, along with wellness and medical services.			
HRS § 226-23: Objectives and policies for socio-cultural advancement – leisure.			
Objective: Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.			
Policies:			
(1) Foster and preserve Hawaii's multi-cultural heritage through supportive cultural, artistic, recreational, and humanities-oriented programs and activities.	**X**		
(2) Provide a wide range of activities and facilities to fulfill the cultural, artistic, and recreational needs of all diverse and special groups effectively and efficiently.	**X**		
(3) Enhance the enjoyment of recreational experiences through safety and security measures, educational opportunities, and improved facility design and maintenance.	**X**		

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(4) Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.	**X**		
(5) Ensure opportunities for everyone to use and enjoy Hawaii's recreational resources.	**X**		
(6) Assure the availability of sufficient resources to provide for future cultural, artistic, and recreational needs.	**X**		
(7) Provide adequate and accessible physical fitness programs to promote the physical and mental well-being of Hawaii's people.			**X**
(8) Increase opportunities for appreciation and participation in the creative arts, including the literary, theatrical, visual, musical, folk, and traditional art forms.	**X**		
(9) Encourage the development of creative expression in the artistic disciplines to enable all segments of Hawaii's population to participate in the creative arts.	**X**		
(10) Assure adequate access to significant natural and cultural resources in public ownership.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as the potential uses of the site include recreational spaces, and space for Hawaiian cultural services.			
HRS § 226-24: Objective and policies for socio-cultural advancement – individual rights and personal well-being.			
Objective: Planning for the State's socio-cultural advancement with regard to individual rights and personal well-being shall be directed towards achievement of the objective of increased opportunities and protection of individual rights to enable individuals to fulfill their socio-economic needs and aspirations.			
Policies:			
(1) Provide effective services and activities that protect individuals from criminal acts and unfair practices and that alleviate the consequences of criminal acts in order to foster a safe and secure environment.			**X**
(2) Uphold and protect the national and state constitutional rights of every individual.			**X**
(3) Assure access to, and availability of, legal assistance, consumer protection, and other public services which strive to attain social justice.			**X**
(4) Ensure equal opportunities for individual participation in society.			**X**
Discussion: N/A			
HRS § 226-25: Objectives and policies for socio-cultural advancement – culture.			
Objective: Planning for the State's socio-cultural advancement with regard to culture shall be directed toward the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawaii's people.			
Policies:			
(1) Foster increased knowledge and understanding of Hawaii's ethnic and cultural heritages and the history of Hawaii.	**X**		
(2) Support activities and conditions that promote cultural values, customs, and arts that enrich the lifestyles of Hawaii's people and which are sensitive and responsive to family and community needs.	**X**		
(3) Encourage increased awareness of the effects of proposed public and private actions on the integrity and quality of cultural and community lifestyles in Hawaii.			**X**
(4) Encourage the essence of the aloha spirit in people's daily activities to promote harmonious relationships among Hawaii's people and visitors.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the community support training facilities will foster lifestyles traditional to Hawaii and will reflect the cultural values of the community.			
HRS § 226-26: Objectives and policies for socio-cultural advancement – public safety.			
Objectives: Planning for the State's socio-cultural advancement with regard to public safety shall be directed towards the achievement of the following objectives:			

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(1) Assurance of public safety and adequate protection of life and property for all people.	**X**		
(2) Optimum organizational readiness and capability in all phases of emergency management to maintain the strength, resources, and social and economic well-being of the community in the event of civil disruptions, wars, natural disasters, and other major disturbances.	**X**		
(3) Promotion of a sense of community responsibility for the welfare and safety of Hawaii's people.	**X**		
Policies related to public safety:			
(1) Ensure that public safety programs are effective and responsive to community needs.	**X**		
(2) Encourage increased community awareness and participation in public safety programs.			**X**
Policies related to criminal justice:			
(1) Support criminal justice programs aimed at preventing and curtailing criminal activities.			**X**
(2) Develop a coordinated, systematic approach to criminal justice administration among all criminal justice agencies.			**X**
(3) Provide a range of correctional resources which may include facilities and alternatives to traditional incarceration in order to address the varied security needs of the community and successfully reintegrate offenders into the community.			**X**
Policies related to emergency management:			
(1) Ensure that responsible organizations are in a proper state of readiness to respond to major war-related, natural, or technological disasters and civil disturbances at all times.	**X**		
(2) Enhance the coordination between emergency management programs throughout the State.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the proposed development incorporates measures to enhance public safety.			
HRS § 226-27: Objectives and policies for socio-cultural advancement – government.			
Objectives: Planning the State's socio-cultural advancement with regard to government shall be directed towards the achievement of the following objectives:			
(1) Efficient, effective, and responsive government services at all levels in the State.			**X**
(2) Fiscal integrity, responsibility, and efficiency in the state government and county governments.			**X**
Policies:			
(1) Provide for necessary public goods and services not assumed by the private sector.			**X**
(2) Pursue an openness and responsiveness in government that permits the flow of public information, interaction, and response.			**X**
(3) Minimize the size of government to that necessary to be effective.			**X**
(4) Stimulate the responsibility in citizens to productively participate in government for a better Hawaii.			**X**
(5) Assure that government attitudes, actions, and services are sensitive to community needs and concerns.			**X**
(6) Provide for a balanced fiscal budget.			**X**
(7) Improve the fiscal budgeting and management system of the State.			**X**

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(8) Promote the consolidation of state and county governmental functions to increase the effective and efficient delivery of government programs and services and to eliminate duplicative services wherever feasible.			**X**
Discussion: N/A			
HAWAII STATE PLAN, CHAPTER 226, HRS – PART III. PRIORITY GUIDELINES	**S**	**N/S**	**N/A**
HRS § 226-101: Purpose. The purpose of this part is to establish overall priority guidelines to address areas of statewide concern.			
HRS § 226-102: Overall direction. The State shall strive to improve the quality of life for Hawaii's present and future present and future population through the pursuit of desirable courses of action in five major areas of statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice, and quality education.			
HRS § 226-103: Economic priority guidelines.			
(a) Priority guidelines to stimulate economic growth and encourage business expansion and development to provide needed jobs for Hawaii's people and achieve a stable and diversified economy:			
(1) Seek a variety of means to increase the availability of investment capital for new and expanding enterprises.	**X**		
(A) Encourage investments which:	**X**		
(i) Reflect long term commitments to the State;	**X**		
(ii) Rely on economic linkages within the local economy;	**X**		
(iii) Diversify the economy;	**X**		
(iv) Reinvest in the local economy;	**X**		
(v) Are sensitive to community needs and priorities; and	**X**		
(vi) Demonstrate a commitment to provide management opportunities to Hawaii residents.	**X**		
(B) Encourage investments in innovative activities that have a nexus to the State, such as:	**X**		
(i) Present or former residents acting as entrepreneurs or principals;			**X**
(ii) Academic support from an institution of higher education in Hawaii;			**X**
(iii) Investment interest from Hawaii residents;			**X**
(iv) Resources unique to Hawaii that are required for innovative activity; and			**X**
(v) Complementary or supportive industries or government programs or projects.	**X**		
(2) Encourage the expansion of technological research to assist industry development and support the development and commercialization of technological advancements.			**X**
(3) Improve the quality, accessibility, and range of services provided by government to business, including data and reference services and assistance in complying with governmental regulations.			**X**
(4) Seek to ensure that state business tax and labor laws and administrative policies are equitable, rational, and predictable.			**X**
(5) Streamline the building and development permit and review process, and eliminate or consolidate other burdensome or duplicative governmental requirements imposed on business, where public health, safety and welfare would not be adversely affected.			**X**

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(6) Encourage the formation of cooperatives and other favorable marketing or distribution arrangements at the regional or local level to assist Hawaii's small-scale producers, manufacturers, and distributors.			**X**
(7) Continue to seek legislation to protect Hawaii from transportation interruptions between Hawaii and the continental United States.			**X**
(8) Provide public incentives and encourage private initiative to develop and attract industries which promise long-term growth potentials and which have the following characteristics:	**X**		
(A) An industry that can take advantage of Hawaii's unique location and available physical and human resources.	**X**		
(B) A clean industry that would have minimal adverse effects on Hawaii's environment.	**X**		
(C) An industry that is willing to hire and train Hawaii's people to meet the industry's labor needs at all levels of employment.	**X**		
(D) An industry that would provide reasonable income and steady employment.	**X**		
(9) Support and encourage, through educational and technical assistance programs and other means, expanded opportunities for employee ownership and participation in Hawaii business.			**X**
(10) Enhance the quality of Hawaii's labor force and develop and maintain career opportunities for Hawaii's people through the following actions:	**X**		
(A) Expand vocational training in diversified agriculture, aquaculture, information industry, and other areas where growth is desired and feasible.	**X**		
(B) Encourage more effective career counseling and guidance in high schools and post-secondary institutions to inform students of present and future career opportunities.			**X**
(C) Allocate educational resources to career areas where high employment is expected and where growth of new industries is desired.			**X**
(D) Promote career opportunities in all industries for Hawaii's people by encouraging firms doing business in the State to hire residents.	**X**		
(E) Promote greater public and private sector cooperation in determining industrial training needs and in developing relevant curricula and on- the-job training opportunities.	**X**		
(F) Provide retraining programs and other support services to assist entry of displaced workers into alternative employment.	**X**		
(b) Priority guidelines to promote the economic health and quality of the visitor industry:			
(1) Promote visitor satisfaction by fostering an environment which enhances the Aloha Spirit and minimizes inconveniences to Hawaii's residents and visitors.			**X**
(2) Encourage the development and maintenance of well-designed, adequately serviced hotels and resort destination areas which are sensitive to neighboring communities and activities and which provide for adequate shoreline setbacks and beach access.			**X**
(3) Support appropriate capital improvements to enhance the quality of existing resort destination areas and provide incentives to encourage investment in upgrading, repair, and maintenance of visitor facilities.			**X**

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(4) Encourage visitor industry practices and activities which respect, preserve, and enhance Hawaii's significant natural, scenic, historic, and cultural resources.			**X**
(5) Develop and maintain career opportunities in the visitor industry for Hawaii's people, with emphasis on managerial positions.			**X**
(6) Support and coordinate tourism promotion abroad to enhance Hawaii's share of existing and potential visitor markets.			**X**
(7) Maintain and encourage a more favorable resort investment climate consistent with the objectives of this chapter.			**X**
(8) Support law enforcement activities that provide a safer environment for both visitors and residents alike.			**X**
(9) Coordinate visitor industry activities and promotions to business visitors through the state network of advanced data communication techniques.			**X**
(c) Priority guidelines to promote the continued viability of the sugar and pineapple industries:			
(1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.			**X**
(2) Continue efforts to maintain federal support to provide stable sugar prices high enough to allow profitable operations in Hawaii.			**X**
(3) Support research and development, as appropriate, to improve the quality and production of sugar and pineapple crops.			**X**
(d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:			
(1) Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.	**X**		
(2) Assist in providing adequate, reasonably priced water for agricultural activities.			**X**
(3) Encourage public and private investment to increase water supply and to improve transmission, storage, and irrigation facilities in support of diversified agriculture and aquaculture.			**X**
(4) Assist in the formation and operation of production and marketing associations and cooperatives to reduce production and marketing costs.			**X**
(5) Encourage and assist with the development of a waterborne and airborne freight and cargo system capable of meeting the needs of Hawaii's agricultural community.			**X**
(6) Seek favorable freight rates for Hawaii's agricultural products from interisland and overseas transportation operators.			**X**
(7) Encourage the development and expansion of agricultural and aquacultural activities which offer long-term economic growth potential and employment opportunities.	**X**		
(8) Continue the development of agricultural parks and other programs to assist small independent farmers in securing agricultural lands and loans.			**X**
(9) Require agricultural uses in agricultural subdivisions and closely monitor the uses in these subdivisions.			**X**
(10) Support the continuation of land currently in use for diversified agriculture.	**X**		
(11) Encourage residents and visitors to support Hawaii's farmers by purchasing locally grown food and food products.	**X**		
(e) Priority guidelines for water use and development:			

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(1) Maintain and improve water conservation programs to reduce the overall water consumption rate.			**X**
(2) Encourage the improvement of irrigation technology and promote the use of nonpotable water for agricultural and landscaping purposes.			**X**
(3) Increase the support for research and development of economically feasible alternative water sources.			**X**
(4) Explore alternative funding sources and approaches to support future water development programs and water system improvements.			**X**
(f) Priority guidelines for energy use and development:			
(a) Encourage the development, demonstration, and commercialization of renewable energy sources.	**X**		
(b) Initiate, maintain, and improve energy conservation programs aimed at reducing energy waste and increasing public awareness of the need to conserve energy.	**X**		
(c) Provide incentives to encourage the use of energy conserving technology in residential, industrial, and other buildings.			**X**
(d) Encourage the development and use of energy conserving and cost-efficient transportation systems.			**X**
(g) Priority guidelines to promote the development of the information industry:			
(1) Establish an information network that will serve as the catalyst for establishing a viable information industry in Hawaii.			**X**
(2) Encourage the development of services such as financial data processing, a products and services exchange, foreign language translations, telemarketing, teleconferencing, a twenty-four-hour international stock exchange, international banking, and a Pacific Rim management center.			**X**
(3) Encourage the development of small businesses in the information field such as software development, the development of new information systems and peripherals, data conversion and data entry services, and home or cottage services such as computer programming, secretarial, and accounting services.			**X**
(4) Encourage the development or expansion of educational and training opportunities for residents in the information and telecommunications fields.			**X**
(5) Encourage research activities, including legal research in the information and telecommunications fields.			**X**
(6) Support promotional activities to market Hawaii's information industry services.			**X**
(7) Encourage the location or co-location of telecommunication or wireless information relay facilities in the community, including public areas, where scientific evidence indicates that the public health safety, and welfare would not be adversely affected.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the vision for WE DO is to provide community-based job opportunities derived from development of infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for the Waiohuli community.			

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
HRS § 226-104: Population growth and land resources priority guidelines.			
(a) Priority guidelines to effect desired statewide growth and distribution:			
(1) Encourage planning and resource management to ensure that population growth rates throughout the State are consistent with available and planned resource capacities and reflect the needs and desires of Hawaii's people.			**X**
(2) Manage a growth rate for Hawaii's economy that will parallel future employment needs for Hawaii's people.			**X**
(3) Ensure that adequate support services and facilities are provided to accommodate the desired distribution of future growth throughout the State.	**X**		
(4) Encourage major state and federal investments and services to promote economic development and private investment to the neighbor islands, as appropriate.			**X**
(5) Explore the possibility of making available urban land, low-interest loans, and housing subsidies to encourage the provision of housing to support selective economic and population growth on the neighbor islands.			**X**
(6) Seek federal funds and other funding sources outside the State for research, program development, and training to provide future employment opportunities on the neighbor islands.			**X**
(7) Support the development of high technology parks on the neighbor islands.			**X**
(b) Priority guidelines for regional growth distribution and land resource utilization:			
(1) Encourage urban growth primarily to existing urban areas where adequate public facilities are already available or can be provided with reasonable public expenditures, and away from areas where other important benefits are present, such as protection of important agricultural land or preservation of lifestyles.	**X**		
(2) Make available marginal or nonessential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.			**X**
(3) Restrict development when drafting of water would result in exceeding the sustainable yield or in significantly diminishing the recharge capacity of any groundwater area.			**X**
(4) Encourage restriction of new urban development in areas where water is insufficient from any source for both agricultural and domestic use.			**X**
(5) In order to preserve green belts, give priority to state capital-improvement funds which encourage location of urban development within existing urban areas except where compelling public interest dictates development of a noncontiguous new urban core.			**X**
(6) Seek participation from the private sector for the cost of building infrastructure and utilities, and maintaining open spaces.			**X**
(7) Pursue rehabilitation of appropriate urban areas.			**X**
(8) Support the redevelopment of Kakaako into a viable residential, industrial, and commercial community.			**X**
(9) Direct future urban development away from critical environmental areas or impose mitigating measures so that negative impacts on the environment would be minimized.			**X**
(10) Identify critical environmental areas in Hawaii to include but not be limited to the following: watershed and recharge areas; wildlife habitats (on land and in the ocean); areas with endangered species of plants and wildlife; natural streams and water bodies; scenic and recreational shoreline resources; open			**X**

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
space and natural areas; historic and cultural sites; areas particularly sensitive to reduction in water and air quality; and scenic resources.			
(11) Identify all areas where priority should be given to preserving rural character and lifestyle.			**X**
(12) Utilize Hawaii's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands, and other limited resources for future generations.	**X**		
(13) Protect and enhance Hawaii's shoreline, open spaces, and scenic resources.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the WE DO project will support economic growth needs by providing space for economic opportunities and job training. The site has the potential for residential development on the Site in the future if desired by the Waiohuli community.			
HRS § 226-105: Crime and criminal justice.			
Priority guidelines in the area of crime and criminal justice:			
(1) Support law enforcement activities and other criminal justice efforts that are directed to provide a safer environment.			**X**
(2) Target state and local resources on efforts to reduce the incidence of violent crime and on programs relating to the apprehension and prosecution of repeat offenders.			**X**
(3) Support community and neighborhood program initiatives that enable residents to assist law enforcement agencies in preventing criminal activities.			**X**
(4) Reduce overcrowding or substandard conditions in correctional facilities through a comprehensive approach among all criminal justice agencies which may include sentencing law revisions and use of alternative sanctions other than incarceration for persons who pose no danger to their community.			**X**
(5) Provide a range of appropriate sanctions for juvenile offenders, including community-based programs and other alternative sanctions.			**X**
(6) Increase public and private efforts to assist witnesses and victims of crimes and to minimize the costs of victimization.			**X**
Discussion: N/A			
HRS § 226-106: Affordable housing.			
Priority guidelines for the provision of affordable housing:			
(1) Seek to use marginal or nonessential agricultural land and public land to meet housing needs of low- and moderate-income and gap-group households.			**X**
(2) Encourage the use of alternative construction and development methods as a means of reducing production costs.			**X**
(3) Improve information and analysis relative to land availability and suitability for housing.			**X**
(4) Create incentives for development which would increase home ownership and rental opportunities for Hawaii's low- and moderate-income households, gap-group households, and residents with special needs.			**X**
(5) Encourage continued support for government or private housing programs that provide low interest mortgages to Hawaii's people for the purchase of initial owner-occupied housing.			**X**
(6) Encourage public and private sector cooperation in the development of rental housing alternatives.			**X**
(7) Encourage improved coordination between various agencies and levels of government to deal with housing policies and regulations.			**X**

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(8) Give higher priority to the provision of quality housing that is affordable for Hawaii's residents and less priority to development of housing intended primarily for individuals outside of Hawaii.			**X**
Discussion: N/A			
HRS § 226-107: Quality education.			
Priority guidelines to promote quality education:			
(1) Pursue effective programs which reflect the varied district, school, and student needs to strengthen basic skills achievement;			**X**
(2) Continue emphasis on general education "core" requirements to provide common background to students and essential support to other university programs;			**X**
(3) Initiate efforts to improve the quality of education by improving the capabilities of the education work force;			**X**
(4) Promote increased opportunities for greater autonomy and flexibility of educational institutions in their decision-making responsibilities;			**X**
(5) Increase and improve the use of information technology in education by the availability of telecommunications equipment for:			**X**
(A) The electronic exchange of information;			**X**
(B) Statewide electronic mail; and			**X**
(C) Access to the Internet.			**X**
Encourage programs that increase the public's awareness and understanding of the impact of information technologies on our lives;			**X**
(6) Pursue the establishment of Hawaii's public and private universities and colleges as research and training centers of the Pacific;			**X**
(7) Develop resources and programs for early childhood education;			**X**
(8) Explore alternatives for funding and delivery of educational services to improve the overall quality of education; and			**X**
(9) Strengthen and expand educational programs and services for students with special needs.			**X**
Discussion: N/A			
HRS § 226-108: Sustainability.			
Priority guidelines and principles to promote sustainability shall include:			
(1) Encouraging balanced economic, social, community, and environmental priorities;	**X**		
(2) Encouraging planning that respects and promotes living within the natural resources and limits of the State;	**X**		
(3) Promoting a diversified and dynamic economy;	**X**		
(4) Encouraging respect for the host culture;	**X**		
(5) Promoting decisions based on meeting the needs of the present without compromising the needs of future generations;	**X**		
(6) Considering the principles of the ahupuaa system; and	**X**		
(7) Emphasizing that everyone, including individuals, families, communities, businesses, and government, has the responsibility for achieving a sustainable Hawaii.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as the WE DO project focuses on creating economic and environmental sustainability for the Waiohuli community.			
HRS § 226-109: Climate change adaptation priority guidelines.			
Priority guidelines to prepare the State to address the impacts of climate change, including impacts to the areas of agriculture; conservation lands; coastal and nearshore marine areas; natural and cultural resources; education; energy; higher education; health; historic preservation; water resources; the built environment, such as housing, recreation, transportation; and the economy shall:			

HAWAII STATE PLAN, CHAPTER 226, HRS – PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(1) Ensure that Hawaii's people are educated, informed, and aware of the impacts climate change may have on their communities;			**X**
(2) Encourage community stewardship groups and local stakeholders to participate in planning and implementation of climate change policies;			**X**
(3) Invest in continued monitoring and research of Hawaii's climate and the impacts of climate change on the State;			**X**
(4) Consider native Hawaiian traditional knowledge and practices in planning for the impacts of climate change;	**X**		
(5) Encourage the preservation and restoration of natural landscape features, such as coral reefs, beaches and dunes, forests, streams, floodplains, and wetlands, that have the inherent capacity to avoid, minimize, or mitigate the impacts of climate change;	**X**		
(6) Explore adaptation strategies that moderate harm or exploit beneficial opportunities in response to actual or expected climate change impacts to the natural and built environments;	**X**		
(7) Promote sector resilience in areas such as water, roads, airports, and public health, by encouraging the identification of climate change threats, assessment of potential consequences, and evaluation of adaptation options;	**X**		
(8) Foster cross-jurisdictional collaboration between county, state, and federal agencies and partnerships between government and private entities and other nongovernmental entities, including nonprofit entities;			**X**
(9) Use management and implementation approaches that encourage the continual collection, evaluation, and integration of new information and strategies into new and existing practices, policies, and plans; and			**X**
(10) Encourage planning and management of the natural and built environments that effectively integrate climate change policy.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as the WE DO project aims to preserve the natural environment and sustainability.			

5.1.8 Hawai'i State Environmental Policy, Chapter 344, HRS

The State Environmental Policy provides guidelines for agencies to create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawai'i. The environmental Guidelines (HRS §344-4) suggest that insofar as practical, the development of programs consider: population; land, water, mineral, visual, air, and other natural resources; flora and fauna; parks, recreation, and open space; economic development; transportation; energy; community life and housing; education and culture; and, citizen participation. The Project's consistency with the State Environmental Policy is outlined in the table below:

Table 5-3: Hawai'i State Environmental Policy and Guidelines, Chapter 344-3 and 344-4, HRS

State Environmental Policy, Chapter 344, Hawaii Revised Statutes (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	S	N/S	N/A
STATE ENVIRONMENTAL POLICY			
§344-3 Environmental policy. It shall be the policy of the State, through its programs, authorities, and resources to:			
(1) Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawaii.			**X**
(2) Enhance the quality of life by:			
(A) Setting population limits so that the interaction between the natural and artificial environments and the population is mutually beneficial;			**X**
(B) Creating opportunities for the residents of Hawaii to improve their quality of life through diverse economic activities which are stable and in balance with the physical and social environments;			**X**
(C) Establishing communities which provide a sense of identity, wise use of land, efficient transportation, and aesthetic and social satisfaction in harmony with the natural environment which is uniquely Hawaiian; and	**X**		
(D) Establishing a commitment on the part of each person to protect and enhance Hawaii's environment and reduce the drain on nonrenewable resources.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as it has been designed to preserve natural resources in the area, including buffer areas along the existing gulches and drainageways surrounding the Site. The Project includes proposed renewable energy sources to help reduce the drain on nonrenewable resources.			
GUIDELINES			
§344-4 Guidelines. In pursuance of the state policy to conserve the natural resources and enhance the quality of life, all agencies, in the development of programs, shall, insofar as practicable, consider the following guidelines:			
(1) Population.			
(A) Recognize population impact as a major factor in environmental degradation and adopt guidelines to alleviate this impact and minimize future degradation;	**X**		
(B) Recognize optimum population levels for counties and districts within the State, keeping in mind that these will change with technology and circumstance, and adopt guidelines to limit population to the levels determined.			**X**
Discussion: The Project has been designed to mitigate environmental degradation by preserving natural drainageways and the inclusion on natural buffer areas.			
(2) Land, water, mineral, visual, air, and other natural resources.			
(A) Encourage management practices which conserve and fully utilize all natural resources;	**X**		
(B) Promote irrigation and waste water management practices which conserve and fully utilize vital water resources;			**X**
(C) Promote the recycling of waste water;			**X**
(D) Encourage management practices which conserve and protect watersheds and water sources, forest, and open space areas;	**X**		

State Environmental Policy, Chapter 344, Hawaii Revised Statutes (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(E) Establish and maintain natural area preserves, wildlife preserves, forest reserves, marine preserves, and unique ecological preserves;	**X**		
(F) Maintain an integrated system of state land use planning which coordinates the state and county general plans;			**X**
(G) Promote the optimal use of solid wastes through programs of waste prevention, energy resource recovery, and recycling so that all our wastes become utilized.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as it is anticipated to include water conservation measures in the design, including landscaping that incorporate drought-tolerant native plants and other water efficient landscape design techniques. The Project also includes protection of the watersheds and natural drainageways by maintaining natural buffer areas and the anticipated preservation of the wiliwili forest identified through consultation with the biological consultant.			
(3) Flora and fauna.			
(A) Protect endangered species of indigenous plants and animals and introduce new plants or animals only upon assurance of negligible ecological hazard; and	**X**		
(B) Foster the planting of native as well as other trees, shrubs, and flowering plants compatible to the enhancement of our environment.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as it includes an anticipated preserve for the wiliwili forest identified through consultation with the biological consultant. The anticipated landscaping throughout the Site will incorporate drought-tolerant native plants.			
(4) Parks, recreation, and open space.			
(A) Establish, preserve and maintain scenic, historic, cultural, park and recreation areas, including the shorelines, for public recreational, educational, and scientific uses;	**X**		
(B) Protect the shorelines of the State from encroachment of artificial improvements, structures, and activities; and			**X**
(C) Promote open space in view of its natural beauty not only as a natural resource but as an ennobling, living environment for its people.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as it includes recreational spaces with walking paths and green space along the natural buffer area surrounding the Site. The proposed greenway trails will also connect to the proposed trailhead at the western end of the Site where a small one-acre park is proposed.			
(5) Economic development.			
(A) Encourage industries in Hawaii which would be in harmony with our environment;	**X**		
(B) Promote and foster the agricultural industry of the State; and preserve and conserve productive agricultural lands;	**X**		
(C) Encourage federal activities in Hawaii to protect the environment;			**X**
(D) Encourage all industries including the fishing, aquaculture, oceanography, recreation, and forest products industries to protect the environment;			**X**
(E) Establish visitor destination areas with planning controls which shall include but not be limited to the number of rooms;			**X**
(F) Promote and foster the aquaculture industry of the State; and preserve and conserve productive aquacultural lands.			**X**
Discussion: The proposed project is supportive of the State's goals as stated above, as it includes community-based economic opportunities for agricultural cultivation rooted in indigenous knowledge and traditional Hawaiian farming and renewable energy that promotes long-term economic sustainability.			

State Environmental Policy, Chapter 344, Hawaii Revised Statutes (Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
(6) Transportation.			
(A) Encourage transportation systems in harmony with the lifestyle of the people and environment of the State;			**X**
(B) Adopt guidelines to alleviate environmental degradation caused by motor vehicles;			**X**
(C) Encourage public and private vehicles and transportation systems to conserve energy, reduce pollution emission, including noise, and provide safe and convenient accommodations for their users.			**X**
Discussion: N/A			
(7) Energy.			
(A) Encourage the efficient use of energy resources.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as it includes renewable energy that promotes localized sustainability.			
(8) Community life and housing.			
(A) Foster lifestyles compatible with the environment; preserve the variety of lifestyles traditional to Hawaii through the design and maintenance of neighborhoods which reflect the culture and mores of the community;	**X**		
(B) Develop communities which provide a sense of identity and social satisfaction in harmony with the environment and provide internal opportunities for shopping, employment, education, and recreation;	**X**		
(C) Encourage the reduction of environmental pollution which may degrade a community;			**X**
(D) Foster safe, sanitary, and decent homes;			**X**
(E) Recognize community appearances as major economic and aesthetic assets of the counties and the State; encourage green belts, plantings, and landscape plans and designs in urban areas; and preserve and promote mountain-to-ocean vistas.	**X**		
Discussion: The proposed project is supportive of the State's goals as stated above, as it will promote a cohesive community compatible with the environment and surrounding area.			
(9) Education and culture.			
(A) Foster culture and the arts and promote their linkage to the enhancement of the environment;			**X**
(B) Encourage both formal and informal environmental education to all age groups.			**X**
Discussion: N/A			
(10) Citizen participation.			
(A) Encourage all individuals in the State to adopt a moral ethic to respect the natural environment; to reduce waste and excessive consumption; and to fulfill the responsibility as trustees of the environment for the present and succeeding generations; and			**X**
(B) Provide for expanding citizen participation in the decision making process so it continually embraces more citizens and more issues.			**X**
Discussion: N/A			

5.2 MAUI COUNTY

County-specific land use plans and ordinances pertaining to the Project include the General Plan and the zoning code. DHHL maintains land use authority over the lands they own and steward. These lands are subject to DHHL land use designations. The Maui County land use program is discussed here for reference.

5.2.1 Maui Island Plan

The County of Maui's of Maui Island Plan (MIP) is the policy document for the long-range comprehensive development of the Island of Maui that indicates urban and rural growth areas where development is intended and will be supported. Among the purposes of the MIP are to guide the pattern of development in County of Maui and the direction for future growth, the economy, and social and environmental decisions on the island through 2030. The MIP undergoes a comprehensive review periodically, with the last plan being completed and adopted in 2012.

5.2.2 Maui County Zoning

The County zoning code (MCC Chapter 19) regulates the type and intensity of uses in the State Land Use Agricultural District and can specify in more detail the permissible uses and intensity in the State Land Use Agricultural District consistent with the State Land Use law (Chapter 205, HRS). The Project Site is zoned Agriculture District (AG) (see Figure 7).

5.3 APPROVALS AND PERMITS

A listing of anticipated State and County permits and approvals required for the Proposed Project is presented below.

Table 5-4: Anticipated Approvals and Permits

Permit/Approval	Responsible Agency
Land Use Designation Updates	DHHL
Grading/Building Permits	County Department of Public Works
Chapter 6E, HRS Historic Preservation Review	State Historic Preservation Division
Chapter 195D, HRS	Department of Natural Resources Division of Forestry and Wildlife (DOFAW); Division of Aquatic Resources (DAR)
National Pollutant Discharge Elimination System (NPDES) Permit	State Department of Health
Noise Permit	State Department of Health
Noise Variance	State Department of Health

Permit/Approval	Responsible Agency
Land Use Designation Updates	DHHL
Disability and Communication Access Board (DCAB) Document Review (ADA Compliance)	State Department of Health
National Environmental Policy Act and related federal authorities such as Endangered Species Act and National Historic Preservation Act	Dependent upon a federal nexus such as a federal permit requirement or use of federal funds. The appropriate lead federal agency will depend on permitting agency or funding source.

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6 ALTERNATIVES

This section identifies and analyzes reasonable alternatives that could attain the objectives of the proposed action.

6.1 ALTERNATIVE #1: WE DO (PREFERRED ALTERNATIVE)

The preferred alternative is the development scenario that combines development and construction with community-based job opportunities derived from development of infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for the community in which it is located. The preferred alternative is described in section 2.3 and includes: community training facilities, infrastructure training and implementation sites, agricultural training sites, renewable energy training and implementation sites, opportunities for water resource development and distribution, and opportunities for community conservation have been described in detail throughout this Environmental Assessment. It has been selected because it will serve to not only provide housing for DHHL Beneficiaries but also provide economic development opportunities and capacity building to the community.

6.2 ALTERNATIVE #2: DHHL MAUI ISLAND PLAN LAND USES FOR PROJECT SITE

Two alternative development scenarios were presented in the 2004 MIP. Both alternatives included a mix of low density residential, community use areas, and subsistence and general agriculture, consistent with DHHL Land Use Designations at the time. The primary difference between the two alternatives in the MIP was the lot size for low-density residential housing set at either a one-half acre (MIP Alternative 1) or an acre (MIP Alternative 2). The larger lot sizes in MIP Alternative 2, expanded the residential development area and reduced the area available for agriculture.

The development scenarios put forth in the MIP have become outdated as DHHL has moved toward land uses that increase density with recent changes to Administrative Rules permitting rental and multifamily housing and aligning land uses identified in the 2022 General Plan Update. The two scenarios presented in the MIP do not advance the potential for long-term local economic development and capacity building that the preferred alternative does. It may be possible under a strictly residential development plan to hire local contractors with local employees to construct housing, but these jobs will move naturally to new locations as the Project Site is built out. A development scheme that does not involve some service or commercial activity and no business start up or training spaces will offer no long-term employment opportunities, no long-term mentoring opportunities, and no long-term opportunities for business incubation.

6.3 ALTERNATIVE #3: NO ACTION

This alternative involves making no land use changes to the Project Site. The purpose of this project to provide short- and long-term economic opportunities for the Waiohuli community to foster self-sufficiency and potential future use for community development would therefore be unmet.

7 FINDINGS AND ANTICIPATED DETERMINATION

To determine whether development of the Proposed Project could be expected to have a significant impact on the physical and human environment, all alternatives and expected consequences of the Proposed Project have been evaluated, including potential primary, secondary, short-range, long-range, and cumulative impacts. Based on this evaluation, the DHHL anticipates issuing a FONSI. The supporting rationale for this finding is presented in this chapter.

7.1 SIGNIFICANCE CRITERIA

Based upon the previous information presented in this document the proposed permitting and construction of the Project will likely have no significant environmental impacts. This determination is based upon the 13 Significance Criteria outlined in Chapter 343, HRS, as amended and Title 11 Chapter 200.1-13, HAR 1996, discussed below.

(1) Involves an irrevocable commitment of any natural, cultural, or historical resource;

Discussion: The project does not irrevocably commit any natural, cultural, or historic resources. A consultative process and evaluation of historic and cultural resources was conducted to evaluate potential impacts and is still ongoing to ensure the proposed design elements will preserve historic resources. Any potential adverse impacts to the lands and/or historic resources with the Project Site will be mitigated as appropriate through the HRS 6E-8 (Historic Preservation) process in continued consultation with SHPD.

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

Discussion: The proposed project does not significantly curtail beneficial uses of the environment. The proposed land uses have been designed to preserve natural drainageways within the existing gulches with green spaces to create a natural buffer along the boundary of the Project Site.

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

Discussion: Compliance with Chapter 344, HRS is documented at length in Chapter 5.1.8 of this document. The investment in infrastructure improvements is intended to support the Waiohuli community by creating economic opportunities and fostering self-sufficiency.

(4) Substantially affects the economic or social welfare or cultural practices of the community or State;

Discussion: The proposed project is directly supportive of the economy and social welfare. The main purpose and goals are to provide short- and long-term economic opportunities that will foster greater self-sufficiency for the people of upcountry Maui through capacity building and

facilitating homegrown jobs. By creating economic development and job training opportunities, the proposed project will make the community a more vibrant area for commerce, cultural practices, and recreational uses in the surrounding area.

(5) Substantially affects public health;

Discussion: Under the potential full buildout scenario, the proposed project would offer social services and health services within the Project Site for the local community that they would otherwise need to seek elsewhere. As a result, the Waiohuli community members will not need to travel to other parts of the island to seek these services.

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

Discussion: Secondary impacts are expected to be beneficial as the potential full buildout scenario will provide additional housing to serve the Native Hawaiian community. This will have a marginal impact on the population of Upcountry Maui.

(7) Involves a substantial degradation of environmental quality;

Discussion: Environmental quality will not be degraded by the project. Beneficial environmental impacts of the proposed land uses will be supported by the conceptual design by maintaining natural drainageways and preserving the natural environment. Impacts from construction are temporary and mitigatable with BMPs.

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

Discussion: Individually and cumulatively, this project is not expected to have a considerable impact on the environment as discussed throughout this document. The proposed land uses for the Project Site have been designed to preserve the natural drainageways along the gulches forming the boundary of the property. Secondary beneficial impacts under the potential full buildout scenario will be provided through the proposed solar farm. By developing renewable energy sources to serve the community, the project will contribute to broader goals of mitigating environmental impacts caused by fossil fuel-based energy generation.

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

Discussion: The Project Site does not contain habitat for threatened or endangered species. Recommended best practices for avoidance of impacts to avian species, the Blackburn's Sphinx Moth and the Hawaiian hoary bat will be incorporated into the project.

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

Discussion: Under the potential full buildout scenario, the project is expected to have secondary beneficial impacts to air quality by providing renewable energy sources to serve the community. There may be short-term direct and indirect impacts related to air quality that could potentially

occur during construction. However, these construction-related impacts will be minimized and confined to the immediate vicinity of the site and BMPs will be implemented to limit localized impacts.

The applicant will work with local developers and planners in the area to minimize potential impacts from groundwater development to ensure groundwater quality is not impacted and groundwater levels do not decline. All stormwater discharges related to construction and/or operation activities within the Site will comply with the Water Quality Standards, specified in Chapter 11-54, HAR and/or permitting requirements, specified in Chapter 11-55, HAR.

While the project is expected to generate moderate noise impacts typically associated with community uses under the potential full buildout scenario, these impacts are expected to be nominal and will be fairly consistent with land uses in the surrounding residential area and abutting community center. During construction, the proposed action may result in short-term noise impacts generated by construction activities. However, the project will mitigate these temporary impacts in compliance with all permissible community noise standards in accordance with the DOH Administrative Rules, Title 11, Chapter 46 "Community Noise Control" regulations.

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

Discussion: Due to the location of the Project Site far from any coastal areas, there are no potential direct impacts related to climate change, such as seal level rise and coastal erosion. In addition, there are no wetlands or flood plains on or near the Site. The project is in an area designated as minimal flood hazard with a less than 1 percent chance for a flood event and is not in a tsunami zone. The proposed project has included some sustainable design that takes into consideration the projected increase in flood frequency from extreme rain events by preserving natural drainageways along the gulches.

(12) Substantially affects scenic vistas and view planes, during day or night, identified in County or State plans or studies; or,

Discussion: The impact on scenic vistas and view planes after completion of the project are considered to be marginal. The Project Site comprises a gradual slope from east to west and the impact on visual planes from surrounding land uses will be minimal as most of the surrounding area is comprised of vacant land.

(13) Requires substantial energy consumption or emits substantial greenhouse gases.

Discussion: The proposed project includes development of renewable energy sources from a solar farm which will contribute toward County goals for reducing fossil fuel energy consumption and carbon production.

7.2 ANTICIPATED DETERMINATION

On the basis of impacts and mitigation measures examined in this document and analyzed under the above criteria, it is determined that the Project will not have a significant effect on the physical or human environments. DHHL anticipates a FONSI, pursuant to Chapter 343, HRS and Title 11, Chapter 200.1, HAR.

8 CONSULTATION

8.1 EARLY CONSULTATION

A pre-assessment consultation was conducted from December 2023 through August 2024 prior to preparation of the Draft EA. The purpose of the pre-assessment consultation was to consult with agencies, organizations and individuals with technical expertise, or an interest that might be affected by the proposed Project.

The following agencies, organizations, and individuals were sent pre-assessment consultation letters. Those that provided written comments (either by hardcopy or email) are highlighted in **bold *italics***. Copies of the written comments and responses are reproduced in Appendix H.

8.1.1 State of Hawai'i

- Department of Agriculture
- ***Department of Accounting and General Services***
- Department of Business, Economic Development & Tourism
- DBEDT - Hawai'i State Energy Office/Strategic Industries Division
- ***DBEDT - Land Use Commission***
- ***DBEDT - Office of Planning & Sustainable Development***
- ***Department of Defense - Engineering Office***
- ***Department of Education***
- Department of Health
- Department of Health, Environmental Health Administration
- ***Department of Health - Clean Air Branch***
- Department of Health - Clean Water Branch
- Department of Health - Environmental Management Division
- Department of Health - Wastewater Branch
- Department of Health - Safe Drinking Water Branch
- ***Department of Health - Solid & Hazardous Waste Branch***
- Department of Health - Hazard Evaluation & Emergency Response Office
- Department of Health - Environmental Health Services Division
- Department of Health - Indoor and Radiological Health Branch
- Department of Health - Sanitation Branch
- ***Department of Health - Maui District Health Program Office***
- Department of Health Public Health Nursing
- ***Department of Human Services***
- Department of Labor and Industrial Relations
- Department of Land and Natural Resources
- DLNR - State Historic Preservation Division
- DLNR - Land Division
- DLNR Commission on Water Resource Management

- DLNR Division of Aquatic Resources
- DLNR Division of Boating & Ocean Recreation
- ***DLNR DOFAW***
- DLNR DOFAW Na Ala Hele
- ***DLNR Engineering Division***
- DLNR Office of Conservation & Coastal Lands
- ***Department of Public Safety***
- ***Department of Transportation***
- Department of Transportation, Airports Division - Engineering Branch
- Department of Transportation - Harbors
- Department of Transportation - Highways
- Department of Transportation, Highways Division, Planning Branch
- Department of Transportation, Statewide Transportation Planning Office
- Department of Transportation – Airports, Maui District
- Department of Transportation - Highways, Maui District
- Hawai‘i Housing Finance and Development Corporation
- Hawai‘i Public Housing Authority
- Hawai‘i Tourism Authority
- Hawai‘i State Judiciary
- Office of Hawaiian Affairs

8.1.2 Maui County

- Department of Environmental Management
- ***Department of Housing and Human Concerns***
- Department of Management
- ***Department of Parks and Recreation***
- Department of Planning
- Department of Public Works
- Department of Transportation
- ***Department of Water Supply***
- Maui Planning Commission
- ***Fire Department***
- ***Police Department***
- Maui Metropolitan Planning Organization
- Maui Redevelopment Agency

8.1.3 Elected Officials

- Mayor Richard Bissen
- State Senator Lynn DeCoite
- State Representative Kyle Yamashita
- Council Member Yuki Lei Sugimura

8.1.4 Community Groups and Neighboring Properties

- Aha Moku o Maui Inc.
- Council for Native Hawaiian Advancement
- Hawai‘i Wildfire Management Organization
- Kamehameha Schools Maui Campus
- Ka ‘Ohana O Kahikinui Inc.
- Kēōkea Homestead Farms Lots Association
- Maui Cultural Lands, Inc.
- Maui Historical Society
- Maui Native Hawaiian Chamber of Commerce
- Maui Tomorrow Foundation, Inc.
- Native Hawaiian Legal Corporation
- Pa‘upena Community Development Corporation
- Wailuku Community Association
- Waiohuli Hawaiian Homesteaders Association, Inc.

8.2 DRAFT ENVIRONMENTAL ASSESSMENT CONSULTATION

The environmental review included a 30-day public comment period after the publication of the Draft EA on November 8, 2024, to further identify environmental issues and concerns to be addressed in the Final EA. Comments and input received during this public comment period have been reviewed and the Final EA reflects consideration of these comments in the planning and implementation of the proposed project. While some of the comments received have been incorporated into this document, the comprehensive set of comments received, and corresponding responses are reproduced in Appendix I.

Table 8-1: Draft Environmental Assessment Publication Notice and Comments

Agency/Organization	DEA Notice Sent	DEA Comment Date
State of Hawai‘i		
Environmental Review Program	X	
Department of Accounting and General Services	X	12/9/24
Department of Attorney General	X	
Department of Agriculture	X	

Agency/Organization	DEA Notice Sent	DEA Comment Date
Department of Business, Economic Development & Tourism	X	
DBEDT – Hawai'i State Energy Office/Strategic Industries Division	X	
DBEDT - Land Use Commission	X	
DBEDT - Office of Planning & Sustainable Development	X	12/6/24
Department of Defense - Engineering Office	X	
Department of Education	X	11/27/24
Department of Hawaiian Home Lands	X	
Department of Health	X	
Department of Health, Environmental Health Administration	X	
Department of Health - Clean Air Branch	X	11/15/24
Department of Health - Clean Water Branch	X	
Department of Health - Environmental Management Division	X	
Department of Health - Wastewater Branch	X	
Department of Health - Safe Drinking Water Branch	X	
Department of Health - Solid and Hazardous Waste Branch	X	11/26/24
Department of Health - Hazard Evaluation & Emergency Response Office	X	
Department of Health - Environmental Health Services Division	X	
Department of Health - Indoor and Radiological Health Branch	X	
Department of Health - Sanitation Branch	X	
Department of Health – Vector Control Branch	X	
Department of Health – State Laboratories Division	X	
Department of Human Services	X	
Department of Land and Natural Resources	X	
DLNR - State Historic Preservation Division	X	
DLNR - Land Division	X	
DLNR Commission on Water Resource Management	X	11/22/24
DLNR Division of Aquatic Resources	X	
DLNR Division of Boating & Ocean Recreation	X	

Agency/Organization	DEA Notice Sent	DEA Comment Date
DLNR DOFAW	X	
DLNR DOFAW Na Ala Hele	X	
DLNR Engineering Division	X	12/8/24
DLNR Office of Conservation & Coastal Lands	X	
Department of Public Safety	X	
Department of Transportation	X	11/26/24
Department of Transportation, Airports Division - Engineering Branch	X	
Department of Transportation - Harbors	X	
Department of Transportation - Highways	X	
Department of Transportation, Highways Division, Planning Branch	X	
Department of Transportation, Statewide Transportation Planning Office	X	
Hawai‘i Housing Finance and Development Corporation	X	
Hawai‘i Public Housing Authority	X	
Hawai‘i Tourism Authority	X	
Office of Hawaiian Affairs	X	
Maui County		
Corporation Counsel	X	
Department of Environmental Management	X	11/27/24
Department of Fire and Public Safety	X	
Department of Housing	X	
Department of Human Concerns	X	
Department of Management	X	
Department of Parks and Recreation	X	
Department of Planning	X	
Department of Public Works	X	
Department of Transportation	X	
Department of Water Supply	X	
Maui Planning Commission	X	
Police Department	X	
Maui Metropolitan Planning Organization	X	
Maui Redevelopment Agency	X	

Agency/Organization	DEA Notice Sent	DEA Comment Date
Elected Official		
Mayor Richard Bissen	X	
State Senator Lynn DeCoite	X	
State Representative Kyle Yamashita	X	
Council Member Yuki Lei Sugimura	X	
Utilities		
Hawaiian Electric Company, Inc.	X	
Spectrum	X	
Hawaiian Telcom	X	
Hawai‘i Gas	X	
Media		
Maui News	X	
Maui Now	X	
Honolulu Star Advertiser	X	
Honolulu Civil Beat	X	
Community Organizations		
Aha Moku o Maui Inc.	X	
Council for Native Hawaiian Advancement	X	
Hawai‘i Wildfire Management Organization	X	
Kamehameha Schools Maui Campus	X	
Ka Ohana O Kahikinui Inc.	X	
Kēōkea Homestead Farms Lots Association	X	
Maui Cultural Lands, Inc.	X	
Maui Historical Society	X	
Maui Native Hawaiian Chamber of Commerce	X	
Maui Tomorrow Foundation, Inc.	X	
Native Hawaiian Legal Corporation	X	
Pa‘upena Community Development Corporation	X	
Wailuku Community Association	X	
Waiohuli Hawaiian Homesteaders Association, Inc.	X	
Paukukalo Hawaiian Homestead Commty Assoc.	X	
Villages of Leiali‘i Phase1A Association	X	
Waiehu Kou Commty Homestead Association	X	

Agency/Organization	DEA Notice Sent	DEA Comment Date
Waiehu Kou Phase 3 Association Inc	X	
Waiehu Kou Residence Lots, Phase II Association Inc.	X	
Waiohuli Undivided Interest Lessees	X	
Maui Homestead Farmers & Ranchers Association	X	
Maui Mokupuni Council	X	
Malama Kakanilua	X	

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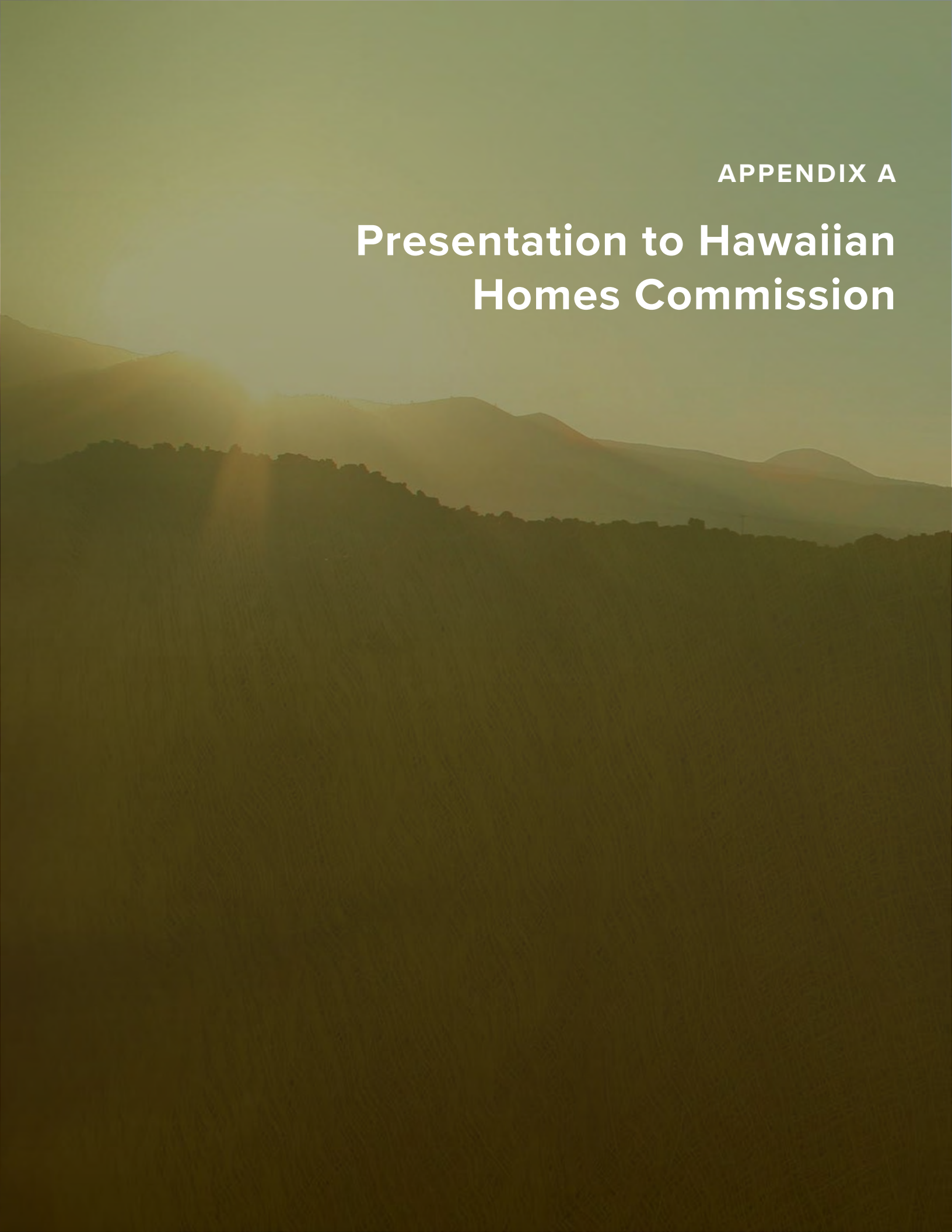


APPENDIX A

Presentation to Hawaiian Homes Commission

“WE DO”

Waiohuli Economic Development Opportunities

Waiohuli Hawaiian Homesteaders Association, Inc

Presentation to

Hawaiian Homes Commission

Department of Hawaiian Home Lands

September 2022

Purpose of Today's Informational Presentation

- Introduce WE DO
- WHHA's Request for 65-year General Lease Disposition in accordance Sec. 204(2) and 207(c) of HHCA and DHHL's Kuli'a I Ka Nu'u Program
- Provide update on WHHA's submission of deliverables for Right of Entry #688

WE-DO Purpose

- Provide short- and long-term economic opportunities derived from the development of a master planned community
  - Community-based jobs - families can grow and nurture; remain in Hawaii
  - Core sector jobs (housing, water, wastewater, energy)
  - 21st Century career path development – stability, parity
  - Entrepreneurial and Small business support, incubation
- Secure and leverage public/private resources to support proposed land uses, and in turn, economic development
- Through Public-Private Partnership, work with contractors, professionals and service providers to foster training and mentorship in various fields of expertise.

Waiohuli Hawaiian Homesteaders Association (WHHA)

1999 Established

- Mission - to . . . "unite under the mana of all Hawaii Nei, to protect, preserve, and defend the Hawaiian Homes Land Trust as defined in the Hawaiian Homes commission Act of 1920, as amended, and combine our efforts for the rehabilitation and betterment of all Native Hawaiian Homeland beneficiaries."

2005 Received 501(c)(3) designation

- Created a strategic plan for the Waiohuli Community to promote social interaction, education and sustainability
- Engaged in DHHL's sponsored programs including Kulia I Ka Nu'u, Regional Planning

2007 Received initial 5 of 17 acres of land from DHHL for community use (Lic. No. 695)

2010 Participated in development of Keokea-Waiohuli Regional Plan

- Development of a community facility
- Development of water resource

WE DO

WHHA… next 12 years

Secured $4,215,000

- $3,805,000 in GIA funding from Legislature (Non DHHL)
- $410,000 in Regional Plan Priority Project Grants from DHHL

Developed (in response to community planning)

- Certified commercial kitchen, Comfort station, Outdoor amphitheater, Community garden, Hale Halawai, open park space

Created

- Mentoring partnerships with project contractors & professionals resulting in “3 to 1” leveraging

The Start of WE DO

2018 November	WHHA Board establishes WE-DO • To create and sustain economic opportunities derived from development
2018 December	Request for Land Disposition • [Sec. 204(2) and 207(c) of HHCA] • Kuli'a I Ka Nu'u Program
2019 May	Beneficiary Consultation @ Kula Community Center
2019 August	HHC approves ROE to 150 acres to conduct due diligence for WE DO
2021 July	Governor Approves $80M Special Purpose Revenue Bond (SPRB)
2022 June	Initial presentation to DHHL Administration

WE DO

WE DO Plan

Completion of ROE Deliverables

- ✓ Submit a Master Plan
- ✓ Submit a Project Business Plan
- Consult with and work closely with DHHL on completing HRS Chapter 343 and HRS 6E compliance documentation and studies
- ✓ Submit bi-annual progress reports to DHHL and the HHC.

Site Assessment ✓

- Land Use Context, location, surrounding uses, land use designations
- Geology/Topography, Hydrology/Drainage, Land Cover
- History/Culture, Demographics
- Infrastructure, incl. water availability study

Findings of Note

Water

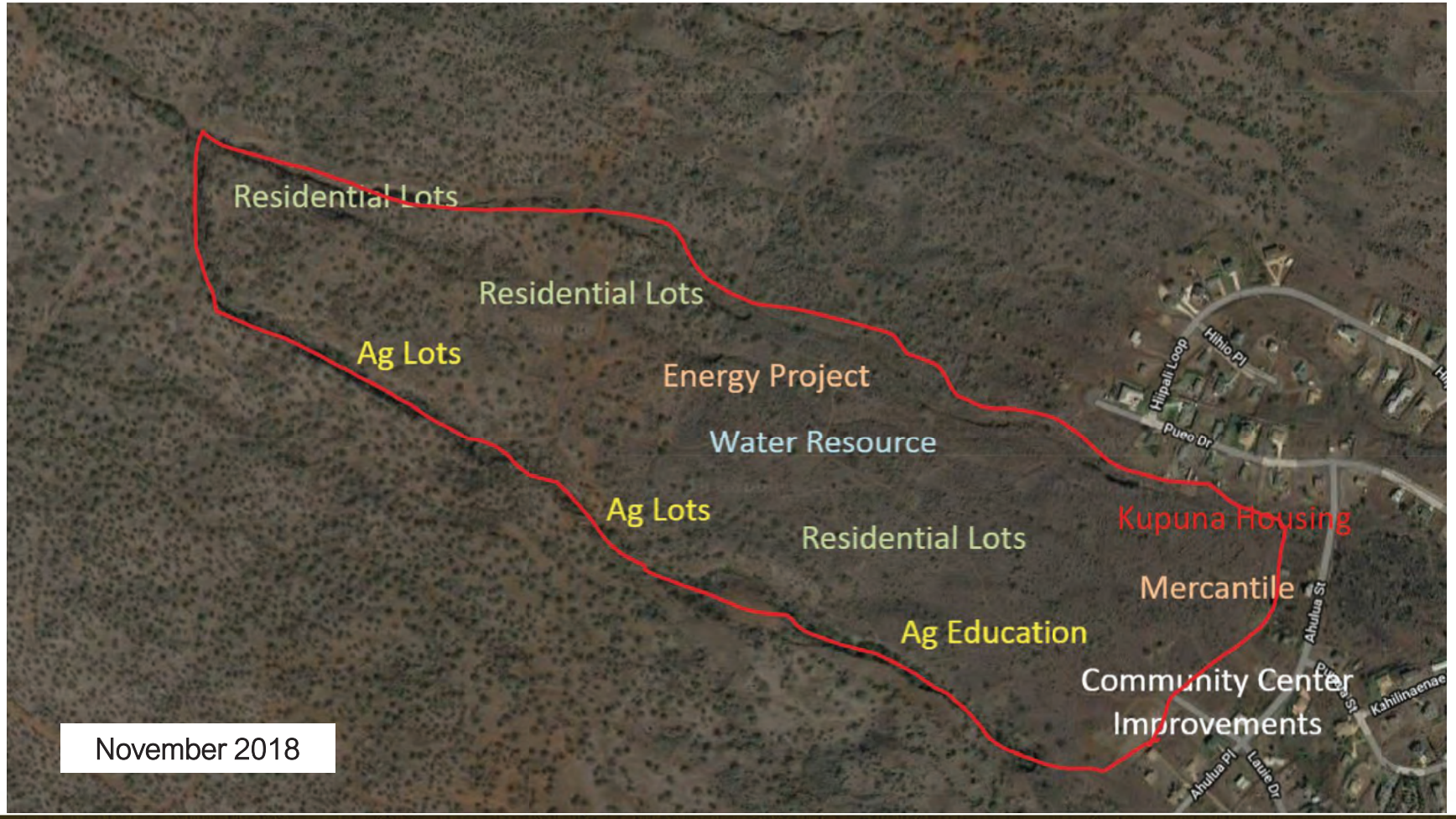
- Located on the Kama'ole Aquifer
  - Aquifer sustainable yield of 11 mgd
  - Planned water development estimated to satisfy WE DO development needs

Topography & Drainage

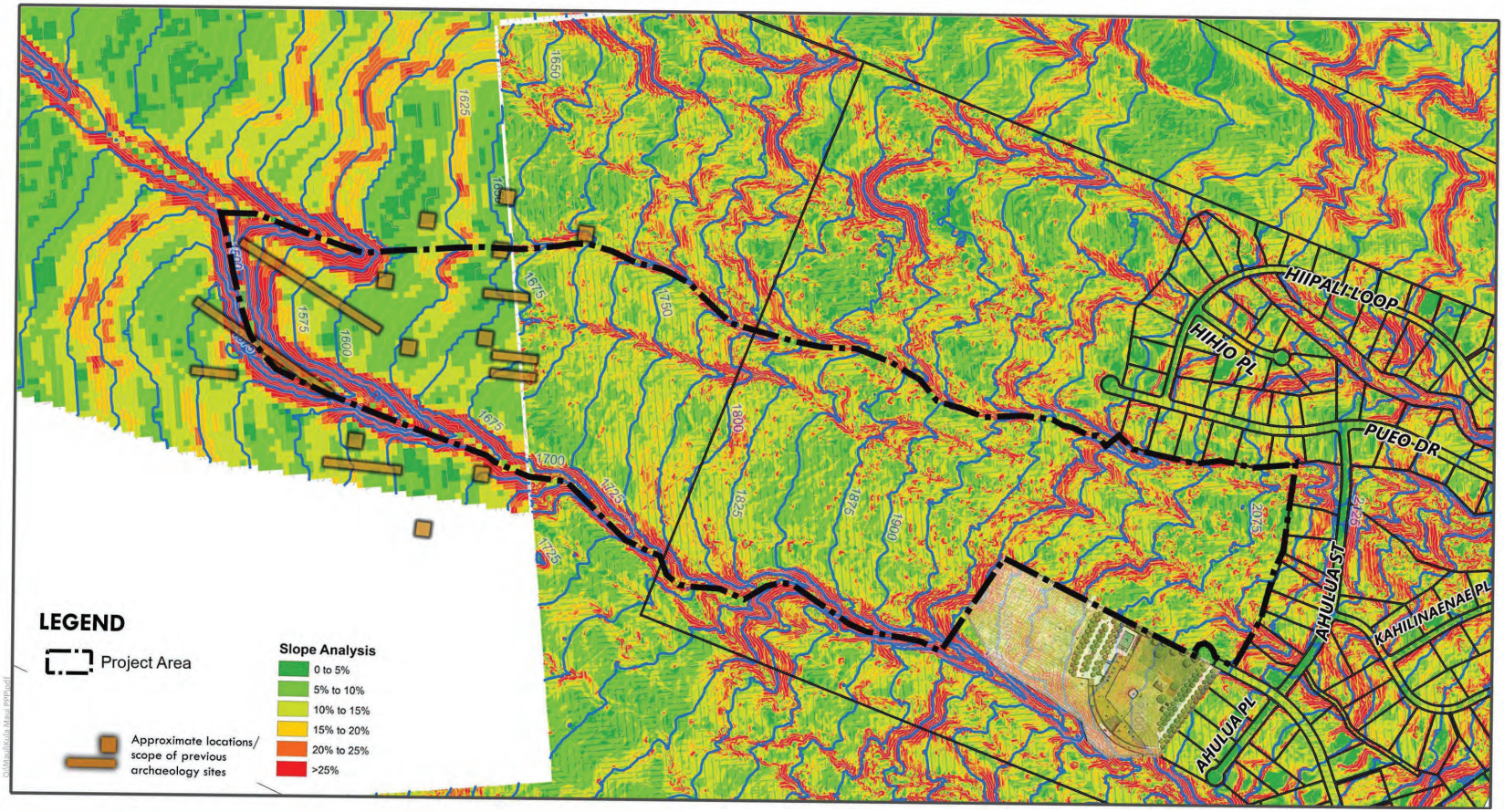
- Concept layout preserves gulches, minimizes grading, maximizes views
- Waiohuli's contours drove the WE DO concept layout

Archaeology

- Entirety of the Kēōkea-Waihouli Tract has been extensively surveyed for archaeological resources
  - WE DO site planning is designed to avoid disturbance of identified sites
  - Proper preservation steps and monitoring will be implemented as necessary


Residential Lots
Residential Lots
Ag Lots
Energy Project
Water Resource
Ag Lots
Residential Lots
Kupuna Housing
Mercantile
Ag Education
Community Center
Improvements
November 2018
Hihio Pl
Hipali Loop
Pueo Dr
Ahulua St
Ahulua Pl
Lauie Dr
Kahilinaenae

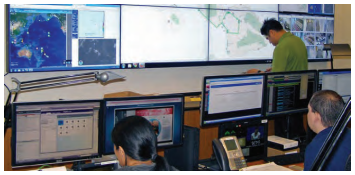
WE DO


LEGEND
Project Area
Approximate locations/ scope of previous archaeology sites
Slope Analysis
0 to 5%
5% to 10%
10% to 15%
15% to 20%
20% to 25%
>25%
HIIPALI LOOP
HIHIO PL
PUEO DR
AHULUA ST
KAHILINAENAE PL
AHULUA PL
1650
1625
1575
1600
1675
1700
1725
1750
1800
1825
1875
1900
2075
2125

WE DO.

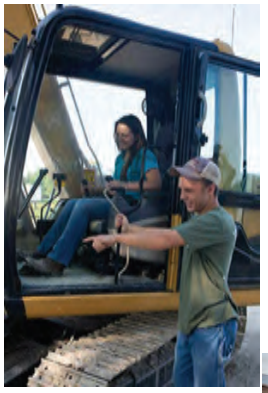
Renewable Energy

Agricultural Technology



Technology, Keiki Care, Small Business Health Care

Kūpuna Care

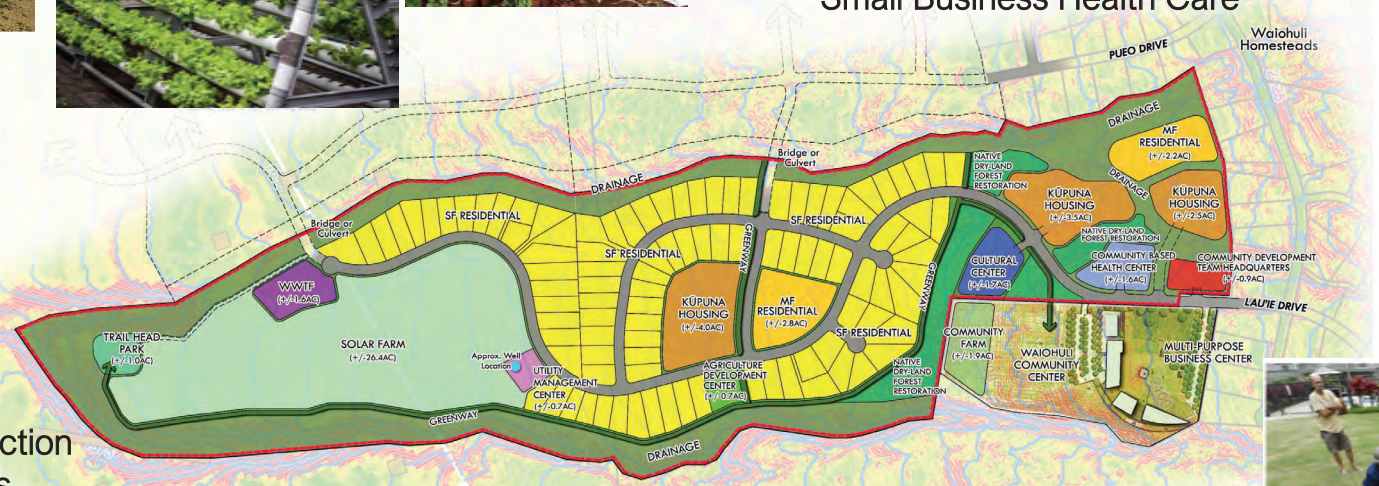


Construction Jobs

Water and Wastewater

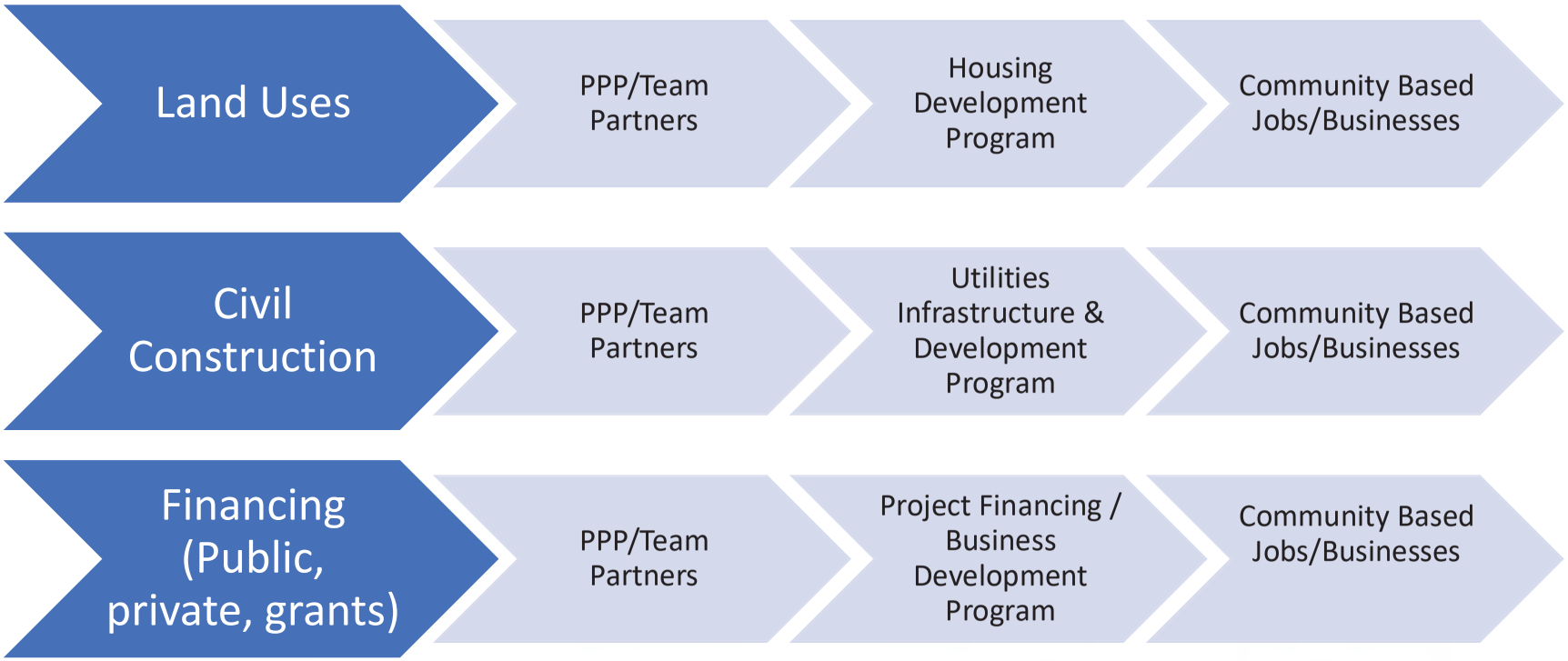
Community Spaces

Multi-Generational Communities



WE DO

WE DO Strategy – "*Community Building Communities*"



WE DO.

Aligning Concept Plan with Vision

Housing (Infrastructure, single family, multi-family, rental, kūpuna housing)

Short Term	Long Term
Planning	Rental mgmt. & services
Design (civil, vertical)	Elderly management & services
Engineering	Common area maintenance
Survey	Security, smart home technologies
Environmental	PV & Solar
Construction	Legal services
Legal Services	Kūpuna care center
PV & Solar	
Homebuyer Counseling	
Loan & Escrow Services	

Aligning Concept Plan with Vision

Agricultural (housing with subsistence farming, vertical farming)

Short Term	Long Term
Ag Education & Techical Assistance	Ag education and technical assistance
	Ag processing
	Ag co-op
	Storage and transportation
	Marketing
	Small business support

Aligning Concept Plan with Vision

Community Spaces (learning center, cemetery, cultural preservation)

Short Term	Long Term
Planning, civil	Program development
Construction	Grant writing
	Arts and culture venues
	Legal services
	Childcare services/center

Aligning Concept Plan with Vision

Energy, Water, Wastewater

Short Term	Long Term
Planning, civil	Management and maintenance jobs
Construction	Technical support
Marketing	Cyber security
Distribution	Legal Services
Management	
Technial support	

Economic Overlay

Experienced, Hawaii-Based Teaming Partner(s) – Funding by 2022 Grant In Aid

- Assessment
  - Identify community skillsets
  - Determine interests, readiness
  - Match needs with support services
- Coordination / Implementation
  - Align support services
  - Teaming partners mentorships
  - Other communities
  - Timing with development schedule
- Evaluation / Performance Measurements
  - Quantifiable results
  - Community impact

Business Plan

- Itemized description of proposed land uses, quantities and phasing plan
- ROM estimates for civil and vertical costs
- Sources of funding
  - $80M SPRB & Biden Infrastructure Funding for initial phase
- Phasing
- Expense & Income budget
- Key partners committed to the project

Business Plan

Sources of funding

- Special Purpose Revenue Bond ($80 Million)
- Federal, State, and Foundation Grants
- Federal and State Tax Credits
- USDA Rural Development
  - USDA Rural Utilities Service
- CoBANK Rural Community Development
- US Department of Commerce
  - Economic Development Administration
- US Department of the Interior
  - Bureau of Indian Affairs
- US Department of Energy
  - Office of Energy Efficiency and Renewable Energy
- Investment Banking and Corporate Bonds
- Private Equity and Hedge Fund Financing
- National Endowment for the Humanities
- US Department of Education
- US Department of Health and Human Services
  - Administration for Community Living
  - Administration on Aging
  - Administration for Native Americans
- Biden Infrastructure Investment and Jobs Act
- Office of Hawaiian Affairs

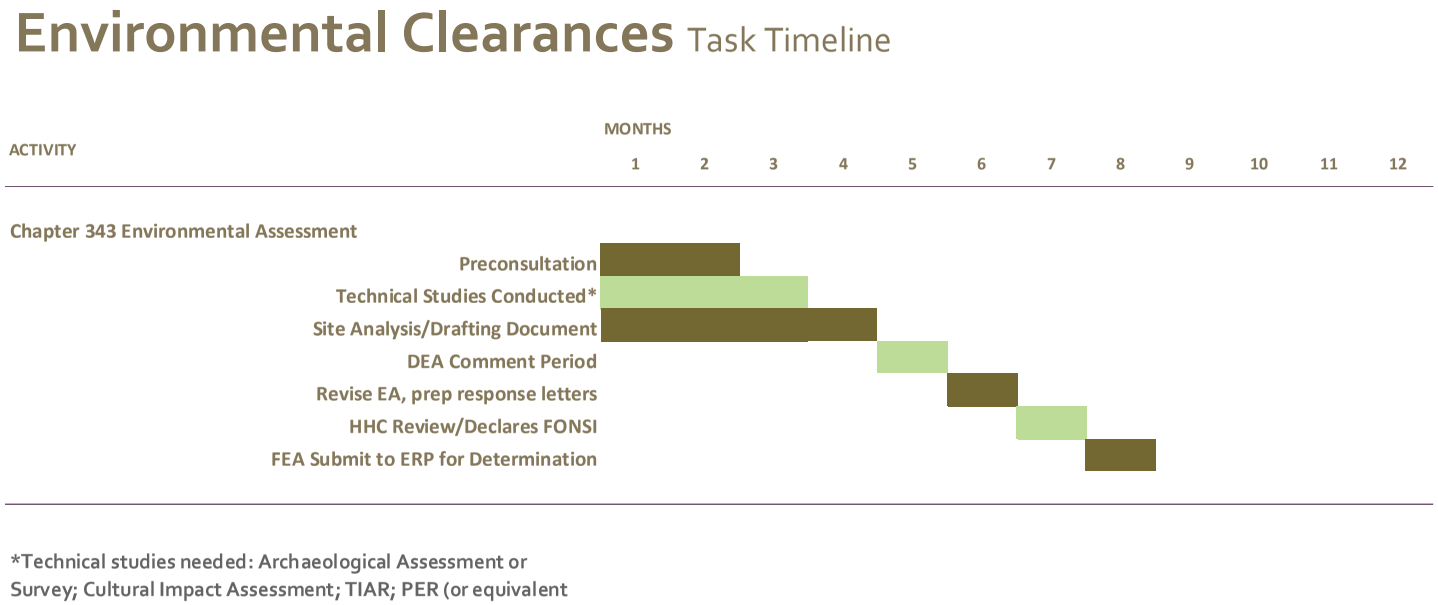
Bi-Annual Reporting

ROE issued January 2020 (36-month term ends Jan 2023)

1st Report	Feb 2020 – Jul 2020 (submitted Aug 2020)
2nd Report	Aug 2020 – Jan 2021 (submitted Feb 2021)
3rd Report	Feb 2021 – Jul 2021 (submitted Aug 2021)
4th Report	Aug 2021 – Jan 2022 (submitted Feb 2022)
5th Report	Feb 2022 – Jul 2022 (WE DO draft plan review Jun 2022)

HRS Chapter 343 Compliance (pending)

- Literature review
- Technical Studies
- HRS Chapter 343 FONSI is anticipated

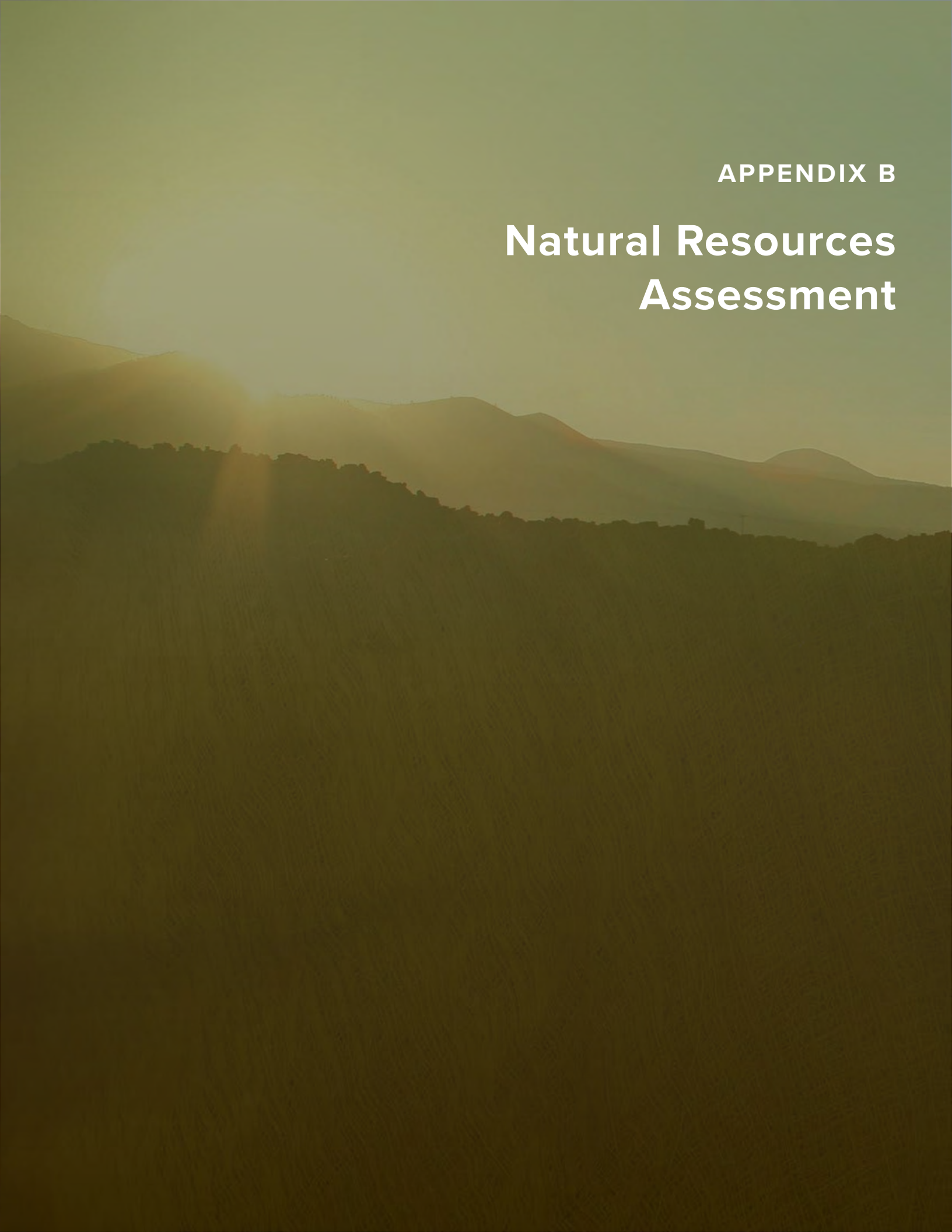


*Technical studies needed: Archaeological Assessment or Survey; Cultural Impact Assessment; TIAR; PER (or equivalent

Next Steps

- Complete due diligence review with DHHL
- Exercise extension clause to ROE term
- Seek Preliminary GL approval from HHC
- Complete Chapter 343 Compliance / Secure GL disposition


MAHALO



APPENDIX B

Natural Resources Assessment

A Natural Resources Assessment for the Waiohuli Economic Development Opportunities Project Island of Maui

LeGrande Biological Surveys Inc
4348 Waialae Ave 940
Honolulu HI 96816

Prepared by:
Maya L. LeGrande

Prepared for:
PBR Hawaii

DRAFT
April 2024

Introduction

The Department of Hawaiian Home Lands is proposing a development on Lands located in Keokea, Kula, Maui for the Waiohuli Economic Development Opportunities (WEDO) Project which includes community support training facilities, infrastructure training, agricultural development, and renewable energy development. The Project Area (PA) totals approximately 150 acres between two parcels [TMKs (2) 2-2-002:014 and (2) 2-2-028-181] (Fig. 1). LeGrande Biological Surveys Inc. was tasked with providing a report outlining the current plant and animal species extant within the PA. This report includes these findings as well as recommendations for any native species located within the PA as well as any that could possibly be utilizing the habitats in and around the general area that may be affected by the proposed land use change.

Site Description

The parcel is located on the western slope of Haleakalā, the eastern mountain of Maui Island. The climate of the site is described as arid with a Mean Annual Rainfall of 15 to 25 inches (Giambelluca et al., 2013). Soil in the PA is exclusively kamaole very stony silt loam [KGKC] (NRCS 2024), a well drained 3-15% slope characterized with cobbles, stones, and boulders. Figures 1 and 2 (following page) shows an aerial of the PA as well as a topographic map showing the drainages and elevational gradient. The PA appears to be lands used historically as pasture/ranch lands. The mauka (upslope) TMK is characterized by a non-native grassland (1,800-2,100 feet elevation) and the makai TMK (1,480-1,800 feet elevation) is dominated by large extensive groves of the native wiliwili (*Erythrina sandwicensis*) with non-native understory (cover photo).

Methods

Plant Survey

Two biologists surveyed the PA on February 14, 15, and 16, 2024. The entire 150 acres were included in the survey with focus on the areas with habitat that had a higher probability of harboring natives. Plant species were identified as they were encountered during meandering transects walked through the PA and along boundaries. Gulches were surveyed and mapped along the boundaries of the PA as well as obvious drainages within the PA (Fig. 10). Notes were made on plant associations and distribution, disturbances, topography, substrate type, exposure, and drainage. Species names for plants follow *Manual of the Flowering Plants of Hawai'i* (Wagner, Herbst, & Sohmer, 1990; Wagner & Herbst, 1999) for native and naturalized flowering plants, *Hawai'i's Ferns and Fern Allies* (Palmer, 2003) and *Taxonomic and Nomenclatural Updates to the Fern and Lycophyte Flora of the Hawaiian Islands* (Ranker et al, 2019) for ferns, and *A Tropical Garden Flora* (Staples & Herbst, 2005) for ornamental plants. More recent name changes for naturalized plant species follow Imada (2019).

Figure 1. Aerial with PA outlined in red also showing the two separate TMK units.

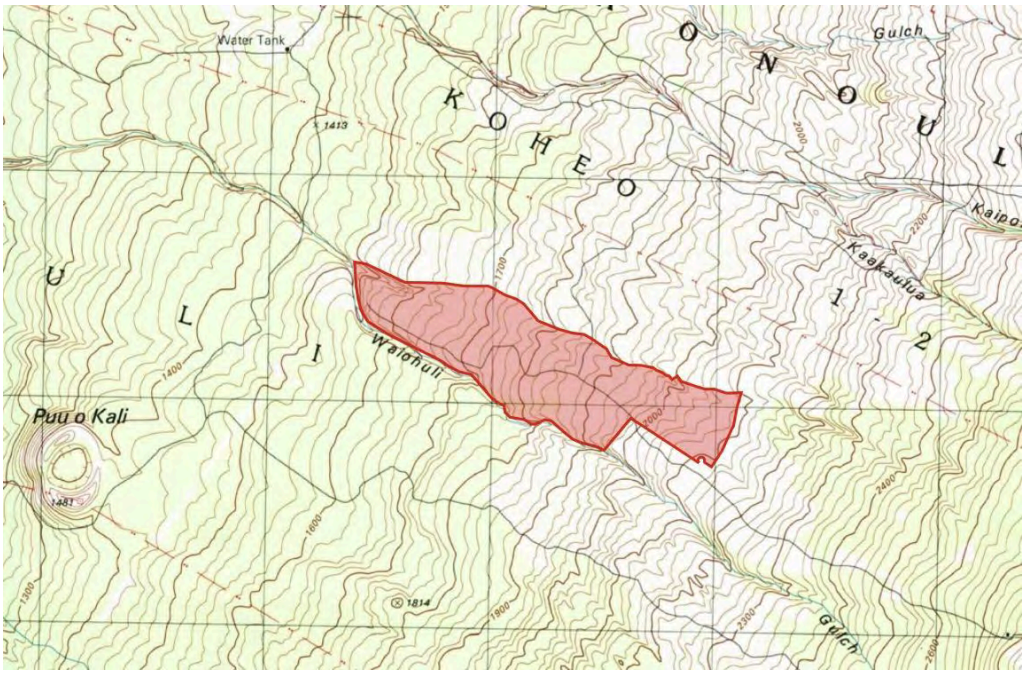


Figure 2. Topographic map showing PA in red with Waiohuli Gulch along the southern boundary.

Avian Survey

Bird surveys were conducted in the morning hours between 6:30 am and 8:00 am, noting species present and estimated abundance. Passive observations were also noted throughout the day. Birds were identified by visual observations aided by Leica 7 X 42 binoculars, and by listening for vocalizations. Weather conditions were ideal with unlimited visibility, overcast conditions, and winds between 5 and 12 miles per hour. The avian phylogenetic order and nomenclature used in this report follows the AOU *Check-List of North and Middle American Birds* 2021, and the 64th supplement to the checklist (Chesser et al., 2023).

Mammalian Survey

Notes were made of any mammal sightings or indicators of mammalian presence, such as tracks, scat, or rubbings. Mammalian phylogenetic order and nomenclature follow *Mammal Species of the World* (Wilson and Reeder, 2005).

Figure 3. Waiohuli Gulch with wiliwili trees along the banks. Silt buildup in rocky streambed.

Figure 4. Northern section of the PA with smaller drainage to the left and northern drainage along the PA boundary to the right. Wiliwili trees are abundant and tree tobacco can be seen in the small drainage.

Results

Flora

The majority of the survey area is characterized by grasslands that were at one time pasturelands and dominated by invasive and weedy plant species. There are three main vegetation types found within the PA; Panicum-Cactus Grassland, Disturbed Dryland Forest, and Gulch Vegetation. All three vegetation types are described in the following sections.

Panicum-Cactus Grassland

This vegetation type occurs in the upper elevation areas (1,800-2,100 feet) of the PA, primarily in the upper TMK. The dominant plant species are non-native including the most abundant species Guinea grass (*Megathyrsus maximus*) and Buffelgrass (*Cenchrus ciliaris*) that forms a continuous grassland (Fig. 5) with other species scattered throughout including panini cactus (*Opuntia ficus-indica*), golden crown beard (*Verbesina encelioides*), spiny amaranth (*Amaranthus spinosus*), swollen fingergrass (*Chloris barbata*), pitted beardgrass (*Bothriochloa pertusa*), Partridge pea (*Chamaecrista nictitans*), rattlepod (*Crotalaria pallida*), Sacramento bur (*Triumfetta semitriloba*), klu (*Vachellia farnesiana*), pua pihi (*Zinnia peruviana*). Trees are scattered throughout the grassland including *kiawe* (*Prosopis pallida*) and black wattle (*Acacia mearnsii*). Natives

that were observed infrequently or locally common were *ʻuhaloa* (*Waltheria indica*), ʻilima (*Sida fallax*), along with a few scattered wiliwili (*Erythrina sandwicensis*) trees.

Disturbed Dryland Forest

This vegetation type is located in the lower elevation TMK of the PA between 1,480 feet to 1,800 feet elevation. Wiliwili is the dominant tree species in this area. The groves are extensive and are found on the plateau area between the two main gulches as well and growing on the sloping banks of the drainages. The wiliwili population, although not officially counted, number in the hundreds but most probably into the thousands. The ground in this area does not appear to have been as disturbed as in the mauka section of the PA. The wiliwili trees are growing out of a substrate of smaller boulders and moss rock. Signs of regeneration were also observed in pockets of soil between the rocks. The understory is dominated by Guinea grass and buffelgrass. A few ʻanunu (*Sicyos pachycarpus*) vines were beginning to grow in some of the understory and one ilieʻe (*Plumbago zeylanica*) plant was observed at the edge of one of the groves.

Gulch Vegetation

Both Waiohuli Gulch and the northern gulch are very deep in some areas, up to 100 feet. In many areas water erosion has worn the gulches to bedrock with boulders and silt along the bottom of the stream bed. There are occassionally "dry fall" areas where the streambed plunges over a steep cliff (Fig. 6). Tree species in or on the gulch sides include chinaberry (*Melia azerdarach*), jacaranda (*Jacaranda mimosifolia*), black wattle, lantana (*Lantana camara*), Mauritius hemp (*Furcraea foetida*), elephant grass (*Cenchrus purpureus*), molasses grass (*Melinis minutiflora*), koa haole (*Leucaena leucocephala*), sourbush (*Pluchea carolinensis*), natal redtop (*Melinis repens*), *Ipomoea obscura*, hedgehog gourd (*Cucumis dispaceus*), hairy merremia (*Distimake aegyptius*), moon flower (*Ipomoea alba*), castor bean (*Ricinus communis*), Lionʻs ear (*Leonotis nepetifolia*), false ragweed (*Parthenium hysterophorus*), prickly lettuce (*Lactuca sativa*), hairy abutilon (*Abutilon grandifolium*), gold fern (*Pityrogramma austroamericana*), wild parsley (*Petroselinum crispum*), mexican poppy (*Argemone mexicana*), and tree tobacco (*Nicotiana glauca*). Natives observed infrequently or rarely include koali ʻawa (*Ipomoea indica*), ʻānunu, ilieʻe, and the ferns kumuniu (*Doryopteris decipiens*), and kalamoho (*Pallaea ternifolia*).

Figure 5. Vegetation in the upper or mauka TMK is characterized by Panicum-Cactus grassland with abundant panini cactus, kiawe, and the occasional native ʻilima shrubs (foreground) and few wiliwili trees.

Figure 6. Dry fall in Waiohuli Gulch with tree tobacco in foreground.

Fauna

Avian Fauna

A total of 14 species, representing 8 separate families (Table 2) were observed during the survey. Avian diversity and densities were in keeping with the location, disturbance, and vegetation present within the study site. Four species—Zebra Dove (*Geopelia striata*), Common Myna (*Acridotheris tristis*), house finch (*Haemorhous mexicanus*), and scaly-breasted munia (*Lonchura punctulata*) were the most frequently observed and heard.

The only evidence of native bird species was a tropic bird (*Phaethon* sp.) or koaʻe roost site (Fig. 7). It is probable that other native bird species such as the Pacific Golden-plover or kōlea (*Pluvialis fulva*) Hawaiian Short-eared owl or pueo (*Asio flammeus sandwichensis*) utilize the habitats within the PA. Both of these birds forage in agricultural fields and pastures.

Figure 7. Cave area in the northern gulch with obvious guano markings characteristic of tropic bird (koaʻe kea or koaʻe ʻula) *Phaethon* spp. roosting or nesting site.

Mammalian Fauna

Signs of introduced terrestrial mammalian species including axis deer (*Axis axis*) and Feral pigs (*Sus scrofa*) were detected including trails, scat, and tree rubbing. Domestic dogs (*Canis familiaris*) were heard and observed near the northeastern corner of the PA. Though not observed, it is likely that cats (*Felis catus*), Small Indian mongoose (*Urva auropunctata*), roof rat (*Rattus rattus*), brown rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans hawaiiensis*), and European house mouse (*Mus musculus domesticus*) use resources within the general area on a seasonal basis.

Table 1. Avian Species Detected- Waiohuli Project Area- 2024

Common Name	Species	Status
	Family	
	COLUMBIDAE - Pigeons & Doves	
Spotted Dove	*Streptopelia chinensis*	A
Zebra Dove	*Geopelia striata*	A
	ALAUDIDAE-Larks	
Eurasian Skylark	*Alauda arvensis*	A
	ZOSTEROPIDAE - White-eyes	
Warbling White-eye	*Zosterops japonicus*	A
	PHASIANIDAE- Partridges, Grouse, Turkeys, and old World Quail	
Black Francolin	*Francolinus francolinus*	A
Gray Francolin	*Francolinus pondicerianus*	A
Ring-necked pheasant	*Phasianus colchicus*	A
	MIMIDAE-mockingbirds and Thrashers	
Northern Mockingbird	*Mimus polyglottos*	A
	STURNIDAE - Starlings	
Common Myna	*Acridotheres tristis*	A
	ESTRILDIDAE - Estrildid Finches	
Common Waxbill	*Estrilda astrild*	A
African Silverbill	*Euodice cantans*	A
Scaly-breasted Munia	*Lonchura punctulata*	A
	FRINGILLIDAE – Fringillidae and Cardueline Finches and Allies	
House Finch	*Haemorhous mexicanus*	
	CARDINALIDAE - Cardinals & Allies	
Northern Cardinal	*Cardinalis cardinalis*	A

Legend to Table 1

Status

A Alien – introduced by humans, naturalized

Discussion and Recommendations

The proposed WEDO PA is located in an area that has encountered past disturbances to the natural native habitat over the last several centuries. The upper elevations of the PA are dominated by an extensive non-native grassland and development in this area is not expected to have any negative effects on native flora and fauna owing to the limited native natural resources found in this area. The lower elevation TMK included in the PA harbors extensive groves of wiliwili, the endemic dryland tree species. Recommendations for plant, bird, and bat species are discussed in the following appropriate sections. Implementation of the recommendations (provided below as bulleted items) will minimize potential impacts to listed species to the maximum extent practicable.

Floral Resources

Native plant habitat within the proposed project area has been highly modified by human activities, non-native ungulates, and introduced plant and invertebrate species both historically and at present. There were a total of 90 species documented during the current survey. Ten of those species are considered native (endemic, indigenous, or questionably indigenous). 89% of the species are considered non-native. Endemic species include; *Dorypoteris decipiens, Erythrina sandwicensis,* and *Sicyos pachycarpus*. Indigeous species found were *Pellaea ternifolia, Ipomoea indica, Sida fallax, Oxalis corniculata, Plumbago zeylanica, Dodonaea viscosa,* and *Waltheria indica*. Char (1994) carried out a survey just mauka of the current PA at elevations between 1,800- 3,000 feet. Her survey included a portion of Waiohuli Gulch and the upper elevations of the current PA. The vegetation was similar and she noted most of the natives that we found excepting ʻanunu. Five native species that were not found presently but listed on her 1994 include, *Psilotum nudum, Cocculus orbiculatus, Argemone glauca, Osteomeles anthyllidifolia,* and *Solanum americanum*.

Although none of the native species that were documented at the survey area are listed as endangered or threatened under either the federal or State of Hawaiʻi endangered species statutes. (HDLNR, 1998; USFWS, nd-a), the extensive groves of wiliwili trees in the makai portion of the PA are an example of an ever-dwindling habitat type historically found on all the the main Hawaiian Islands. Dryland forests have been highly impacted in Hawaiʻi due to their geographical location in direct competition for urban development, agricultural activities, and habitat that introduced plant, animal, and invertebrate species tend to invade and become established. The wiliwili has been increasingly threatened by land use changes, introduced invertebrate species that predate on the plants and seeds thus impacting the survival of this endemic species. It is recommended that the lower portion of this PA be utilized as a preserve for the wiliwili forest and possibly used as an outplanting site for other native dryland species.

Figures 8 & 9. Native ferns infrequently observed in basalt outcroppings included; kalamoho (*Pallaea ternifolia*) and kumuniu (*Doryopteris decipiens*).

Faunal Resources

Animals and/or signs of animals documented within the survey area include Axis deer, pigs, the previously discussed bird species. The following sections discuss probable species that may be utilizing the survey area or air space in the general location and recommendations if warranted.

Avian Resources

Pueo

The Hawaiian short-eared owl or pueo (*Asio flammeus sandwichensis*) is listed as endangered by the State of Hawaiʻi only on the island of Oʻahu; it is not a federally listed species. It is an endemic subspecies of the widespread short-eared owl (*Asio flammeus*). Pueo are found on all of the main Hawaiian Islands, at elevations ranging from sea level to 2,438 m (8,000 feet). Pueo are active during the day, with increased activity levels at dawn and dusk, and are commonly seen hovering or soaring over open areas. There is limited information regarding breeding of this species, but nests have been found throughout the year. Nests are made of scrapes in the ground lined with grasses and feather down.

Nēnē

Nēnē or Hawaiian Goose (*Branta sandvicensis*) were not observed within the PA or in the general surrounding areas. The habitat is not conducive for foraging and/or loafing. Generally human impacts to this species revolve around vehicular interactions, human feeding, and disturbance to nesting birds, eggs, chicks, and goslings. These potential threats can be minimized to the maximum extent practicable by implementing the following minimization measures:

- Don't feed birds especially if they approach for handouts.
- Secure all food rubbish in close trash receptacles.
- Establish a 15 mile an hour speed limit within the site.

Waterbirds

None of the four extant endemic endangered waterbird species or subspecies were recorded on the site. They are Hawaiian Duck or koloa (*Anas wyvilliana*), Hawaiian Coot or ʻalae keʻokeʻo (*Fulica alai*), the Hawaiian endemic sub-species of both the Common Gallinule or ʻalaeʻula (*Gallinula chloropus sandvicensis*), and the Black-necked Stilt or aeʻo (*Himantopus mexicanus knudseni*). There is no habitat that any of the four waterbird species would utilize for foraging and/or nesting in the PA.

Seabirds

It is possible that the endangered Hawaiian Petrel, Band-rumped Storm-Petrel, and the threatened Newell's Shearwater over-fly the project area between April and the middle of December each year in small numbers. The primary cause of mortality in Hawaiian Petrels, Newell's Shearwaters and Band-rumped Storm-Petrels in Hawai'i is thought to be predation by alien mammalian species at the nesting colonies (USFWS, 1983; Simons and Hodges, 1998). Collision with man-made structures is considered the second most significant cause of mortality of these seabird species in Hawai'i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with man-made structures (Rodriguez et al., 2017) and, if not killed outright, become easy targets of opportunity for feral mammals (Ainley et al., 2001, Hue et al., 2001).

The principal potential impact that current habitat modifications or changes pose to protected seabirds is an increased threat that birds will be downed after becoming disoriented by lights. The two ways outdoor lighting can pose a threat to nocturnally flying seabirds is if: 1) during construction it is deemed expedient or necessary to conduct night-time construction activities; or, 2) following build-out, permanent outdoor lighting is installed.

- If night-time construction activity or equipment maintenance is proposed during any construction phases of the project, all associated lights should be shielded, and when large flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground (USFWS, 2023). Deleterious impacts to transiting seabirds can be avoided if construction occurs during daylight hours and all outdoor lighting installed is fully "dark sky compliant" (HDLNR-DOFAW, 2016). DLNR recommends avoiding construction-related night-time lighting between September 15 and December 15 (DLNR, 2016).
- Install automatic motion sensor switches and controls on all permanent outdoor lighting and/or turn off lights when human activity is not occurring in the area.

Mammalian Resources

The findings of the mammalian survey are consistent with the location and habitats present. Although no rodents were recorded it is likely that some of the four established Muridae found on Maui Island—roof rat, brown rat, Polynesian rat, and European house mouse use resources within the general area on a seasonal basis. These introduced rodents are deleterious to native ecosystems and native faunal species.

Although no mammalian species currently protected or proposed for protection under either the federal or State of Hawai‘i endangered species programs were detected during this survey (DLNR, 2015; USFWS, nd-a), the ʻōpeʻapeʻa or Hawaiian hoary bat is known to occur in this area (Bruner 1994, H.T.Harvey & Associates 2020).

Hawaiian hoary bat

The ʻōpeʻapeʻa – endemic Hawaiian hoary bat (*Lasiurus cinereus semotus*), currently recognized as an endemic species *Lasiurus semotus* (Pinzari et al. 2020) overfly the project area on a seasonal basis. Historically, Bruner (1994) observed one individual foraging above pasture lands during his surveys of the Kula Residential Lots just mauka of the WEDO PA. This species will forage and roost in a wide range of habitats including forest canopies, edges of forests, and open pastures (Bonaccorso et al., 2015). A recent bat survey carried out in 2017 and 2018 (H.T.Harvey & Associates 2020) on the western slopes of Haleakalā (which included the PA) found that bats were primarily using gulches, grassland, and low density habitats for foraging and roosting. Owing that the PA encompasses two large gulches and that the habitat is optimal for foraging bats, the following is recommended: During the pupping season, females carrying their pups may be less able to vacate a roost site if the tree is felled. Further, adult female bats sometimes leave their pups in the roost tree while they forage. Very small pups may be unable to flee a tree that is being felled.

- Potential adverse impacts from such disturbance can be avoided or minimized by not clearing woody vegetation taller than 4.6 m (15 ft) between June 1 and September 15, the period in which bats may have pups.
- Do not use barbed wire fencing that the bats can become entangled in.

Other Resources of Potential Concern

Blackburn‘s Sphinx Moth/Tree tobacco

The endemic Blackburn’s Sphinx Moth [BSM] (*Manduca blackburni*) is a State of Hawai‘i and federally listed endangered invertebrate species. The caterpillars are either gray (purple) or green morphs with scattered white spots and stripes down the sides (found October –May), the moth can be up to 5 inches long, grayish brown with 5 orange spots along the abdomen (found year-round). This rare species is most commonly found on the introduced tree tobacco plant (*Nicotiana glauca*) as its native host plant, `aiea (*Nothocestrum latifolium*), has become rare.

Tree tobacco plants were observed as locally common but restricted to the 2 larger gulches at the northern and southern boundaries of the PA. Several plants were inspected for any signs of BSM including chew, eggs, or caterpillars. None were observed. Due to the location of the tree tobacco plants growing mainly in the gulches, which are not planned for disturbance, the need for removal of plants is unlikely. It is

recommended that any tree tobacco plants planned for removal at any stages of this or any other project in the PA be inspected for BSM eggs or caterpillars prior to vegetation or ground clearing activities. A qualified biologist with experience recognizing eggs, caterpillars, and chew is required in order to protect BSM habitat. Critical Habitat that overlaps the PA is designated (USFWS, nd-b; USFWS 2023) for BSM.

Coconut rhinoceros beetle

The Coconut rhinoceros beetle (CRB) *Oryctes rhinoceros* is an invasive beetle species from SouthEast Asia that has become established on Oʻahu and is now spreading to other Hawaiian Islands. The beetles feed on palm species and are a threat to our coconut trees as well as native *Pritchardia* species and other ornamental palms. The Coconut Rhinoceros Beetle Response (crbhawaii.org) recommends best management practices to discourage CRB from becoming established including limiting mulch, compost, and decaying plant material in thick piles of 2 inches or more and spreading mulch in thin layers to keep the material dry which is not favorable for the beetle larvae.

Wetlands/Riparian Habitat

The National Wetland Inventory (NWI) website was accessed (USFWS 2024b) and a map was generated showing Waiohuli Gulch as ‘Riverine‘, denoting a river or stream channel (Fig. 10). Field surveys determined that in addition to the two large gulches that delineate the PA boundaries to the north and south, a smaller drainage in the northern section of the PA has 2 headwaters that converge into one eventually meeting with the unnamed northern gulch at the lower elevations of the PA (Fig 11). All of these drainages appear to be intermittent streams that only hold water during precipitation events. The drainages including Waiohuli Gulch eventually converge into Waipuilani Gulch that empties into the sea just south of Kihei Beach Park. No additional wetland indicators were present within the survey area.

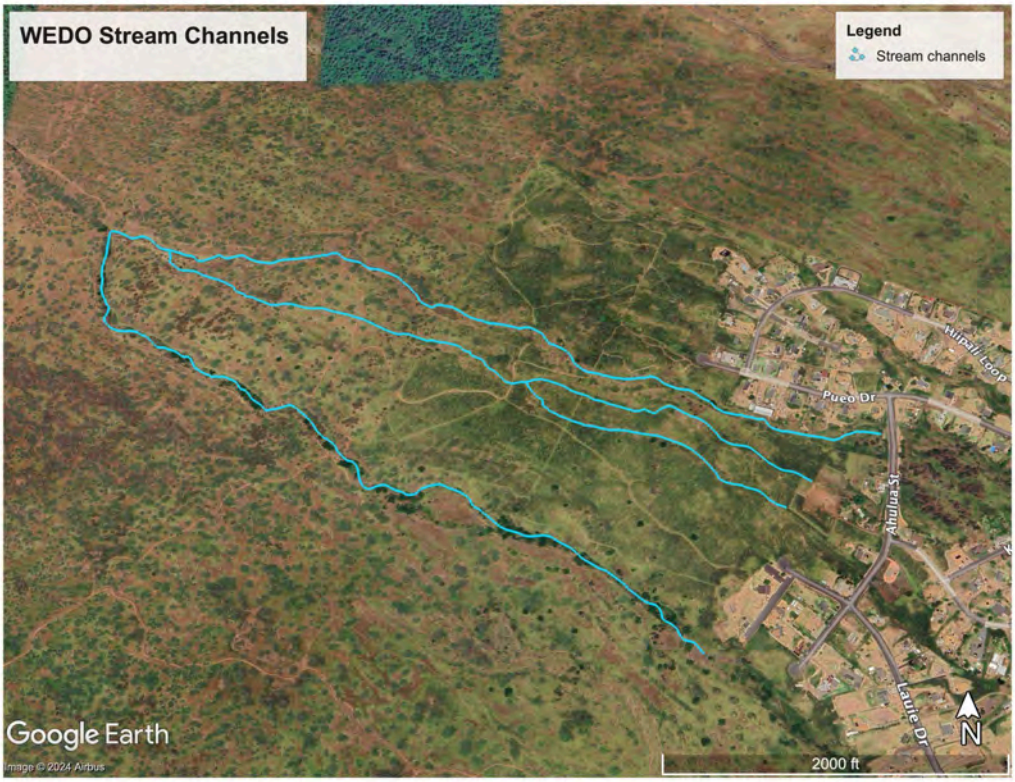


Figure 10. Stream channels mapped during the field survey of WEDO PA.

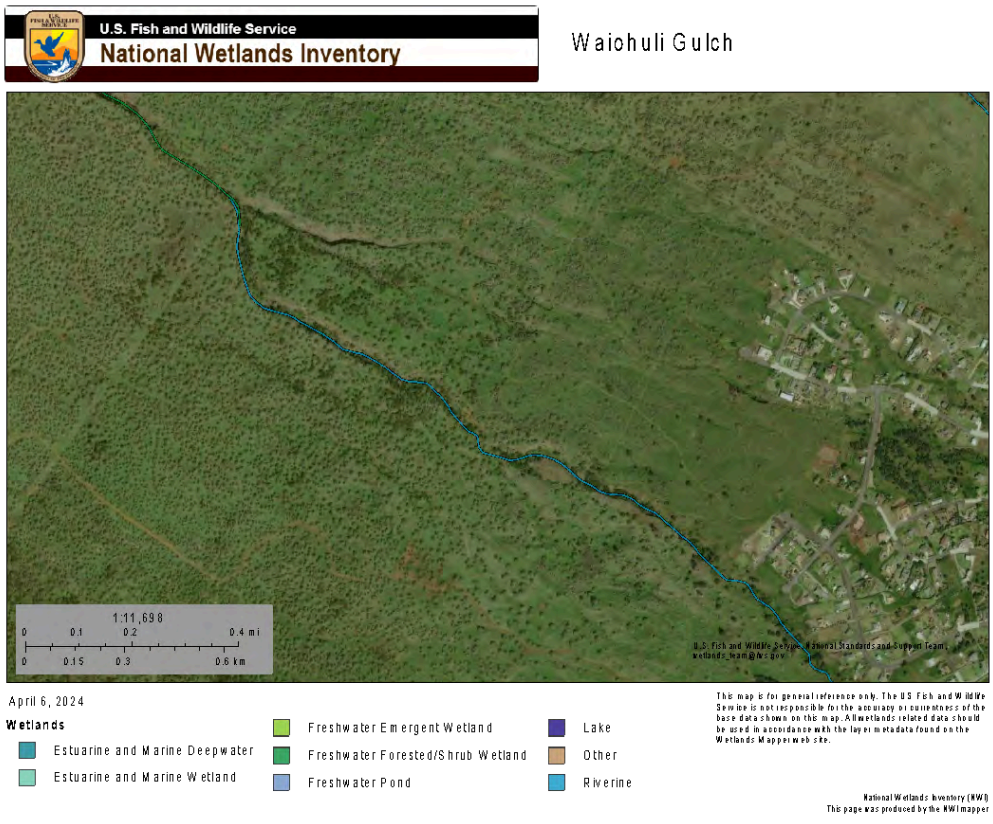


Figure 11 Waiohuli Gulch mapped as Riverine NWI 2024 data.

Appendix A

Table 1. Plant Species Observed at the WEDO Project Area

Pteridophytes

Ferns and fern allies

Scientific Name	Common Name	Status
NEPHROLEPIDACEAE		
Nephrolepis brownii (Desv.) Hovenkamp & Miyam.		Nat
PTERIDACEAE		
***Doryopteris decipiens* (Hook.) J.Sm.**	**kumuniu, ʻiwaʻiwa**	**End**
Pellaea ternifolia (Cav.) Link	**kalamoho**	**Ind**
Pityrogramma austroamericana Domin	gold fern	Nat
THELYPTERIDACEAE		
Christella dentata (Forssk.) Brownsey & Jermy	downy wood fern	Nat

Monocotyledons

ASPARAGACEAE		
Furcraea foetida (L.) Haw.	Mauritius hemp	Nat
CYPERACEAE		
Cyperus rotundus L.	nut grass	Nat
POACEAE		
Axonopus fissifolius Raddi Kuhlm.	narrow-leaved carpetgrass	Nat
Bothriochloa pertusa (L.) A.Camus	pitted beardgrass	Nat
Cenchrus ciliaris L.	buffelgrass	Nat
Cenchrus purpureus (Schumach.) Morrone	elephant grass	Nat
Chloris barbata Sw.	swollen fingergrass	Nat
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat
Digitaria insularis (L.) Mez ex Ekman	sourgrass	Nat
Megathyrsus maximus (Jacq.) B.K. Simon & W.L. Jacobs	Guinea grass	Nat
Melinis minutiflora P.Beauv.	molasses grass	Nat
Melinis repens (Willd.) Zizka	Natal redtop	Nat
Setaria parviflora (Poir.) Kerguelen	yellow foxtail	Nat
Urochloa mutica (Forssk.) T.Q.Nguyen	California grass	Nat

Dicotyledons

ACANTHACEAE		
Asystacia gangetica (L.) T.Anderson subsp. *gangetica*	chinese violet	Nat
AMARANTHACEAE		
Amaranthus spinosus L.	spiny amaranth	Nat
Chenopodium murale L.	goosefoot	Nat
Dysphania carinata (R.Br.) Mosyakin & Clemants	goosefoot	Nat
APIACEAE		
Ciclospermum leptophyllum (Pers.) Sprague ex Britton & P.Wilson	fir-leaved celery	Nat
Petroselinum crispum (Mill.) A.W.Hill	parsley	Nat
APOCYNACEAE		
Asclepias physocarpa (E.Mey.) Schltr.	balloon plant	Nat
ASTERACEAE (COMPOSITAE)		
Ageratina adenophora (Spreng.) R.M.King & H.Rob.	Maui pāmakani	Nat
Bidens pilosa L.	Spanish needle	Nat
Conyza bonariensis (L.) Cronq.	hairy horseweed	Nat
Crassocephalum crepidioides (Benth.) S. Moore	redflower ragweed	Nat
Emilia fosbergii Nicolson	pualele	Nat
Emilia sonchifolia (L.) Raf. var. *sonchifolia*	Flora's paintbrush	Nat
Lactuca sativa L.	prickly lettuce	Nat
Parthenium hysterophorus L.	false ragweed	Nat
Pluchea carolinensis (Jacq.) G. Don	sourbush	Nat
Senecio madagascariensis Poir.	fireweed	Nat
Sonchus oleraceus L.	sow thistle	Nat
Tridax probumbens L.	coat buttons	Nat
Verbesina encelioides (Cav.) Benth.&Hook.	golden crown-beard	Nat
Youngia japonica (L.) DC.	Oriental hawksbeard	Nat
Zinnia peruviana (L.) L.	pua pihi	Nat
BIGNONIANACEAE		
Jacaranda mimosifolia D.Don	jacaranda	Nat
BRASSICACEAE		
Capsella bursa-pastoris (L.) Medik.	shepard's purse	Nat
CACTACEAE		
Opuntia ficus-indica (L.) Mill.	prickly pear, panini	Nat

CONVOLVULACEAE		
Distimake aegyptius (L.) Simoes & Staples	hairy merremia	Nat
Ipomoea alba L.	moon flower	Nat
***Ipomoea indica* (J. Burm.) Merr.**	**koali ʻawa, koaliʻawahia**	**Ind**
Ipomoea triloba L.	little bell	Nat
CRASSULACEAE		
Kalanchoe tubiflora (Harv.)	chandelier plant	Nat
CUCURBITACEAE		
Cucumis dipsaceus Ehrenb. ex Spach	hedgehog gourd	Nat
Momordica charantia L.	balsam pear	Nat
***Sicyos pachycarpus* Hook. & Arn.**	**kūpala, ʻānunu**	**End**
EUPHORBIACEAE		
Euphorbia hirta L.	garden spurge	Nat
Euphorbia prostrata Alton	prostrate spurge	Nat
Ricinus communis L.	castor bean	Nat
FABACEAE		
Acacia mearnsii De Willd.	black wattle	Nat
Chamaecrista nictitans (L.) Moench	partridge pea	Nat
Crotalaria pallida Aiton	smooth rattlepod	Nat
Desmanthus pernambucanus (L.) Thell.	slender mimosa	Nat
Desmodium triflorum (L.) DC.	tick clover	Nat
***Erythrina sandwicensis* O.Deg.**	**wiliwili**	**End**
Glycine microphylla Tindale	small-leaf glycine	Nat
Leucaena leucocephala (Lam.) de Wit subsp. *leucocephala*	koa haole	Nat
Macroptilium atropurpureum (DC.) Urb.	twining cow pea	Nat
Mimosa pudica L. var. unijuga (Duchass. & Walp.) Griseb.	sensitive plant	Nat
Prosopis pallida (Humb.&Bonpl.)ex Willd. Kunth	kiawe, mesquite	Nat
Vachellia farnesiana (L.) Wight&Arn.	klu	Nat
GERANIACEAE		
Erodium cicutarium (L.) LʻHer.	alfilaria, pin clover	Nat
MALVACEAE		
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	Nat
Malva parviflora L.	cheese weed	Nat
Malvastrum coromandelianum (L.) Garke	false mallow	Nat
***Sida fallax* Walp.**	**ʻilima**	**Ind**
Sida rhombifolia L.	Cuba jute	Nat
Triumfetta semitriloba Jacq.	Sacramento bur	Nat
MELIACEAE		
Melia azedarach L.	chinaberry	Nat

OXALIDACEAE		
***Oxalis corniculata* L.**	**yellow wood sorrel**	**Ind?**
PAPAVERACEAE		
Argemone mexicana L.	Mexican poppy	Nat
PASSIFLORACEAE		
Passiflora subpeltata L.	white passionflower	Nat
PHYLLANTHACEAE		
Phyllanthus debilis Klein ex Willd.	niruri	Nat
PLUMBAGINACEAE		
***Plumbago zeylanica* L.**	**ilieʻe**	**Ind**
PORTULACACEAE		
Portulaca oleracea L.	pigweed	Nat
Portuaca pilosa L.		Nat
ROSACEAE		
Rubus argutus Link	prickly Florida blackberry	Nat
Rubus rosifolius Sm.	thimbleberry	Nat
SAPINDACEAE		
***Dodonaea viscosa* Jacq.**	**ʻaʻaliʻi**	**Ind**
SCROPHULARIACEAE		
Buddleja asiatica Lour.	butterfly bush	Nat
SOLANACEAE		
Nicotiana glauca Graham	tree tobacco	Nat
Solanum linnaeanum Hepper & P.M.L.Jaeger	apple of Sodom	Nat
STERCULIACEAE		
***Waltheria indica* L.**	**ʻuhaloa**	**Ind?**
VERBENACEAE		
Lantana camara L.	lantana	Nat

Legend to Table 1

STATUS = distributional status for the Hawaiian Islands:

- **End**= endemic; native to Hawaiʻi, unique to Hawaiian Islands.
- **Ind** = indigenous; native to Hawaiʻi, but not unique to the Hawaiian Islands.
- **Ind?**= questionably indigenous to Hawaiʻi, data is unclear as to the exact arrival in 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.

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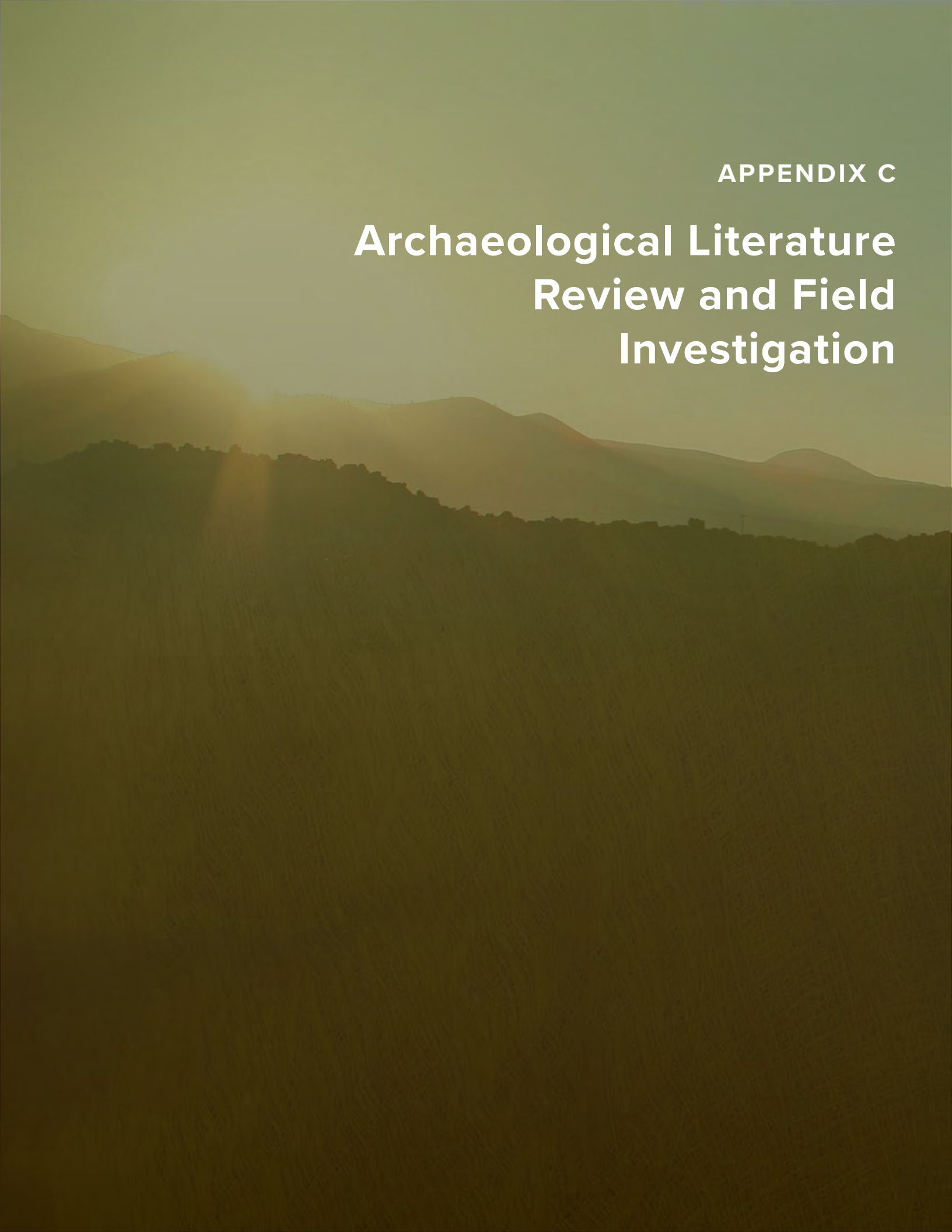

APPENDIX C

Archaeological Literature Review and Field Investigation

SCS Project 2973 LRFI-1.1

ARCHAEOLOGICAL LITERATURE REVIEW AND FIELD INSPECTION FOR WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO) PROJECT IN WAIOHULI AHUPUA‘A, MAKAWAO (KULA) DISTRICT, ISLAND OF MAUI, HAWAI‘I [TMK: (2) 2-2-002:014 por. and (2) 2-2-028:181 por.]

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INTRODUCTION

At the request of Pueo Development LLC (project proponent), and on behalf of the Department of Hawaiian Home Lands (DHHL) (landowner), Scientific Consultant Services, Inc. (SCS), has prepared this archaeological Literature Review and Field Inspection (LRFI) for the Waiohuli Economic Development Opportunities (WE DO) project in Waiohuli Ahupuaʻa, Makawao (Kula) District, Island of Maui [tax map key (TMK): (2) 2-2-002:014 portion (por.) and (2) 2-2-028:181 por.]. The project area is shown on portions of a U. S. Geological Survey (USGS) topographical map, a TMK map, and a Google Earth aerial photograph (Figures 1 through 3).

The proposed project encompasses an area of 150 acres within the State of Hawaii Department of Hawaiian Home Lands (DHHL) Kēōkea-Waiohuli Subdivision. This area is planned for further subdivision and development to support a mix of uses, including residential lots, *kūpuna* (elderly; *lit*. ancestor, grandparent) housing, a solar farm, and community resource centers.

This report is not intended to meet HAR §13-276 requirements for an Archaeological Inventory Survey (AIS) but aims to identify potential cultural resources in the project area and its vicinity and to provide in brief the history of relevant archaeological research in Waiohuli Ahupuaʻa. Thus, the scope of work for the current investigation includes the following:

- Literature review consisting of a study of previous archaeological reports pertaining to the project area and its vicinity. This research is conducted in order to determine what type of archaeological sites have been recorded in the project area environs, broadly construed, and what features or sites are likely to be documented on the subject property or the terrain adjacent to it, if any.

- Field inspection via pedestrian survey of the project area. This inspection is conducted in order (1) to identify any surface archaeological features and (2) to investigate and assess the potential for impact to such sites. This assessment will also identify any sensitive areas that may require further investigation or mitigation before work on the project proceeds.

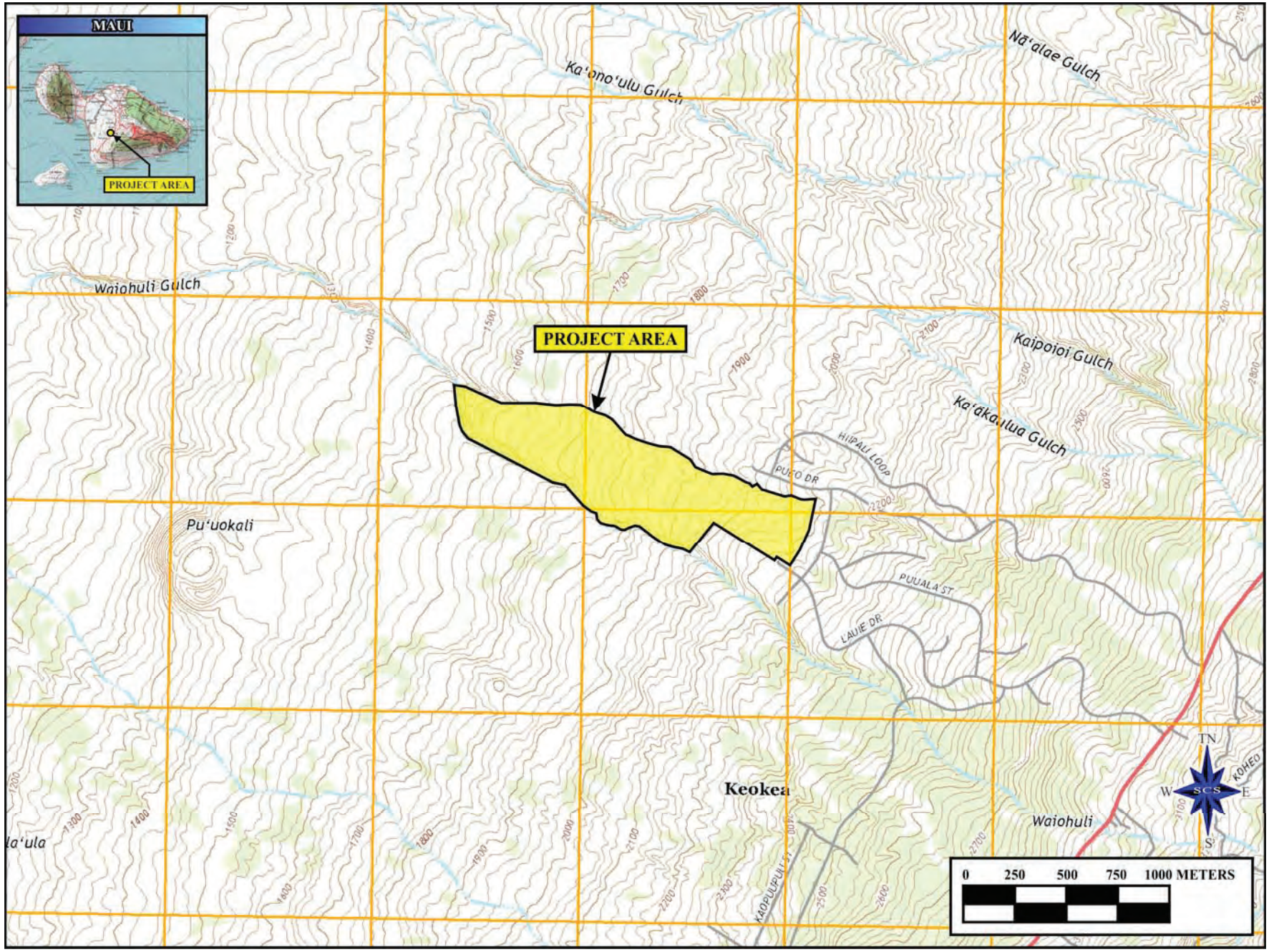

Figure 1: A portion of a 2017 USGS topographic map (Wailuku quadrangle) showing the project area location

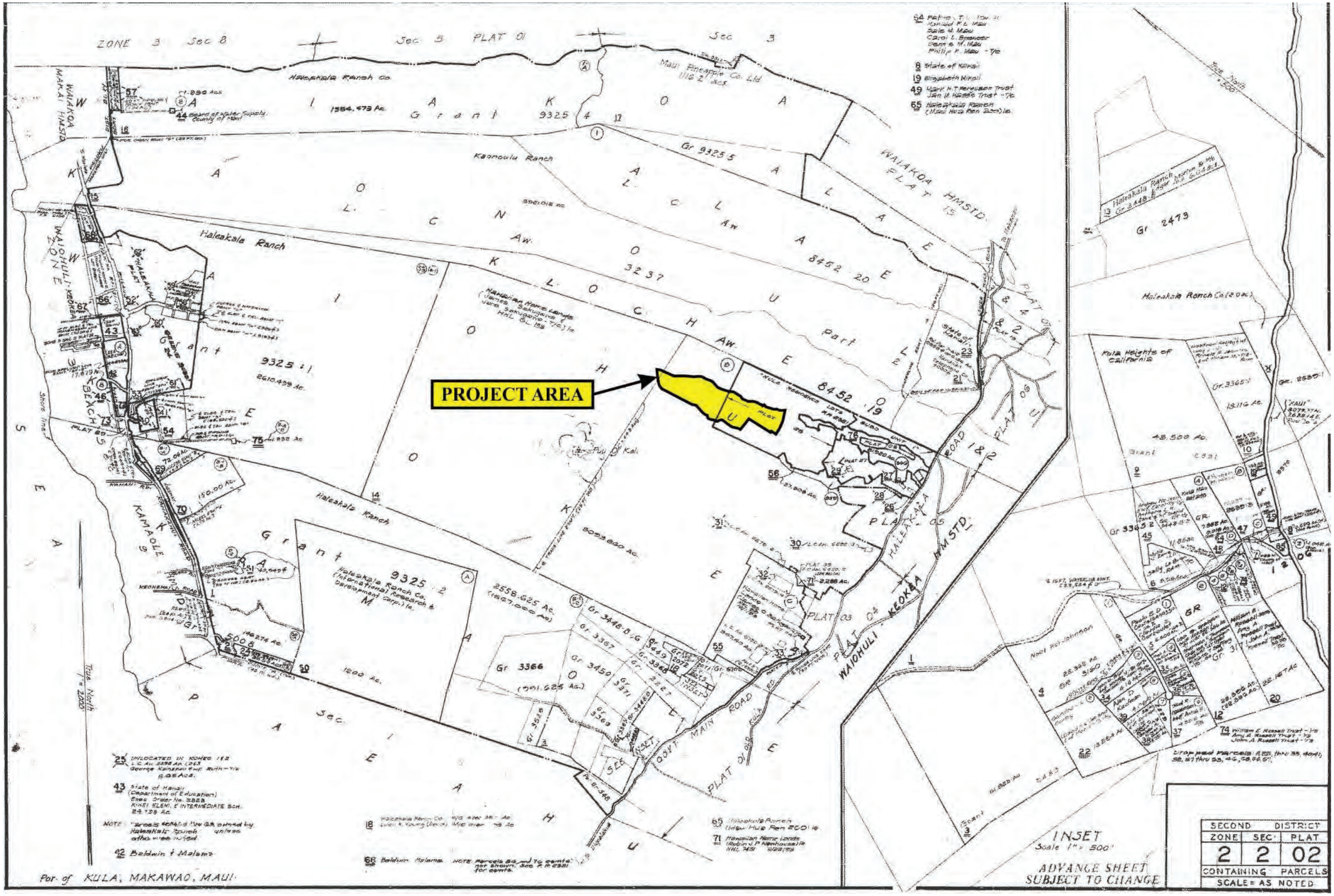

Figure 2: TMK map showing the location of the project area in the context of TMK plat: (2) 2-2-002 (County of Maui Property Assessment Division 2008a). Note that the map may not be drawn to scale.

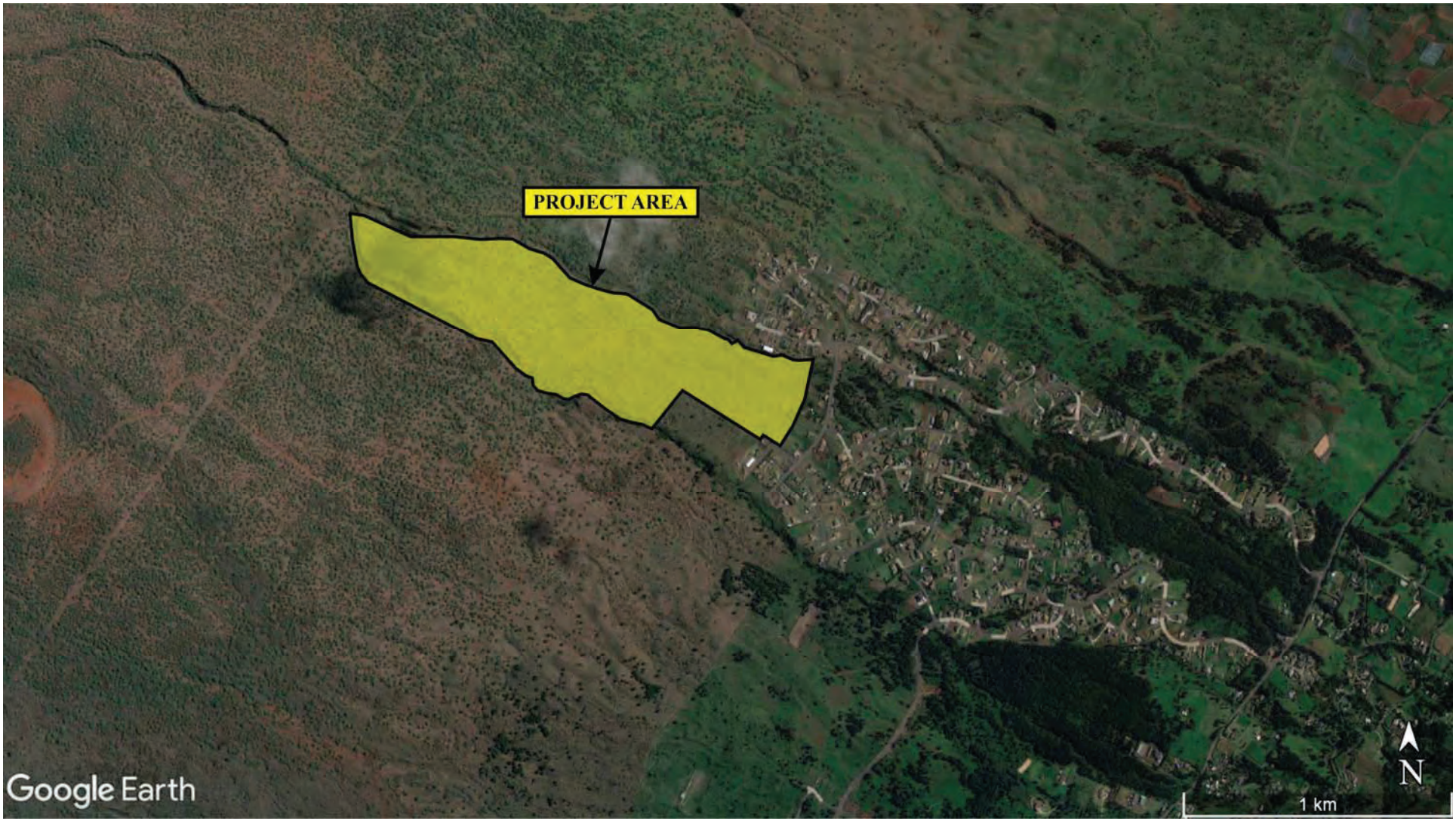

Figure 3: Google Earth aerial photograph (imagery date: 6/15/2019) showing the location of the project area

ENVIRONMENTAL SETTING

GEOLOGY AND TOPOGRAPHY

Maui is the second largest island of the Hawaiian Archipelago. It has been formed by two volcanoes: the older and smaller Mauna (mountain) Kahālāwai ("house of waters") on the western end and the younger and larger Haleakalā ("house of the sun") to the east. The former reaches 1,754 meters (5,788 ft) above mean sea level (amsl) at Puʻu Kukui ("candlenut peak"), the latter soars to 3,055 m (10,023 ft) amsl at Puʻu ʻUlaʻula ("red peak"). The Isthmus of Maui that joins the two volcanoes was formed by erosional deposits from Haleakalā against the slopes of Mauna Kahālāwai (Macdonald et al. 1986:380). Mauna Kahālāwai's drier southern and western slopes make up the majority of West Maui, while its east face and the Isthmus make up Central Maui. Haleakalā's eastern slopes constitute East Maui, while its elevated areas constitute Upcountry Maui. The northern coastline of Haleakalā is Maui's North Shore, while the sunny coastline from Māʻalaea Bay to Kaupō is South Maui. Elevation in the project area, located in Upcountry Maui, ranges from 448 to 646 m amsl.

LOCATION

The 150-acre project area [TMK: (2) 2-2-002:014 por. and (2) 2-2-028:181 por.] does not yet have a street address, but the adjacent Waiohuli Community Center [TMK: (2) 2-2-028:152] is located at 881 Lauiʻe Drive. The project area is bounded on east the east, and partially on the north and south, by an existing residential area [TMK: (2) 2-2-028] that includes the aforementioned community center. The rest of the project area is surrounded by as yet undeveloped DHHL lands.

The project area is located in the Census Designated Place (CDP) of Keokea and the judicial district of Makawao (Hawaii State Office of Planning 2021b, c). Addresses in the State of Hawaii typically use CDP in place of city or town, and local residents commonly use CDP names colloquially to describe places. Therefore, the project area might be referred to as located in Kēōkea, even though it is in the contemporary Waiohuli, rather than Kēōkea Ahupuaʻa (Hawaii State Office of Planning 2021a). It may also be referred to as located in "Kula" (*lit*. "plain, field"), a general name for the western uplands of East Maui (see Traditional Political Boundaries below) or in Upcountry Maui.

CLIMATE

With the prevailing winds blowing from the northeast, the project area could fall into the rain shadow of Haleakalā, as it is located on the southwestern slopes of that mountain. However, because of its elevation, it benefits from somewhat increased precipitation due to orographic lift. This suggests that the project area should expect moderate rainfall.

Mean annual rainfall over the project area is 514 mm (20.2 in) (Giambelluca et al. 2014). Most of it occurs over the winter and spring months, with mean monthly rainfall peaking at 95.3 mm (3.75 in) in January. The summer months are dry, with the lowest monthly average rainfall of 15.7 mm (0.62 in) in August (Giambelluca et al. 2014).

Average annual air temperature in the project area is 20.0 °C (67.9 °F). August is the hottest month with an average of 21.9 °C (71.4 °F), while February is the coolest with an average at 17.9 °C (64.3 °F) (Giambelluca et al. 2014).

HYDROLOGY

The State of Hawaii Division of Aquatic Resources (Parham et al. 2008) does not include the project area in any watershed on account of the lack of perennial streams in Kula or Upcountry Maui. The State of Hawaii Commission on Water Resource Management places the project area within the Hapapa Watershed (Hawaii State Office of Planning 2023), which includes the Waipuʻilani Gulch that runs along the southern border of the project area. The non-perennial stream that flows through this gulch is called Waipuʻilani Stream (Hawaii State Office of Planning 2022). Since the watercourse is non-perennial, it is not a reliable water source for the region. Pre-Contact, the Kēōkea area was watered by fog drip, but Post-Contact deforestation has removed this as a source of moisture, causing the area to become more dry (Vora 1998:87).

SOILS

According to Foote et al. (1972: Map Sheet 104) and the U. S. Department of Agriculture Natural Resource Conservation Service, and University of California, Davis California Soil Resource Lab (2017), the project area is located in a region of soils of the Iao Series, specifically Kamaole very stony silt loam, 3 to 15 percent slopes (KGKC). Figure 4 is a soil map of the project area and its vicinity, and Table 1 is a list of soil types shown on that figure.

Foote et al. (1972:59) describe the Kamaole Series as consisting "of well-drained soils on uplands" that are "developed in volcanic ash." KGKC is described as having moderate permeability, slow-to medium runoff, and slight-to-moderate erosion hazard, with roots that in some places "penetrate to a depth of 2 feet [0.6 m]" (Foote et al. 1972:59). KGKC was historically "used for pasture and wildlife habitat" (Foote et al. 1972:59).

Table 1: Soil type abbreviations used in the soil map (Figure 4 below)

Map	Full Soil Name	Map	Full Soil Name
IaA	Iao silty clay, 0 to 3 percent slopes	PZUE	Puuone sand, 7 to 30 percent slopes
IbB	Iao cobbly silty clay, 3 to 7 percent slopes	rRR	Rough broken land

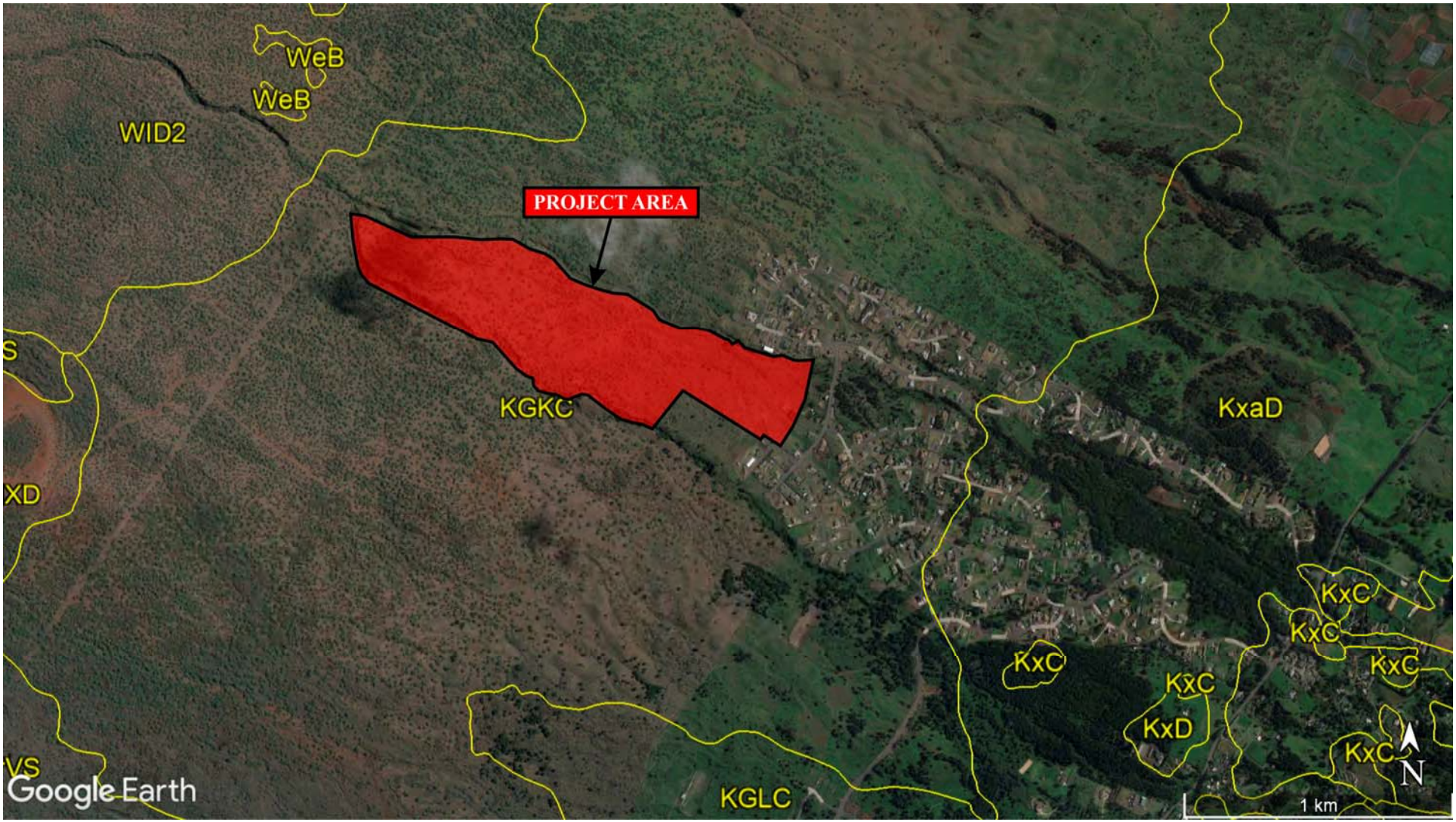

Figure 4: Google Earth aerial photograph (imagery date: 6/15/2019) showing the soil series in the project area and in its vicinity (U. S. Department of Agriculture Natural Resource Conservation Service, and University of California at Davis Soil Resource Lab 2017)

VEGETATION

According to Juvik and Juvik (1998:122, 127–28) before human settlement the native ecosystem of the area would have been "lowland dry and mesic forest, woodland, and shrubland." Indigenous flora that may persist in this environment include *ʻaʻaliʻi* (hopbush, *Dodonaea viscosa*), *ʻākia* (*Wikstroemia* sp.), *ēlama* (*Diospyros hillebrandii*), *kāwelu* (variable lovegrass, *Eragrostis variabilis*), *koa* (*Acacia koa*), *koʻokoʻolau* (*Bidens* sp.), *ʻohiʻa* (*Metrosideros macropus*), *pili* (black speargrass, *Heteropogon contortus*), *ʻūlei* (Hawaiian hawthorn *Osteomeles anthyllidifolia*), and *wiliwili* (*Erythrina sandwicensis*). The project area is near the transition to another ecosystem at higher elevation which Juvik and Juvik (1998: 122, 126) classify as "montane dry and mesic forest and woodland." Notable native plant species persisting in this ecosystem include *ʻōhiʻa lehua* (*Metrosideros polymorpha*), *koa* (*Acacia koa*), *māmane* (*Sophora chrysophylla*), and Hawaiʻi alpine hairgrass (*Deschampsia nubigena*).

HISTORICAL SETTING

TRADITIONAL POLITICAL BOUNDARIES

Tradition has it that Maui was divided into *moku* (districts) and *ahupuaʻa* (subdistricts) by the *kahuna* (priest) Kalaihaʻōhia at the time of Kakaʻalaneo at the end of the 15th or the beginning of the 16th century (Beckwith 1970:383; Fornander 1919-20, Vol. 6:248). The etymology of the word *ahupuaʻa* may be traced to the practice of marking subdistrict boundaries with "a heap (*ahu*) of stones surmounted by an image of a pig (*puaʻa*), or of laying a pig or other tribute on the altar as a tax to the chief" (Pūkuʻi et al. 1986:9). These divisions provide access to ecosystems at various elevations, incorporating natural resources from the ocean to the mountain peaks (Lyons 1875a:111), and many are still commonly used to refer to locations despite the changes in land tenure (Sterling 1998:3). *Ahupuaʻa* were often subdivided into smaller portions of *ʻāina* (land) called *ʻili* (*lit*. surface, area) or *ʻiliʻāina* administered by *aliʻi* (chiefs) acting as *konohiki* (head man of a land division) to more powerful *aliʻi*, but unlike the larger units the *ʻili* were not meant to encompass a broad selection of resource areas (Lyons 1875b:33; Lucas 1995:40). *ʻIli kūpono* (sometimes shortened to *ʻili kū*), were a type of *ʻili* that were independent from the *ahupuaʻa* they were located within and were run by an *aliʻi* who answered to a higher ranking *aliʻi* (often the ruler of the district or island), rather than to the *aliʻi* who ruled the *ahupuaʻa*. Finally, the *moʻo* (*lit*. small fragment) or *moʻoʻāina* were narrow strips of land within an *ʻili*. The land holding of a *hoaʻāina* (tenant) under an *aliʻi* was called a "*kuleana*" (right, privilege), a term that also came to mean "property" or "title" (Lucas 1995:61). Note that these land divisions are generalized, and the actual place names used in Pre- and Early Post-Contact Hawaiʻi did not always fall within neat categories. Gonschor and Beamer (2014:56) note that other land divisions such as *ʻokana* and *kalana* were in use, with attempts to standardize land divisions occurring well after Contact.

Usage of place names was often inconsistent in the records remaining from the Kingdom of Hawaii, and contemporary maps using *ahupua‘a* as drawn by the State of Hawaii do not necessarily match even those records. Attempts to re-construct traditional boundaries, such as Kamehameha Schools' (n.d.) *Aloha ‘Āina Project* and Juan Wilson's (2014) map project for the Aha Kiole Advisory Committee (Aha Moku Council), often show a Kalepolepo Ahupua‘a that is not included among the contemporary *ahupua‘a* of Maui. The Kamehameha Schools (n.d.) map gives the same border between Kēōkea and Waiohuli Ahupua‘a as the contemporary State of Hawaii boundaries, but places Kalepolepo Ahupua‘a in the northern portion of contemporary Waiohuli Ahupua‘a, where the project area is located. While Pre-Contact boundaries for *ahupua‘a* cannot be determined with any great precision, it is possible that the project area would have fallen within Kalepolepo rather than Waiohuli Ahupua‘a by traditional reckoning. Both *ahupua‘a* were part of the traditional Kula Moku. Kula Moku occupies the central dry plain of Maui, as the word *kula* (plain) describes the open country in the middle of the island. The name "Waiohuli" translates as "water of change," and "Kalepolepo" as "the dirt" (Pūku‘i et al. 1974:77, 226).

PRE-CONTACT SETTLEMENT AND ECONOMY

Archaeological data indicate that the initial settlement of the Hawaiian Islands by Polynesians occurred on the windward shores around the 10th century, with populations gradually extending into less resource rich areas in later periods (Kirch 2011:22). It is likely that settled human presence in the project area can be traced to the early period of agricultural development, which on Maui began approximately 1200 (Kirch 1985:142).

Pre-Contact Hawaiian economy was based on agricultural production, marine exploitation, and raising livestock, in addition to collecting wild plants and birds. Patrick Kirch (1985:3) notes that the economy was productive and diverse enough to support "considerable craft specialization … canoe-makers, adz-makers, bird-catchers, wood-carvers and tattooing experts." This description suggests a sophisticated society with a bounty of both surplus food and spare labor to support considerable non-subsistence activities. Settlements were often concentrated in river valleys most amenable to wet *kalo* (taro, *Colocasia esculenta)* cultivation, incorporating *lo‘i* (pond field, irrigated terrace) and irrigation canals. Areas with higher precipitation permitted cultivation of *kō* (sugarcane, *Saccharum officinarum*) and *mai‘a* (banana, *Musa* spp.). Dryland agriculture centering on *‘uala* (sweet potato, *Ipomoea batatas*) as the staple crop was also prevalent, especially in upland regions and on the drier leeward sides of the islands. Indeed, Edward S.C. Handy and Elizabeth G. Handy report that Kula Moku "was widely famous for its sweet-potato plantations: "*‘Uala* was the staple of life here" (1972:511).

According to the model presented by Michael Kolb et al. (1997), dryland agriculture near the upland forests was a key component of Kula Moku's economy. It was typically characterized by regular rotation of crops and heavy dependence on rainfall for irrigation while using stone and earthen embankments extensively (Kolb et al. 1997:6). These traditional practices were well adapted to the drier conditions and lack of perennial streams in the leeward uplands. In *Native Planters in Old Hawaii*, Edward and Elizabeth Handy (1972) write:

> Where potatoes are planted in crumbling lava with humus, as on eastern Maui and in Kona, Hawaii, the soil is softened and heaped carelessly in little pockets and patches using favorable spots on slopes. The crumbling porous lava gives ample aeration without much mounding. [Handy and Handy 1972:131]

Fishing was also a major part of the Pre-Contact economy in coastal Kula. Several fishponds, at Kēōkea Kai, at Waiohuli Kai, and to the north at Kalepolepo, suggest the importance of marine resources to Kula Moku (Colin et al. 2000:11). In *The Hawaiian Planter*, Edward Handy (1940) notes:

> On the south side of western Maui the flat coastal plain all the way from Kīhei and Ma'alaea to Honokahua, in old Hawaiian times, must have supported many fishing settlements and isolated fishermen's houses, where sweet potatoes were grown in the sandy soil or red lepo [soil] near the shore. For fishing, this coast is the most favorable on Maui, and, although a considerable amount of taro was grown, I think it is reasonable to suppose that the large fishing population, which presumably inhabited this leeward coast, ate more sweet potatoes than taro with their fish. [Handy 1940:159]

Elspeth Sterling (1998) includes the waters near Kīhei among a list of favorable offshore fishing areas, but also relates a surviving oral tradition that suggests that the people of upland Kula were inexperienced with fishing techniques. Sterling quotes a chant including the following lines:

> *He aina o Kula ua kaulana*
> *Mai na ali'i kahiko*
> *He aina i piha ka e'epa*
> *Kau na nahi i ka pikopiko i ka he'e*
>
> Kula is a land that is famous
> From the days of the ancient chiefs
> A land full of peculiarities
> For the scaling of the suckers of the octopus. [Sterling 1998:243]

The inhabitants of Kula Moku were also reputed to have the ability to carve wooden canoe paddles while lacking knowledge of how to properly employ them to row. Sterling (1998:243) concludes that "*these sayings about the Kula people are because they lived so far from the sea that they were not familiar with the ways of the seashore and therefore appeared stupid*. [emphasis in original]" While there certainly was substantial exploitation of maritime resources along the coast, it is likely that a significant portion of the population was concentrated in upland regions, and these stereotypes were attributed to upland dwellers who did not have much contact with the ocean. Kolb et al. (1997:26) also noted that Kula was considered an excellent location for pig husbandry. It was important enough to provoke a rebellion when a minor chief appointed to oversee the herds of Kula's paramount chief attempted to appropriate all pigs not only in Kula but in the neighboring *moku* as well (Kamakau 1992:142).

PRE-CONTACT POLITICAL HISTORY

Settled by the 10th century, Maui's subsequent population growth and the increase in social stratification allowed the formation of political blocs managed by larger and more complex societies. Michael Kolb et al. (1997:14–15) refer to 1200–1400 as a formation period, noting that the archaeological record shows the building of temples in this timeframe, which is an indicator of sizeable populations and complex organization. By the 1400s, Maui had largely consolidated into two polities: one in Hāna on windward East Maui, and one ruled at different times from Wailuku on the eastern shore of West Maui, or from Lāhainā on the western. Abraham Fornander (1880, Vol. 2:78–79) says that the *aliʻi* of East Maui traced their origins to Kalahuimoku, a Hawaiʻi Island chief who had emigrated to Hāna, while those in West Maui originate from an older Maui line.

Wailuku *aliʻi* Piʻilani is credited with not only unifying Maui, but also with increasing its political status using his connections with the reigning chiefly families of Oʻahu and Hawaiʻi (Fornander 1880, Vol. 2:87). Samuel Kamakau (1992:22–24) relates the *moʻolelo* (story, oral history) of the succession fight between Piʻilani's sons Lono-a-Piʻilani and Kiha-a-Piʻilani. After quarreling between the brothers escalated to violence, Kiha traveled to Hawaiʻi Island, then ruled by his brother-in-law ʻUmi-a-Līloa, in order to convince ʻUmi to send an army to Maui to dethrone Lono. Fornander (1918-19, Vol. 5:178–80) claims that the invasion was known in the oral tradition as the "sailing of the numberless canoes" since they were said to stretch across the Maui channel from Kohala on Hawaiʻi Island, allowing ʻUmi's army to march across them as if on a bridge. According to Kamakau (1992:28–30), while this invasion represented a massive logistical effort involving a "whole year of the making of canoes and war implements," multiple landing attempts failed before a successful invasion at Wailua-iki installed Kiha as Maui's sole ruler. Kiha also oversaw the completion of a stone-lined path begun by his father and named "Ala Loa" (long road) or "King's Trail," which circled the entire island (Beckwith 1970:387).

This *moʻolelo* show the consolidation of political power as rulers of larger and more populous domains had the resources to project military power interisland and command massive infrastructure projects. Patrick Kirch (2010:102) argues that these oral traditions also signify a transition in the political tradition, as the *aliʻi nui* (great chiefs) acquired "direct control over economic production." "Prior to the advent of these powerful rulers," Kirch (2010:102) claims, "*aliʻi nui* … occupied roles that were more ceremonial in nature."

Cummins Speakman (1978:9–13) records that while Maui Island remained politically unified under the line of Piʻilani, the precedent of wars of succession had been established and such wars would recur in the 18th century, when Maui's increasing political and military power gave rise to military rivalry between its *aliʻi* and those of Hawaiʻi Island. Kamakau (1992:68) notes that even though it "was the custom from ancient times … for the chief of one island to give a child to the chief of another island," this practice did not prevent fighting between the rulers. The *aliʻi* Alapaʻi (also called Alapaʻinui; died 1754) was raised in Wailuku at the court of Piʻilani's descendant Kekaulike (c. 1700–1736). After the death of his uncle and chief of Hawaiʻi Island Keaweʻīkekahialiʻiokamoku (c. 1665–1725), Alapaʻi returned there and won the civil war to succeed him. Despite having fostered Alapaʻi, Kekaulike fought against him frequently, limiting the latter's ability to consolidate control over Hawaiʻi Island (Kamakau 1992:65).

When Kekaulike died, right after returning from a raid on Kohala on Hawaiʻi Island, he was succeeded by Kamehameha-nui, the son of a half-sister of Alapaʻi. Arriving on Maui bent on retaliation for the raid, Alapaʻi instead had "a friendly meeting" with his sister and her son (Kamakau 1992:70). Subsequently, Kamehameha-nui faced a civil war with his older half-brother, Kaʻuhi, and Alapaʻi lent his support to his nephew (Fornander 1880, Vol. 2:141). Kamehameha-nui eventually defeated Kaʻuhi and established his reign over Maui (Kamakau 1992:74). Kamehameha-nui's successor was his brother Kahekili II (c. 1737–1794), who eagerly attempted to expand his kingdom, waging war on Oʻahu and challenging the rule of Hawaiʻi *aliʻi* Kalaniʻōpuʻu (c. 1729–1782), who had usurped Alapaʻi's son.

EARLY POST-CONTACT HISTORY

The Post-Contact Period on Maui began on November 26, 1778, with British Explorer Captain James Cook's passing by the island on his way back from the extreme Northern Pacific (Daws 1974:8). David Samwell, a surgeon on the *Discovery* (one of Cook's ships), described the north coast of Maui: "This Island is mountainous, the sides of the Hills are covered with Trees, from thence to the Water side are large open plains on which stand their houses & where they have their plantations of sweet potatoes, Taroo (*sic*) & c." (Beaglehole 2017:1151–52).

Cook's visit occurred in the wake of a war between Hawai‘i Island *ali‘i* Kalani‘ōpu‘u and Maui's Kahekili II (circa 1737–1794), a descendant of Pi‘ilani (Speakman 1978:26). Samwell also recorded his impressions of Kahekili as "a middle aged man ... rather of a mean appearance" (Beaglehole 2017:1151).

At first, the internal affairs on Maui proceeded independently of any significant Western influence. The island reached the height of its political influence under Kahekili II who in addition to his native island was also able to bring O‘ahu, Lāna‘i and Moloka‘i under his rule. Kahekili also exerted hegemony over Kaua‘i through family ties, *de facto* unifying all major islands except for Hawai‘i by 1783. Nonetheless, the warring *ali‘i* soon found ways to acquire gunpowder weapons and even recruit foreigners to operate them. Captain George Vancouver (1757–1798) noted that by the time of his own voyages as a captain in the 1790s (rather than when he had sailed as a junior officer under Cook), there was an active firearms trade in the Hawaiian Islands. Speakman and Rhoda Hackler (1989) write:

> Vancouver was also concerned about the apparent drop in the Hawaiian population since his earlier visit with Captain Cook. He acknowledged the fact that foreigners were no longer a novelty, able to attract great crowds of curious Hawaiians to the beach, but he doubted if that was the complete answer to the evident depopulation….
>
> Vancouver does not seem to have been conscious of disease among the Hawaiian people, but he was aware of the arms trade and interisland warfare and attributed the decrease in the population to the deplorable sale of arms by avaricious European traders to "ambitious and enterprising chieftains." [Speakman and Hackler 1989:42]

Hawai‘i Island *ali‘i* Kamehameha I (r. 1782–1819), who had usurped the son of Kalani‘ōpu‘u, had acquired a significant arsenal of foreign gunpowder weapons, including a canon (called "Lopaka"), which may have allowed him to win a major battle in 1790 at Wailuku. Traces of this conflict were present as late as 1854:

> These sand-hills constitute a huge "Golgotha" for thousands of warriors who fell in ancient battles. In places laid bare by the action of the winds, there were human skeletons projecting, as if in the act of struggling for resurrection from their lurid sepulchers. In many portions of the plain who cart-loads were exposed in this way. Judging of the numbers of the dead, the contest of the old Hawaiians must have been exceedingly bloody. [Bates 1854:313–14]

The battle was called "Kepaniwai ("the damming of waters" – since the many dead bodies temporarily blocked ʻIao Stream) or "Kaʻuwaʻupali" ("clawed off the cliff" – for the many who died by falling down the precipices). The defeated *aliʻi* were able to flee over a mountain trail to Olowalu Ahupuaʻa on the opposite side of the West Maui Mountains, from which they could travel to Molokaʻi and then Oʻahu (Fornander 1918-19, Vol. 5:470; Kamakau 1992:148–49). One party of *aliʻi* making this trek included Kahekili's sister Kalola and several younger female relatives of high rank, with whom Kamehameha caught up with on Molokaʻi (Kamakau 1992:149). Securing marriages with these young noblewomen (including Keōpūolani, the mother of Kamehameha's heirs Liholiho and Kauikeaouli) significantly bolstered his legitimacy as a ruler since he was not of the highest *aliʻi* rank. Because of this, Kamehameha's dynasty could claim lineage of the highest *nīʻau piʻo* (brother-sister pairing) rank (Tregaskis 1973:166, 201).

Kamehameha's bid for conquest and unification, nonetheless, had to wait until Kahekili's death in 1794 and the weakening of Maui in the subsequent succession war won by Kahekili's son Kalanikūpule (1760–1795). Kamehameha I went on to defeat Kalanikūpule, first on Maui, then striking the final blow to the Kahekili line at the battle of Nuʻuanu on Oʻahu in 1795. In the following years, the chiefly Maui families were largely dispossessed of their lands unless they surrendered (Fornander 1919-20, Vol. 6:310). Kamehameha completed his unification of the islands in 1810, when Kauaʻi chief Kaumualiʻi (c. 1778–1824) formally agreed to become his subordinate (Daws 1974:43–44).

During the time of King Kamehameha I the buying and selling of produce to provision sailing ships was strictly regulated (Daws 1974:44). His successors gave into social and political pressure from the lesser chiefs, who wanted a share of the bounty, especially exotic merchandise brought in by foreign merchants. During the reign of Liholiho (Kamehameha II, r. 1819–1824), chiefs imported foreign goods on credit, promising payment in sandalwood (*Santalum*) cut from the mountains. This practice caused famine in some parts of the islands as workers levied for this task were taken away from subsistence agriculture and also exhausted the supply of sandalwood within a few decades (Rhodes and Greene 1993: Chapter V: Section H; Kuykendall 1938, Vol 1:88–92). By the time of the reign of Kauikeaouli (Kamehameha III, r. 1825–1854), free enterprise dominated commerce in the islands, and supplying the booming whaling industry had become the main non-subsistence economic activity.

The increase in foreign visitors brought new cultural ideas along with demographic changes from immigration and introduced infectious diseases. Christian missionaries not only preached their faith but also developed a writing system for the Hawaiian language.

Robert Schmitt (1973:18) records that U.S. missionaries conducted the first census of Maui in 1832, recording 1,784 persons in Kula. A subsequent census four years later counted only 1,001, suggesting substantial population decline (Schmitt 1973: 36). The native population was predisposed to Western-introduced diseases as it had no natural immunity. Thus, "an illness that was considered to be relatively mild could cause severe or fatal consequences" (Schmitt and Nordyke 2001:3). The question of the number of Hawaiians at Contact has been a controversial topic for both scholarly and ideological reasons. Schmitt (1968:43) argues that by 1850 the Hawaiian and part-Hawaiian population had fallen from approximately 300,000 in 1778 to 82,593, giving an estimate of the population at Contact on the low end of the range. On the high end, David Stannard (1989:50) estimated 800,000 to 1 million Hawaiians at time of Contact. A more recent account using the demographic methodology of "backcasting" places the number of Hawaiians in 1778 at 683,200 (Swanson 2019:208).

THE MĀHELE

In the 1840s, during the reign of Kauikeaouli, consequential changes in land tenure occurred. The change is commonly referred to as the "Māhele" (division). Prior to the changes, a *konohiki*, usually a lower ranking chief, acted as superintendent of an *ahupua'a* under a higher ranking *ali'i* and was responsible for the management of resources. After the Māhele, lands were distributed among the *ali'i*, the position of *konohiki* was replaced by a land commissioner, or "*komikina ho'on'āina*" (Lucas 1995:56).

Introducing Western style land ownership had long been advocated by foreign advisors to the *mō'ī* (king) and his *ali'i*. The five-month occupation of the islands by British naval officer George Paulet in 1843 showed that Hawaiian sovereignty was precarious, and those advisors "pointed out to Kauikeaouli that by granting others the right to own land, he would give himself the same privilege … to assign lands to his personal ownership" (Moffat and Fitzpatrick 1995:50), theoretically allowing him to retain land as private property even if national sovereignty were lost. Jon Chinen (1958:25) also notes that the *mō'ī* "did not want his lands to be considered public domain and subject to confiscation by a foreign power in the event of a conquest."

Chinen (1958:8) reports that the Board of Commissioners to Quiet Land Titles (often shortened to "the Land Commission") was established in 1845 for "the investigation and final ascertainment or rejection of all claims of private individuals, whether natives or foreigners, to any land property." The parcels awarded by the Land Commission were called "Land Commission Awards" (LCAs). Initially, this only established crown lands owned by the *mō'ī*, *aupuni* (government) lands, and private lands owned by the *ali'i* (also known as "*konohiki* lands"). Chinen explains:

> Except for the government's right of commutation, a Land Commission Award gave complete title to the lands confirmed. The commutation was satisfied by the payment of cash or the return of land of equal value … generally one third of the value of the unimproved land as of the date of the award. [Chinen 1958:10]

The Kuleana Act of 1850 allowed *maka'āinana* to file claims for the land parcels and house lots on which they had been living or cultivating. In order to file claims, however, they first had to be aware of the awarding of *kuleana* lands and LCAs, procedures that were largely foreign to them. Many *maka'āinana* could not afford the costs associated with filing, and in some cases, the *ali'i* or *konohiki* may have discouraged their *hoa'āina* from filing claims (McGrath et al. 1973:27). People claiming house lots in Honolulu, Hilo, and Lāhainā were in addition required to pay commutation to the government before obtaining a Royal Patent on their awards (Chinen 1971:16). Rural *kuleana* claims required a survey that could be quite costly, assuming the services of one of the few surveyors in the islands could be obtained (Moffat and Fitzpatrick 1995:50). Surveys (and thus, awards) of rural *kuleana* lands often only encompassed land under active cultivation, without including locations such as fallow lands, stream fisheries, *'okipu'u* (swidden gardens), and others (Kame'eleihiwa 1992:295; Kirch and Sahlins 1992:23, 110). These factors may have contributed to the relatively low number and size of claims, as only 8421 *kuleana* awards were issued, totaling only 28,658 acres (Moffat and Fitzpatrick 1995:50).

Kamanamaikalani Beamer and N. Wahine'aipohaku Tong (2016:130) dispute the claim that the Māhele was the chief instrument of dispossession of the *kanaka maoli* (native people). Although the claims system appears to have awarded them little, records show that the *maka'āinana* were able to purchase an estimated 167,290 acres of land between 1850 and 1893, often *aupuni* lands sold to them at relatively low cost. Beamer and Tong (2016:136) also argue that many *ali'i* leased or sold land to *hui* (associations) of *kanaka maoli* in keeping with the former *ali'i - hoa'āina* relationship. In these ways, lands not awarded to *maka'āinana* during the Māhele were still made available.

With land ownership established in law, foreigners gained the long-demanded right to own land in the Kingdom of Hawaii through the Alien Land Ownership Act of 1850 and would eventually acquire "almost two-thirds of the total land area" (Van Dyke 2009:51).

Lloyd Soehren's (2002–19) *Hawaiian Place Names* database notes that Waiohuli Ahupua'a was "omitted at the Māhele, [and] designated Crown land by [King David] Kalākaua [r. 1874–1891] in 1890."

According to the Office of Hawaiian Affairs' (n.d.) *Kipuka* online database, the LCA that is closest to the project area is *ʻāpana* (land parcel, lot; *lit*. piece, slice, portion) 19 of LCA No. 8452, which consisted of the entirety of Kōheo Ahupuaʻa, less *kuleana*. The boundaries ultimately drawn for this award (which was made without a survey) correspond to the contemporary Kōheo 1, 2 Ahupuaʻa. The *ahupuaʻa* was claimed, along with numerous other lands, by Analea Keohokālole, the mother of King Kalākaua. The award of Kōheo Ahupuaʻa (LCA No. 8452 *ʻāpana* 19) to Keohokālole, along with 17 other *ʻāpana*, was confirmed with Royal Patent (RP) No. 4388 in 1858 (Waihona ʻĀina n.d. a, b).

Although not as close to the project area, there were also a number of relatively small LCAs within Waiohuli Ahupuaʻa that appear to have been *kuleana* awards to *makaʻāinana*. The nearest of these, LCA No. 6592 *ʻāpana* 4, is a 1.06-acre lot located approximately 1 km east-southeast from the current project area (County of Maui Real Property Assessment Division 2008b). LCA No. 6592 was awarded to Puana, who claimed six *ʻāpana* (land parcel, lot; *lit*. piece, slice, portion) in Waiohuli Ahupuaʻa, and ultimately received five *ʻāpana* totaling 4.97 acres, confirmed by RP No. 7808 in 1886 (Waihona ʻĀina n.d. a, b). While many such *kuleana* awards became the basis of present-day property parcels drawn on the same boundaries (including a number of such parcels further upslope in Waiohuli Ahupuaʻa), LCA No. 6592 seems to have been subsumed into the lands that passed into the administration of DHHL, with *ʻāpana* 4 overlapping multiple parcels in the relatively recent subdivision of the DHHL lands, as well as a portion of contemporary Puʻuala Street [TMK: (2) 2-2-027:155 por.].

LATE POST-CONTACT TO PRESENT

Whaling declined in the late 19th century, and commercial agriculture and ranching came to the forefront of Hawaiian economy, in part because the Māhele had allowed the consolidation of lands into vast and now privately owned plantations and ranches. Although sugar had been grown on Maui as early as 1828 (Speakman 1978:114), the Reciprocity Treaty of 1875 permitting duty free trade of agricultural products between the Kingdom of Hawaii and the United States turned Hawaiian sugar into an immensely profitable commodity that would become a mainstay of the economy (Kuykendall 1967, Vol 3:46–48). Although some parts of Kula Moku were used for sugarcane in the early- to mid-20th century, the relatively steep uplands near the project area were far from any easy sources of irrigation and not conducive to the large plantations that dominated the sugar (and later pineapple) industry, which required large amounts of water.

Sterling (1998:245) notes that "according to research into old records as reported by Karl H. Korte, Maui district forester for the State Department of Land and Natural Resources" upland Kula once had the natural water supply to support subsistence farming. Sterling (1998) writes:

> Before 1850 Kula was supplied with moisture naturally through the existence of a large forest. "That forest was cut down when land was cleared in Kula to open farm plots in 1850. This was in answer to the demand for food in California during the gold rush," Korte explained….
>
> "The destruction of the forest in Kula was completed by the ranchers clearing for pasture," Korte said.
>
> Before the forests were cut down, he said, it was possible to fill a sizable tank with water from cloud drip in Kula during one night. [Sterling 1998:245]

Kēōkea Town, located well southeast of the project area, is the nearest surviving permanent settlement of historic (over 50 years old) age; as the residential subdivisions to the immediate east of the project area are relatively recent. Kēōkea Town was established by Chinese immigrants of the Hakka ethnic group, who were among the approximately 46,000 Chinese who immigrated to the Kingdom of Hawai'i in the 19th century, mostly as agricultural laborers (Douglas 2003:8). Paul Wood (2011a) reports that the Hakka in Kula were a part of the short-lived potato boom, conveying their crops down an eight-mile-long journey to the coast at Kīhei on mule drawn wagons. Settling at Kēōkea was no small feat, and Wood notes the difficulty providing water for the community:

> Water was scarce here. In drought conditions, people would carry water—via shoulder poles strung with five-gallon cans—from as far away as Makawao, which today is twenty minutes away by car. A single, clogged half-inch pipe delivered trickling mountain water to the sanatorium uphill from Fong Store. People would camp there overnight to fill their barrels. Then in 1905 Shim Mook organized construction of the Kula pipeline. He hauled twenty-foot lengths of six-inch-diameter pipe as high into the forest as his mule teams could climb. From there the Hakka residents carried them higher, as much as a half-mile uphill. [Wood 2011a]

Among the Hakka who formed the settlement at Kēōkea was one Shim[1] Yan Fook Ah Mo Mook, commonly called "Shim Mook" (who lead the aforementioned water pipeline effort). The St. John's Episcopal Church (2007:1) records that in "1899, Shim Mook of Kula wrote to China to ask his people there to send a Chinese teacher for the Chinese children of Kula. They sent the Reverend Shim Yin Chin the same year." Although Father Shim was a Lutheran Christian, after moving from Guandong (Canton), China, to Maui, he was accepted into the Anglican Church as there was no Lutheran Church in Hawai'i at the time. Construction on what became St. John's Episcopal Church (south-southeast of the project area) started in 1906 and was completed in 1907.

[1] Since both Chinese custom and common English romanizations of Chinese names place the family name first, this report follows that practice.

The church in Kēōkea was not only a place of worship, but also served as a schoolhouse where Chinese language and literature were taught, and Father Shim's World Knowledge Society discussed world events and politics. Although as immigrants the Hakka had little political participation, political issues were quite important to the community. St. John's Episcopal Church (2007:6) records that the Hakka faced dispossession from the land they had settled:

> In 1911 the Homestead Act was passed. It was intended to enable farmers to acquire land that they had previously leased from the Government. However this seriously threatened to dispossess the Keokea Chinese, because the land could only be claimed by American citizens. Father Shim wrote to Bishop Restarick regarding the injustice of this. Many of the farmers had worked the land for more than ten years, but their native-born children were not yet of legal age to claim the land themselves. The Bishop then explained the situation to Governor Frear, and, as a result, "The Chinese who had been a long resident in the district, and whose children, 17 or 18 years of age who had been born here were granted leases on the premises which had been occupied and improved until such time as their oldest son, an American citizen, had the right to acquire title." (Hawaiian Church Chronicle, December 1911). This still was an injustice to many, but was a better situation than before the intervention by the Governor. [St. John's Episcopal Church 2007:6]

Although some of the Hakka lost their land, others were able to remain and continue the community they had so painstakingly built.

Kula (albeit south of Waiohuli Ahupua'a) was once home to the famous brothers Sun Dezhang and Sun Deming. Sun Dezhang is better known as "Sun Mei," and by the sobriquets "Maui King" and "King of Kula," as he was called by his contemporaries for his wealth and large cattle ranch (Wood 2011b). Sun Deming is better known as "Sun Zhongshan" in China and Sun Yat-sen in the West, the first provisional president of the Republic of China. The elder brother, Sun Mei, developed a number of business ventures and eventually owned a ranch stretching thousands of acres from the lowlands near Kīhei to the mountain forests (Wood 2011b). Allen Damon (1991:179) states that Sun Mei gave his brother's cause "more than $750,000 during the revolutionary period" and that he also paid for Sun Yat-sen's "education and the care of his family while he was abroad." Although some local oral traditions state that Sun Mei sold his considerable property to fund his brother's revolutionary activities in China, the Museum of Dr. Sun Yat-sen (n.d.) indicates that he lost his ranch because of changes in the law and an unsuccessful lawsuit to maintain his holdings.

Yen Chun and Yansheng Ma Lum (2011) note that Sun Mei's ranch, where Sun Yat-sen's family resided while he was working towards his dream of revolution, is now part of the lands owned by the Haleakala Ranch Company, and that "the old buildings of Sun Mei were all demolished." Although nothing remains of the Sun brothers' home, both of them are honored with statues at the Sun Yet Sen Park well to the south of the project area in Kamaʻole Ahupuaʻa.

Ranching and agriculture eventually gave way to tourism as the primarily economic activity on Maui. Despite that, upland Maui has seen limited commercial development, especially because road access to upland Kula is not convenient. Since most of the tourism sector has developed on the coastal regions, agriculture remains important to upland Kula.

The project area is part of DHHL lands reserved for use by native Hawaiians by the Hawaiian Homes Commission Act, 1920, which designated "the public lands (six thousand acres, more or less) in the district of Kula" as "Hawaiian home lands" (United States Congress 1921:109-110). The uplands of Kēōkea and Waiohuli Ahupuaʻa are "public lands" (government owned), because of the designation of these *ahupuaʻa* as crown lands during the Māhele, since the crown lands were folded into the government lands after the overthrow of the Hawaiian Kingdom. The DHHL was created after the "Act was incorporated as a provision in the State Constitution in 1959 when Hawaiʻi was granted statehood" and "responsibility for the Commission and the Hawaiian home lands was transferred to the State" (State of Hawaii n.d.).

The Hawaii Advisory Committee to the U. S. Commission on Civil Rights (1991:1–2) noted that DHHL generally received "the worst lands in [Hawaiʻi] – remote, inaccessible, arid, and unsuitable for … development," because the sugar planters lobbied to ensure that "valuable agricultural lands [were] exempted from the Hawaiian homelands trust." Although recent development by DHHL shows that their lands in Waiohuli Ahupuaʻa are not wholly unusable for use, these are indeed lands largely unsuitable for plantations and unwanted by the large and powerful commercial agriculture businesses that dominated Hawaiian politics in the leading half of the 20th century.

PREVIOUS ARCHAEOLOGY

The earliest archaeological studies on Maui occurred in the early 20th century, but most research is more recent, generally occurring after legal requirements for protection of significant cultural, historical, and archaeological properties were increasingly implemented and enforced in the 1980s. Archaeological work in the vicinity of the project area is shown on Figure 5.

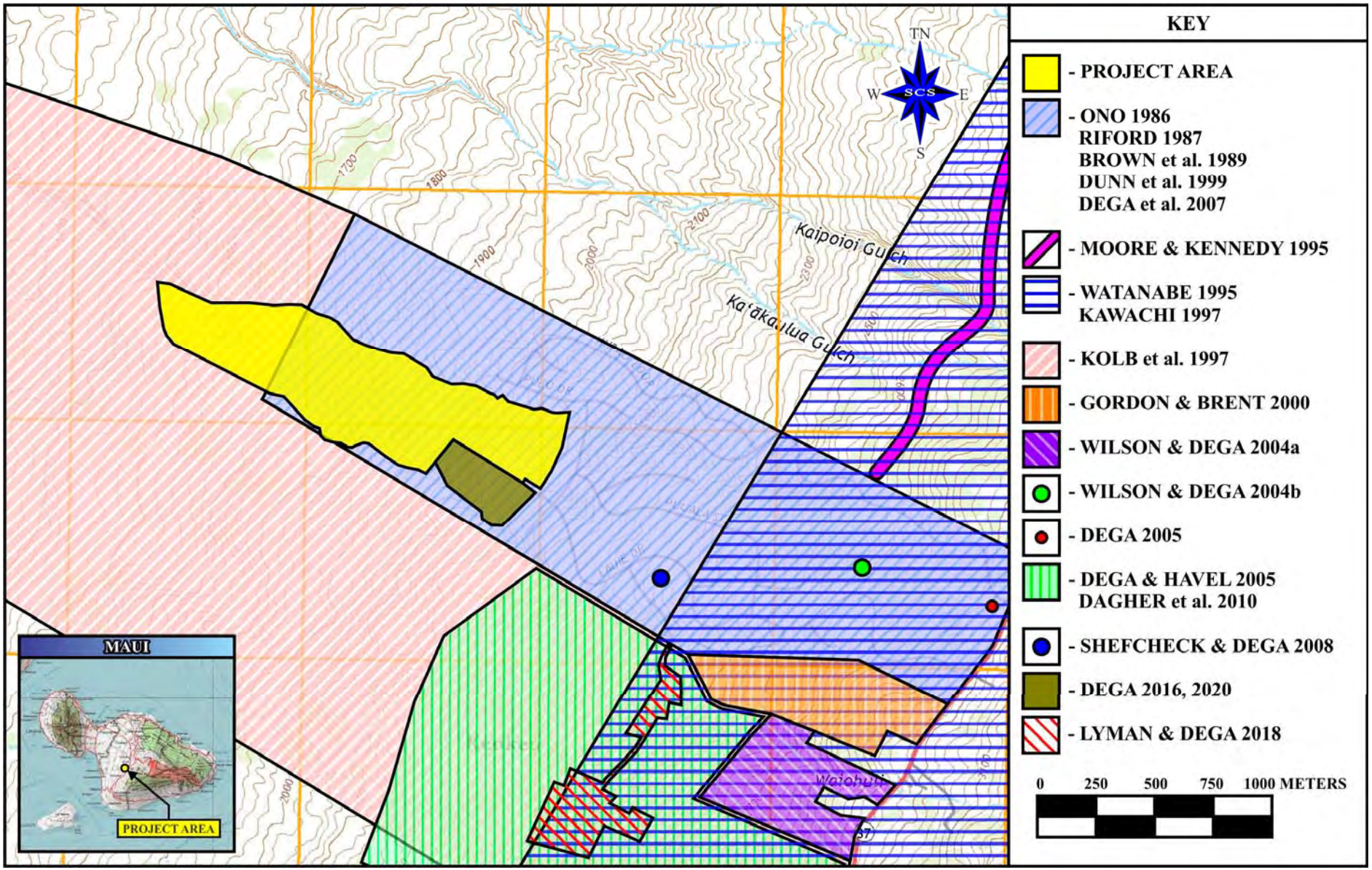

Figure 5: A portion of a 2017 USGS topographic map (Wailuku quadrangle) showing previous archaeology near the project area

EARLY ARCHAEOLOGY (THRUM 1909, STOKES 1909–16, WALKER 1931)

The earliest archaeological endeavors on Maui were undertaken by Thomas G. Thrum (1909), John F.G. Stokes (1909–16), Kenneth P. Emory (1921), and Winslow Walker (1931). These studies identified a number of *heiau* (traditional Hawaiian temples) and other religious features.

Walker (1931) recorded three *heiau* in Waiohuli Ahupua‘a: Kaumehe‘iwa, Kaimupe‘elua, and Pauhu Heiau. Walker (1931:278) marked Kaumehe‘iwa Heiau (Walker Site 212, Bishop site 50-Ma-B15-001, SIHP Site 50-50-10-01039/-02041) with a “?”because of apparent uncertainty of identification, and described it as “a small walled notched shaped heiau. It measures only 50 × 41 feet. The walls are 3 and 4 feet high and 4 feet thick.” Kaimupe‘elua Heiau (Walker Site 213, Bishop site 50-Ma-B15-002, SIHP Site 50-50-10-01040) is described as “a small heiau on a rocky knoll. The natural level of the top has been used and the northeast side built up of stone to 10 feet … interior measures 53 × 55 feet” (Walker 1931:279). Pauhu Heiau Walker Site 214, Bishop site 50-Ma-B15-003, SIHP Site 50-50-10-01041) is described as “a large heiau that was destroyed when the present road was built. 60 × 66 feet with two divisions” (Walker 1931:279).

Kaimupe‘elua Heiau has been placed on the Hawaii Register of Historic Places (HRHP). Kaumehe‘iwa Heiau was likely not listed because of the uncertainty of its identification, while Pauhu Heiau has been destroyed.

EARLY STUDIES AT THE DHHL KĒŌKEA AND WAIOHULI SUBDIVISIONS (RIFORD 1987, BROWN et al. 1989, KOLB et al. 1997)

In March 1986, the Division of State Parks (Ono 1986:no page numbers) conducted a field inspection of “archaeological features which were discovered during the course of road grading” for the Waiohuli-Kēōkea Farmlot subdivision (more precise geographical details were not provided). This field inspection noted two possible Pre-Contact house sites and a number of wall features that could be Pre- or Post-Contact, but could not re-locate the *heiau* reported in the area by Walker (1931). Ono’s (1986) memorandum on the field inspection emphasized the need for the land to be “surveyed by a qualified archaeological consultant prior to the start of any construction activity for the project.”

In December 1986, the Department of Anthropology at BPPM (Riford 1987) conducted an archeological reconnaissance survey and monitoring of fence line trailblazing at the Kēōkea Agricultural [then TMK: (2) 2-2-002:055] and Waiohuli Residential [then TMK: (2) 2-2-002:056] Subdivisions. The Kēōkea subdivision was 351.41 acres, while the Waiohuli subdivision was 673.99 acres, for a total of 1,025.40 acres (Brown et al. 1989:2). Riford (1987:56) noted that this study was the “first systematic reconnaissance survey performed in the Kula section of Maui.”

Riford (1987:23) recorded a total of 113 sites comprising over 252 features were during the survey and monitoring, including features interpreted as relating to Pre-Contact agriculture, habitation, and religious activities. SIHP Site numbers were not initially assigned, and when subsequent archaeological work did so, their recordation of sites and their component features do not match those of Riford (1987). Among the sites recorded by Riford (1987:10) were three *heiau* previously identified by Walker (1931): Molohai (SIHP Site 50-50-10-01037) and Papakea (SIHP Site 50-50-10-01036/-02099) in Kēōkea Ahupuaʻa, and Kaumeheʻiwa (SIHP Site -01039/-02041) in Waiohuli Ahupuaʻa. Additionally, three potential human burials were identified in Kēōkea, while one exposed human burial and five potential burials were identified in Waiohuli (Riford 1987:33). The majority of Riford's (1987:32–33) sites were interpreted as having features associated with agriculture, and a substantial number (including 44 enclosures) were interpreted as associated with habitation.

In 1989, Paul H. Rosendahl, Ph.D., Inc. (PHRI), (Brown et al. 1989) conducted an archeological survey of the Kēōkea and Waiohuli subdivisions studied by Riford (1987). The work included a "preliminary field inspection," a "low-level (30-50 ft. altitude) aerial reconnaissance" using helicopter, and a "variable intensity ground survey" with transects "spaced at 15–40 meter intervals" (Brown et al. 1989:5). Additionally, "limited test excavations were undertaken to recover charcoal for radiocarbon dating and to assess the depth and constituents in cultural strata at selected features" (Brown et al. 1989:16). Brown et al. (1989:7) identified 159 sites consisting of 274 features, of which 114 were associated with permanent habitation. This included 53 sites which correlated to those identified by Riford (1987), although Brown et al. (1989:7-11) grouped some features differently. Unlike in the earlier study, SIHP numbers were assigned for each site recorded by Brown et al. (1989:7-11). Radiocarbon dating of samples from 14 of the sites returned date ranges spanning from 1270 to the present, although a simple from one other site returned a very early date range of 680-1060 (Brown et al. 1989:18). Based on the "Site Location Map" provided by Brown et al. (1989:12), it appears that SIHP Sites 50-50-10-02349, 50-50-10-02352, 50-50-10-02353, 50-50-10-02354, 50-50-10-02385, and 50-50-10-02386 lie within the current project area, and possibly Sites SIHP Sites 50-50-10-02346, 50-50-10-02347, and 50-50-10-02348 as well.

Perhaps the most extensively detailed archeological work in the area is reported in *Kula – the Archeology of Upcountry Maui in Waiohuli and Kēōkea* (Kolb et al. 1997), an archeological and historical settlement survey of the DHHL landholdings in Waiohuli Ahupuaʻa. Conducted in 1992 under the auspices of SHPD and funded by DHHL, this survey encompassed all DHHL lands in Waiohuli Ahupuaʻa [TMK: (2) 2-2-002:014 por.] that had not been already investigated during the previous study (Brown et al. 1989), as well as selected lands in Kēōkea and Kamaʻole Ahupuaʻa, covering a total of 1,644 acres (Kolb et al. 1997: xiii, 34, 80). During this survey, a total

of 219 sites (including those previously identified) were documented, consisting of 1,093 features. Of these, 569 features—more than half—were associated with agriculture, while 212 were associated with permanent habitation, and 121 were associated with temporary habitation (Kolb et al. 1997:96-120). Six *heiau* were documented, including the three previously noted by Riford (1987) and Brown et al (1989), as well three others previously noted by Walker (1931): Kaʻumiʻumimua (SIHP Site 50-50-10-03332), Kauimupeʻelua (SIHP Site -01040), and Pauhu (or Pahua) Heiau (SIHP Site -01041), the latter of which had been "destroyed by the construction of today's Kula highway" (Kolb et al. 1997:129–30). Radiocarbon dating of samples recovered during this study returned date ranges between 1399 and 1955 (Kolb et al. 1997). Kolb et al. (1997:28) noted that "a large number of upcountry *heiau* suggest that almost all settlement was concentrated there." Religious sites are often indicative of dense settlement, which provides the population base needed to support a dedicated priesthood and undertake large construction projects. According to Kolb et al. (1997:189, 281) "the presence of settlement both on the shore and in the uplands seems to mark the establishment of a dual settlement pattern (shore and uplands) from the very start of permanent occupation in Kula." This proposed model of populations concentrated far from the coast is consistent with the previously mentioned (see Pre-Contact Settlement and Economy, above) oral tradition reported by Sterling (1998:243). However, it should be noted that other studies in the lower elevations of Kula Moku have found signs of settlement even in the so called "barren" or transitional zone between the coast and uplands.

MOORE & KENNEDY 1995

In April 1994, Archaeological Consultants of Hawaii, Inc. (Moore and Kennedy 1995) conducted an archaeological survey of an approximately 2,500 m long corridor for Phase I of the proposed Lower Kula Water Transmission Main. This corridor ran from a southern terminus at the border between Waiohuli and Kaʻonoʻulu Ahupuaʻa through Kaʻonoʻulu Ranch [then TMK: (2) 2-2-002:015; now TMK: (2) 2-2-002:082] and lands in Waiakoa Ahupuaʻa [then TMK: (2) 2-2-013:044; now TMK: (2) 2-2-013:007, 047] to a northern terminus at Nāʻalae Road. Moore and Kennedy (1995:30) identified eight historic properties during pedestrian survey of the project corridor. SIHPSites 50-50-10-03543, 50-50-10-03547 and 50-50-10-03548 were remnants of Post-Contact ranching activities, while SIHP Sites 50-50-10-03542, 50-50-10-03544, 50-50-10-03545, 50-50-10-03546 and 50-50-10-03549 were interpreted as originating from the "upland field system known to have existed in the area at the time of contact." Many of these sites were in the northern portion of Kaʻonoʻulu Ahupuaʻa, with only SIHP Sites -03547 -03548 and -03549 in the southern portion closer to Waiohuli Ahupuaʻa (and to the current project area).

UPCOUNTRY MAUI WATERSHED (WATANABE 1995; KAWACHI 1997)

In October 1994, the U.S. Army Corps of Engineers, Honolulu District (Watanabe 1995) conducted a historic preservation assessment for the proposed Upcountry Maui Watershed Improvement Project in Kula, Maui. The project area (shown in Figure 5) for the proposed new waterline stretched entirely across the *moku*, from Kalialinui Ahupuaʻa in the northeast to Kēōkea Ahupuaʻa in the southwest [various sections and plats of TMK zone: (2) 2-2]. Watanabe (1995:no page numbers) surveyed "two corridors starting from Olinda Reservoir at the north to the twin water storage tanks at Keokea to the south," one for the proposed new waterline, and one for the existing Kula Waterline. Four "site complexes" were found in Kalialinui, Ōmaʻopio Pūlehuiki, and Kōheo 1-2 Ahupuaʻa. Of these, only Kōheo 1-2 Ahupuaʻa is near the project area, being located just north of Waiohuli Ahupuaʻa.

In 1996, the U.S. Department of Agriculture Natural Resource Conservation Service (Kawachi 1997) conducted a follow up survey to Watanabe's (1995) work. Three of the historic properties identified by Watanabe (1995) were designated as SIHP Sites 50-50-10-04160 (Ōmaʻopio), 50-50-10-04161 (Pūlehuiki), and 50-50-10-04162 (Kōheo 1-2), which were all subject to subsurface testing by Kawachi (1997:14). Kawachi (1997:15–16) also investigated 14 gulch crossings that were not previously surveyed, and the proposed water lateral distribution system, which was found to pass through or adjacent to five historic properties (SIHP Sites 50-50-10-02050, 50-50-10-02088, 50-50-10-02089, 50-50-10-02091, and 50-50-10-02093) previously identified by Brown et al. (1989).

SCS DATA RECOVERY OPERATIONS AT THE DHHL KĒŌKEA AND WAIOHULI SUBDIVISIONS (DUNN et al. 1999, DEGA et al. 2004, WILSON AND DEGA 2004a, DEGA et al. 2007)

In 1998, SCS (Dunn et al. 1999) conducted archaeological Data Recovery (DR) on 11 sites within the Kula Residential Lots, Unit 1 (no acreage given) [then TMK: (2) 2-2-002:056 por.], part of the DHHL Kula Residence Lots Subdivision, working from site location data provided by the earlier survey by Brown et al. (1989). Dunn et al. (1999:1) attempted to address some of the research questions raised by Kolb et al. (1997) while following the research design and scope of work provided by Ross Cordy (1997), then the SHPD Branch Chief for Archaeology. Excavation was conducted at nine previously identified permanent habitation sites, one previously identified agricultural site, and one newly identified permanent habitation locus (SIHP Site 50-50-10-04554). A total of 31 test units were excavated, with at least two at each of the 11 sites, yielding "datable materials (wood charcoal), a total of sixteen subsurface features, and variable concentrations of lithic, faunal, and midden remains" Dunn et al. (1999:97). A total of 15 samples were submitted for radiocarbon dating, returning date ranges from 1400 to 1955. Of the 15 samples, however, only

seven were "thought to be precisely associated with permanent habitation architectural features" from which they were recovered. After analyzing this data, Dunn et al. (1999:107) note that the lack of results earlier than the 15th century, and the preponderance of date ranges from the 17th century onward, suggested that permanent settlement in upland Kula developed somewhat later than previously proposed (such as by Kolb et al. 1997).

In 2004, SCS (Wilson and Dega 2004a) performed a DR at SIHP Site 50-50-10-02377 [then in TMK: (2) 2-2-02:056 por.; now TMK: (2) 2-2-02:076 por.], which had been previously identified and recommended for data recovery by Brown et al. (1989). A previous DR by SCS (Dunn et al. 1999) had passed over the site since at the time its location was not planned for development, and it was to be preserved *in situ*. DR operations became necessary after development plans changed to include a roadway that would impact the site. SIHP Site -02377 was rerecorded in greater detail, and eight component features were found as a result (Wilson and Dega 2004a:17). Eight test units were excavated at six of the features, recovering glass and lithic debris and identifying several subterranean hearth features. Radiocarbon analysis of two charcoal samples returned a date range of 1480–1660, indicating a Pre-Contact origin, while a more recent date suggests continued use into the Post-Contact Period (Wilson and Dega 2004a:45).

In 2004-05, SCS (Dega et al. 2007) conducted another DR of eight habitation and agricultural sites previously identified by Kolb (1997) in an approximately 400-acre area [given, possibly incorrectly, as TMK: (2) 2-2-002:056 por.] in Waiohuli Ahupua'a. Dega et al. (2007:1) opted to focus on just eight of the 55 sites recommended for data recovery and excavate them intensively rather than spread out attention over a larger number of sites and excavate only a few test units at each. A total of 2,934 Pre-Contact artifacts were recovered, compared to the just 197 recovered by Dega et al. (2004). Consistent with the results of an earlier DR by Dunn et al. (1999), 23 charcoal sample submitted for radiocarbon analysis in this study returned results that largely clustered in the 1400–1600 and post-1700 date ranges (Dega et al. 2007:249).

DEREGO PROPERTY (GORDON AND BRENT 2000)

In 1998-99, Pacific Consulting Services, Inc. (Gordon and Brent 2000) conducted an archeological survey of the approximately 58-acre Derego property [TMK: (2) 2-2-005:004 & 090 through 094] ahead of the proposed consolidation of the parcels and their subsequent subdivision into six lots and two easements. This project area was a portion of Waiohuli Ahupua'a immediately west of Kula Highway that is not part of the DHHL lands, which border it on the north and west. Full pedestrian survey of the project area identified SIHP Sites 50-50-10-04830 (nine Pre-Contact agricultural terraces and associated habitation features), 50-50-10-04831 (two Pre-Contact agricultural features), and 50-50-10-04832 (two probable Pre-Contact agricultural features).

Limited subsurface testing consisted of 50 cm by 50 cm test units or shovel test pits where the test units would not fit. Radiocarbon dating analysis of charcoal samples returned dates of 1455–1650 for SIHP Site -04830 and 1450–1650 for SIHP Site -04831 (no subsurface deposits were found at SIHP Site- 04832). Subsequently, Gordon and Brent (2000:i) determined that sufficient information had been collected on these sites and re-evaluated them as no longer significant.

WILSON AND DEGA 2004b

In 2004, SCS (Wilson and Dega 2004b) conducted an archeological inventory survey (AIS) of a 54.21-acre parcel of land [then TMK:(2) 2-2-005:001, 002, 003, & 055; now TMK:(2) 2-2-005:001, 003, 055, 100, & 101], immediately south of the Derego property and bordered on the west and south by DHHL holdings. A total of 37 sites (23 Pre-Contact) were identified on the property, but since all were thoroughly documented, no further mitigation was recommended for most. Only three sites were recommended for preservation in situ for possible future data recovery: SIHP Site numbers 50-50-10-05590 (permanent habitation site), 50-50-10-05596 (rock shelter), and 50-50-10-05600 (temporary habitation and agricultural site) (Wilson and Dega 2004b:97).

SCS SURVEYS AT KĒŌKEA AND WAIOHULI SUBDIVISIONS (DEGA AND HAVEL 2005; DEGA 2005)

From January to March 2005, SCS (Dega and Havel 2005) conducted an inventory survey to document sites in the nine proposed road corridors in the Kēōkea-Waiohuli Development, Undivided Interest Subdivision [TMK: (2) 2-2-002:014 por.] between Kula Residence Lots and Kēōkea Farm Lots. A total of 18 archeological sites previously identified by Kolb et al. (1997) were rerecorded, and 35 new features were associated with nine of the sites (Dega and Havel 2005:123). A burial, part of SIHP Site 50-50-10-03272, was recommended for preservation, four sites for data recovery, 12 for monitoring, and two for no further work (Dega and Havel 2005:125).

In March 2005, SCS (Dega 2005:no page numbers) was asked by the Self-Help Housing Corporation of Hawaii to document a historic property encountered "during clearing and grubbing operations on Lot 96, a proposed single-family residential parcel … along the northeastern flank of the DHHL Waiohuli Subdivision" [then TMK: (2) 2-2-002:056 por.][2]. The site consisted of "a circular-shaped enclosure measuring 10 meters (m) long by 9 m wide … composed of medium to large cobbles and boulders stacked and faced a variable 2-6 courses high." SCS provided a letter report regarding the archaeological mapping of the site, which was designated as SIHP Site 50-50-10-05684 after Dega (2005) confirmed that it was not previously recorded.

[2] The lots in the DHHL Waiohuli Subdivision were re-drawn and re-numbered multiple times, so "Lot 96" as it was drawn in 2005 may not necessarily correspond to any contemporary TMK parcel.

ARCHAEOLOGICAL MONITORING AT THE DHHL WAIOHULI HIKINA SUBDIVISION (SHEFCHECK AND DEGA 2008, DAGHER et al. 2010; LYMAN AND DEGA 2018)

In 2006, SCS (Shefcheck and Dega 2008) conducted archeological monitoring at SIHP Site 50-50-10-02375 for an infrastructural development project in Waiohuli Hikina Subdivision [then TMK (2) 2 2-002:056 por.], part of the Kula Residence Lots, Unit 2 (Department of Hawaiian Home Lands 2010). SIHP Site -02375 (a permanent habitation) was a historic property that had been documented in the project's area during the AIS by Brown et al. (1989), and SHPD had made a determination of no additional work necessary in 2004. However, because of the infrastructural development project and previous archeology work in the area showing that permanent habitation sites often contained burials, monitoring was performed to mitigate any potential impact to previously unidentified burials or cultural deposits in the vicinity (Shefcheck and Dega 2008:1). No subterranean cultural deposits or burials were identified during monitoring, but further monitoring was recommended for future ground disturbing activities (Shefcheck and Dega 2008:19).

In 2006-08, SCS conducted archeological monitoring (Dagher et al. 2010) of roadway installations at the Kēōkea Agricultural Lots and the Kēōkea-Waiohuli Development, Undivided Interest Subdivision [then TMK: (2) 2-2-002:014 por., 055 por., & 071]. During monitoring, 15 features (14 newly and one previously identified) and ten isolated Pre-Contact artifacts were documented. Dagher et al. (2010:1, 6) designated ten of these newly identified features as five newly documented historic properties: SIHP Site numbers 50-50-10-06468 (subsurface fire pit), 50-50-10-06470 (inadvertently uncovered human skeletal remains), 50-50-10-06487 (subsurface fire pit), 50-50-10 -06430 (inadvertently uncovered *in situ* human remains), and 50-50-10-06772 (enclosure and fire pit). The other four new features were incorporated into SIHP Site numbers 50-50-10-03280, 50-50-10-03272, and 50-50-10-03239. These previously documented sites each incorporated a subsurface fire pit, and SIHP Site -03239 incorporated inadvertently uncovered human skeletal remains. Feature A of SIHP Site 50-50-10-02325 (ovoid enclosure) was also redocumented during this project. The human remains represented a minimum of eight individuals (MNI=8) (Dagher et al. 2010:15).

In May to October 2016, SCS (Lyman and Dega 2018 [Draft]) conducted archaeological monitoring during the Keokea-Waiohuli Development Phase 1A construction work [TMK Plats: (2) 2-2-033 and (2) 2-2-034], within the area previously surveyed by Dega and Havel (2005). No historic properties or cultural material were identified (Lyman and Dega 2018:10)

In June to September 2016, SCS (Dega 2016) also conducted archaeological monitoring for Phase I of the work for the Waiohuli Community Center [TMK: (2) 2-2-028:152 por.], which was reported in a letter to the Waiohuli Hawaiian Homesteaders Association, Inc. (also later forwarded to SHPD). The work for Phase I "consisted of construction of a Hale Halawai, a commercial kitchen with trellised lanai, cultural gardens, and parking" and no historic properties or cultural materials were identified during this work (Dega 2016: no page numbers).

In January 2020, SCS (Dega 2020) monitored Phase II and III of the Waiohuli Community Center [TMK: (2) 2-2-028:152 por.] and produced a letter report for SHPD summarizing the monitoring work. Once again, no historic properties or cultural materials were identified

KULA SETTLEMENT SUMMARY

The corpus of literature regarding upland Kula settlement patterns includes a combination of data from several inventory survey projects (e.g., Kolb et al. 1997, Dega and Havel 2005), and data recovery projects (e.g., Dunn et al. 1999, Dega et al. 2007), in both Waiohuli and Kēōkea Ahupuaʻa. This emergent body of data allows for synthesizing settlement and land use patterns relevant to the project area and has led to revised interpretations of upland habitation over time.

The majority of information suggests that before a wider settlement in the 15th and 16th centuries, only sparse population exploited the upland Kula landscape. Kēōkea and Waiohuli Ahupuaʻa appear to have stabilized through the late 1700s, but that period seems to have been followed by depopulation since archaeological evidence for continued permanent occupation of Kēōkea and southern Waiohuli from the early portion of the 19th century is virtually non-existent (although Kolb et al. note possible re-population of the area by 1900; Kolb et al. 1997:205–06). The studies show that there was a gradual settlement of the area from the 1400s, followed some 400 years later by a fairly abrupt decline and abandonment. An alternative dataset from the northern portion of Waiohuli Ahupuaʻa (see Dunn et al. 1999), however, shows permanent upland habitation occurring primarily after the 1600s, with only a very few sites constructed and occupied prior to the 17th century and none occupied prior to the 15th.

Currently, there is little evidence to suggest differences between households of chiefs and those of commoners. The chiefs, if any settled in the area, were certainly of lesser rank, with the majority of the population consisting of *makaʻāinana* living in two or three structure clusters. Some sites contain up to five or six structures, implying some form of social differentiation; yet evidence that these structures were indeed occupied by higher status individuals has been inconclusive. Permanent habitation architecture across the area is somewhat homogeneous, with no one trait of "form and fit" strategy dominating the others.

Standardization in Pre-Contact upland construction implies a similar resource base for material procurement, while the timing of building suggests a harmonized settlement after the 1400s. Agricultural pursuits appear to have flourished in association with habitation. The majority of the data show that prior to the 1400s only small terraces were identified in terms of architectural structures. The terraces grew and expanded with population increases in the 15th and 16th centuries and rapidly expanded in size and number in the 17th century. Agricultural site construction decreased concomitantly with population decline in the late 1700s and early 1800s.

METHODOLOGY

FIELD METHODS

The archaeological field inspection was conducted on June 18, 2024 by SCS archaeologists Ian Bassford, B.A., and David Stielow, B.A., under the supervision of principal investigator Michael F. Dega, Ph.D. Field methods consisted of a 100% pedestrian survey of the project area and documentation via digital photographs taken at various locations throughout the project area.

LABORATORY METHODS AND CURATION

As no culturally significant sites or artifacts were identified during this project, laboratory work consisted of cataloging field notes and photographs. All field notes and digital photographs have been curated at the SCS laboratory in Honolulu. All measurements were recorded in metric, and true north compass orientation was used.

RESULTS AND RECOMMENDATIONS

The field archaeologists conducted a pedestrian survey of the project area and documented it with photographs but reported that much of the project area was densely covered in foliage, which somewhat limited visibility and may have hidden surface features from detection. Figure 6 is a photograph taken from near the existing community center located adjacent to the project area, showing the extensive ground cover of non-native Guinea grass (*Megathyrsus maximus*). Other vegetation encountered in the project area included *kiawe* (American carob, *Prosopis pallida*), *wiliwili* (*Erythrina sandwicensis*), chinaberry (*Melia azedarach*) and prickly pear cactus (*Opuntia* spp.). Of these, only *wiliwili* is native to Hawai‘i.

The only archaeological feature found during the pedestrian survey was a Post-Contact cattle wall observed along a portion of the northern boundary of the project area (Figure 7). This wall was constructed of basalt cobbles stacked 5 to 7 courses high and incorporated bedrock outcrops in its alignment. It is possible that this is one of the features previously documented by Riford (1987) or Brown et al. (1989), or it may be a newly identified historic property.

Figure 6: Heavy ground cover in the project area (view to north-northwest)

Figure 7: Post-Contact stacked basalt wall used for cattle ranching (upper center; view to east-northeast)

A site map provided by Brown et al. (1989:12) suggests that at least six historic properties (SIHP Sites 50-50-10-02349, 50-50-10-02352, 50-50-10-02353, 50-50-10-02354, 50-50-10-02385, and 50-50-10-02386) identified in that study fall within the project area (Figure 8). Nonetheless, because of the limits of the recordation carried out by these early efforts, at a time when the precision of the available maps was limited and there was no GPS, it is difficult to correlate locations with high confidence.

Known *heiau* in the region have already been located or confirmed as destroyed, and based on the patterns of previous studies finding ritual sites or burials is assessed as relatively unlikely. However, based on known settlement patterns of upland Kula, and the findings of previous studies, it is likely that there are additional historic properties associated with Post-Contact ranching, and Pre- and Post-Contact dryland farming within the project area that were obscured by the heavy vegetation and therefore not found during the field inspection. SCS accordingly recommends archaeological inventory survey (AIS) of the project area.

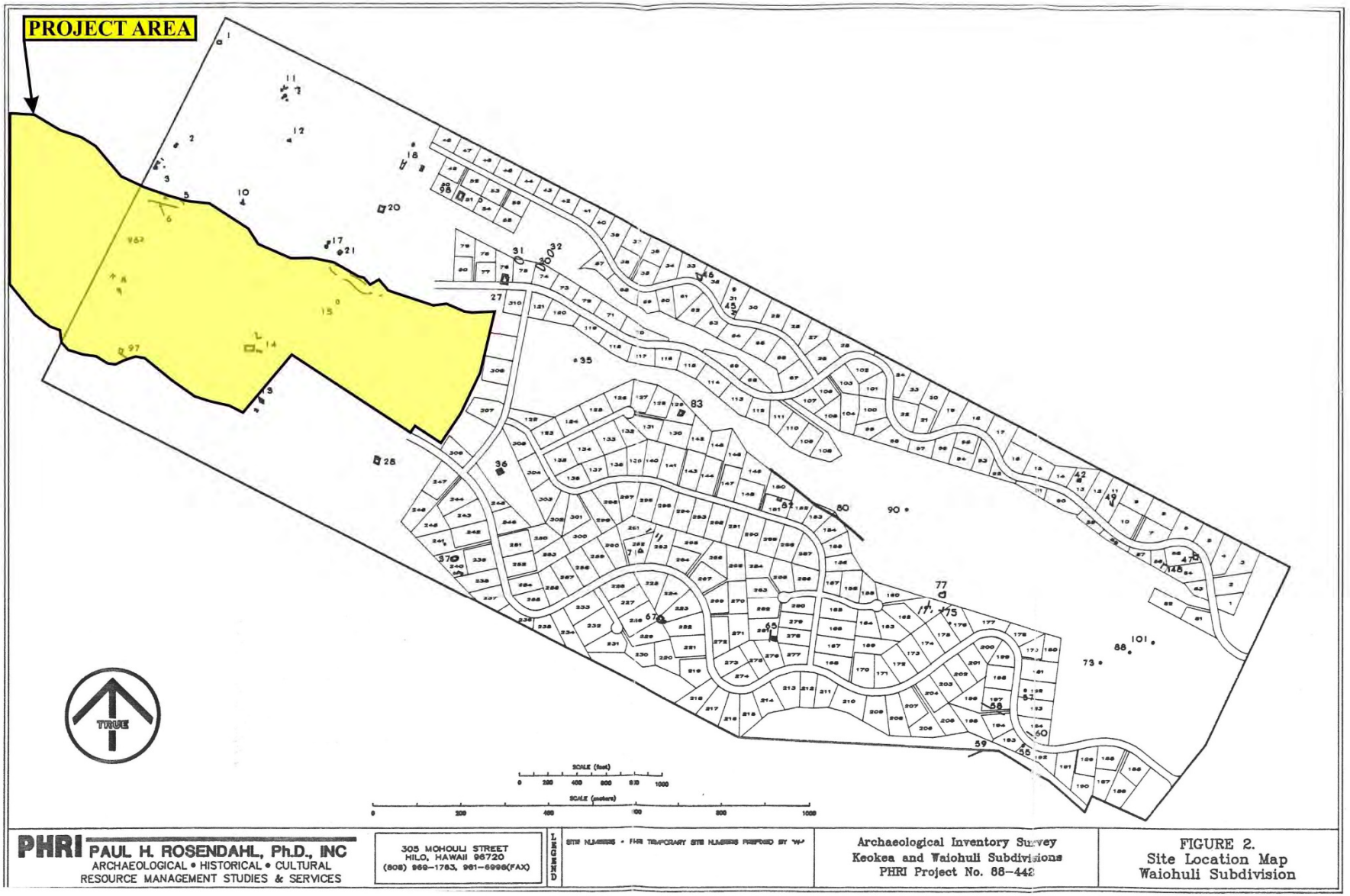

Figure 8: The project area overlaid on the Brown et al. (1989) site map

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APPENDIX D

Cultural Impact Assessment

Cultural Impact Assessment for the Waiohuli Hawaiian Homesteader's Organization Master Planning and Enivironmental Assessment For the Proposed Waiohuli Economic Development Opportunities ("We Do")

Waiohuli Ahupua'a, Kula Moku, Maui Mokupuni, TMKs: (2) 2-2-002-014; (2) 2-2-028-181

Prepared by:

NOHO PAPA HAWAI'I

Prepared for:

The Waiohuli Hawaiian Homesteaders Association

This report was prepared by Nohopapa Hawaiʻi, LLC, for the Waiohuli Hawaiian Homesteaders Association

AUTHORS
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STUDY SUMMARY

Reference	Cultural Impact Assessment (CIA) for the Waiohuli Hawaiian Homesteader's Organization Master Planning and Environmental Assessment for the Proposed Waiohuli Economic Development Opportunities ("WE DO"), Waiohuli Ahupuaʻa, Kula Moku, Maui Mokupuni, Tax Map Keys (TMKs): (2) 2-2-002-014 and (2) 2-2-028-181
Date	October 2024
Land Jurisdiction	The project area is comprised of two land parcels owned by the Department of Hawaiian Home Lands: 1. (2) 2-2-002-014 2. (2) 2-2-028-181
Project Proponent	Waiohuli Hawaiian Homesteaders Association (WHHA) and Pueo Development LLC
Project Location	The project area is comprised of Tax Map Keys (TMKs): (2) 2-2-002-014 and (2) 2-2-028-181, below Kula Highway, within the Department of Hawaiian Home Lands, Waiohuli Homestead Residential Lots, within the ahupuaʻa of Waiohuli, Kula Moku, Maui Mokupuni.
Project Description	The project involves a public-private collaboration with WHHA and Pueo Development LLC that combines traditional construction of a master plan development with community-based job opportunities derived from development of infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for the Waiohuli community. The goal of the project is to provide short and long-term economic opportunities that will foster greater self-sufficiency for the people of upcountry Maui through capacity building and jobs homegrown at the roughly 150-acre site. With the primary goal of creating community-based economic opportunities, the project includes the development of a master plan that incorporates a variety of land uses to support the community. Proposed Land Use Include: • Community Support Training Facilities • Infrastructure Training Sites • Agricultural Development Training Sites • Renewable Energy Development/Training Sites • Natural Drainage Gulch Areas
Project Acreage	The project area consists of two land parcels totaling approximately 150 acres within TMKs: (2) 2-2-002-014 and (2) 2-2-028-181
Document Purpose and Regulatory Context	This study was generated to inform an Environmental Assessment per the requirements of the Hawai'i Environmental Policy Act (HEPA) and its implementing legislation Hawai'i Revised Statutes (HRS) §343. This study is intended to support the proposed project's environmental compliance review.

	The State constitution, state laws and courts require government agencies "to promote and preserve cultural beliefs, practices, and resources of native [sic] Hawaiians and other ethnic groups. Chapter 343 also requires environmental assessment of cultural resources, in determining the significance of a proposed project," (State of Hawai'i Environmental Council 1997). As noted by the State of Hawai'i Environmental Council (1997), "[a] cultural impact assessment analyzes "the impact of a proposed action on cultural practices and features [collectively termed 'cultural resources'] associated with the project area." At the request of the Waiohuli Homestead Association (WHHA) and the Department of Hawaiian Home Lands (DHHL), Nohopapa Hawai'i, LLC, completed this CIA in support of the Environmental Assessment for the WHHA and Pueo Development LLC proposed development of two parcels, totalling 150-acres. Through ethno-historical background research and consultation, this CIA provides an assessment of the proposed project's potential impacts to cultural resources, defined as practices and features, which may include Traditional Cultural Properties (TCP) of ongoing cultural significance that may be eligible for inclusion on the Hawai'i Register of Historic Places, in accordance with Hawai'i Revised Statutes (HRS) Chapter 6E guidelines for significance criteria (AR §13-284) under Criterion E.
Methods	This Cultural Impact Assessment consisted of four primary tasks: (1) ethnohistorical background research; (2) community consultation, summaries, and recommendations; (3) cultural impacts assessment; (4) results reporting. The study spanned a 6-month period from May 2024 through October 2024. Project personnel included: M.A., R. Kalena Lee-Agcaoili and M.A., Kelley L. Uyeoka.
Consultation	Consultation for this CIA was conducted from May 2024 through July 2024. Consultation included identifying appropriate and knowledgeable individuals, conducting consultation through questionnaires, summarizing the participants mana'o, analyzing the information, and preparing the community mana'o summaries for the report. Fifteen individuals and two organizations were contacted in the initial scoping phase of this assessment. Five individuals participated in completing an interview questionnaire and one individual emailed their references for consultation.
Recommendations	See the "Cultural Impact Assessment" subsection of this report, on page 80 for a contextualized and detailed discussion of recommendations gathered through community ethnography regarding the proposed project's potential impacts to cultural resources (practices, features, and beliefs) associated with the project area and/or vicinity.

INTRODUCTION AND METHODS

He Leo Mahalo

Mahalo to all the individuals involved in this project. We are grateful to Kekai Kapu, Perry Artates, Napua Silva, Lokomaikaʻi Brown, and Clifford Santos Jr. for their time, consideration, and manaʻo shared, and to the Waiohuli Homestead Association for the opportunity to complete this CIA for the Department of Hawaiian Home Lands.

Project Background

At the request of the Waiohuli Hawaiian Homestead Association, Inc. (WHHA) and the Department of Hawaiian Home Lands (DHHL), Nohopapa Hawaiʻi, LLC (Nohopapa) conducted a Cultural Impact Assessment to inform an Environmental Assessment supporting the Waiohuli Economic Development Opportunities ("WE DO") located within the ahupuaʻa of Waiohuli, Kula Moku, Maui Mokupuni, TMKs (2) 2-2-028:181 and (2) 2-2-002:014 (Figures 1-3). Through ethnohistorical background research and community engagement efforts, this CIA provides an assessment of the proposed project's potential impacts to cultural resources, defined as practices and features, which may include Traditional Cultural Properties (TCP) of ongoing cultural significance that may be eligible for inclusion on the Hawaiʻi Register of Historic Places, in accordance with Hawaiʻi Revised Statutes (HRS) Chapter 6E guidelines for significance criteria (AR §13-284) under Criterion E.

This study was generated to inform an Environmental Assessment per the requirements of the Hawaiʻi Environmental Policy Act (HEPA) and its implementing legislation Hawaiʻi Revised Statutes §343. This study is intended to support the proposed project's environmental compliance review.

The State constitution, state laws and courts require government agencies "to promote and preserve cultural beliefs, practices, and resources of native [sic] Hawaiians and other ethnic groups. Chapter 343 also requires environmental assessment of cultural resources, in determining the significance of a proposed project," (State of Hawaiʻi Environmental Council 1997). As noted by the State of Hawaiʻi Environmental Council (1997), "[a] cultural impact assessment analyzes "the impact of a proposed action on cultural practices and features [collectively termed 'cultural resources'] associated with the project area."

The proposed project requires compliance with the Hawaiʻi environmental review process per HRS §343. HRS §343 requires consideration of a proposed project's effect on cultural resources (defined as cultural practices and features).

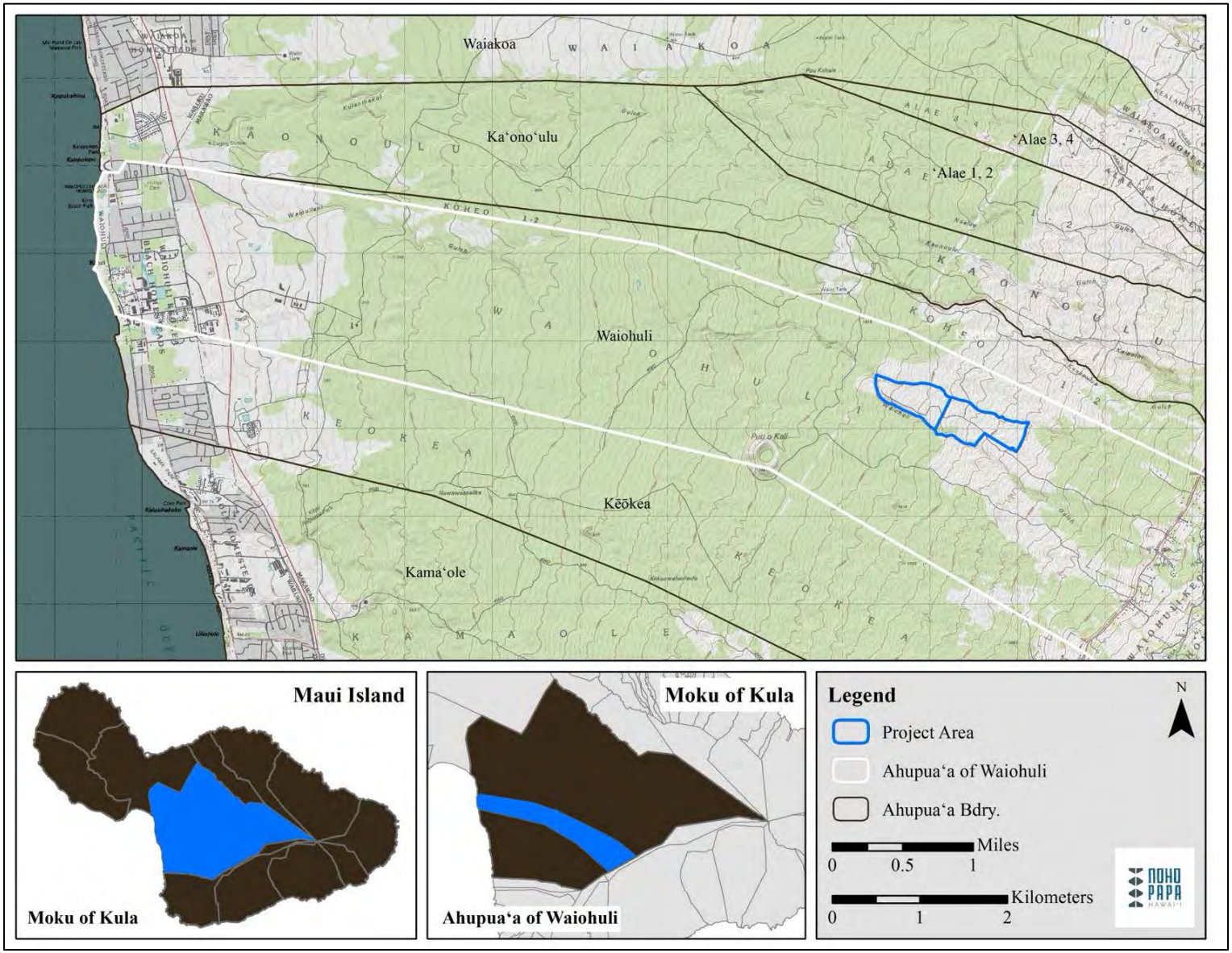


Figure 1. USGS map of the study area outlined in blue. Located in the Waiohuli Ahupua‘a, Kula Moku, Maui Mokupuni (TMKs (2) 2-2-028:181 and (2) 2-2-002:014)

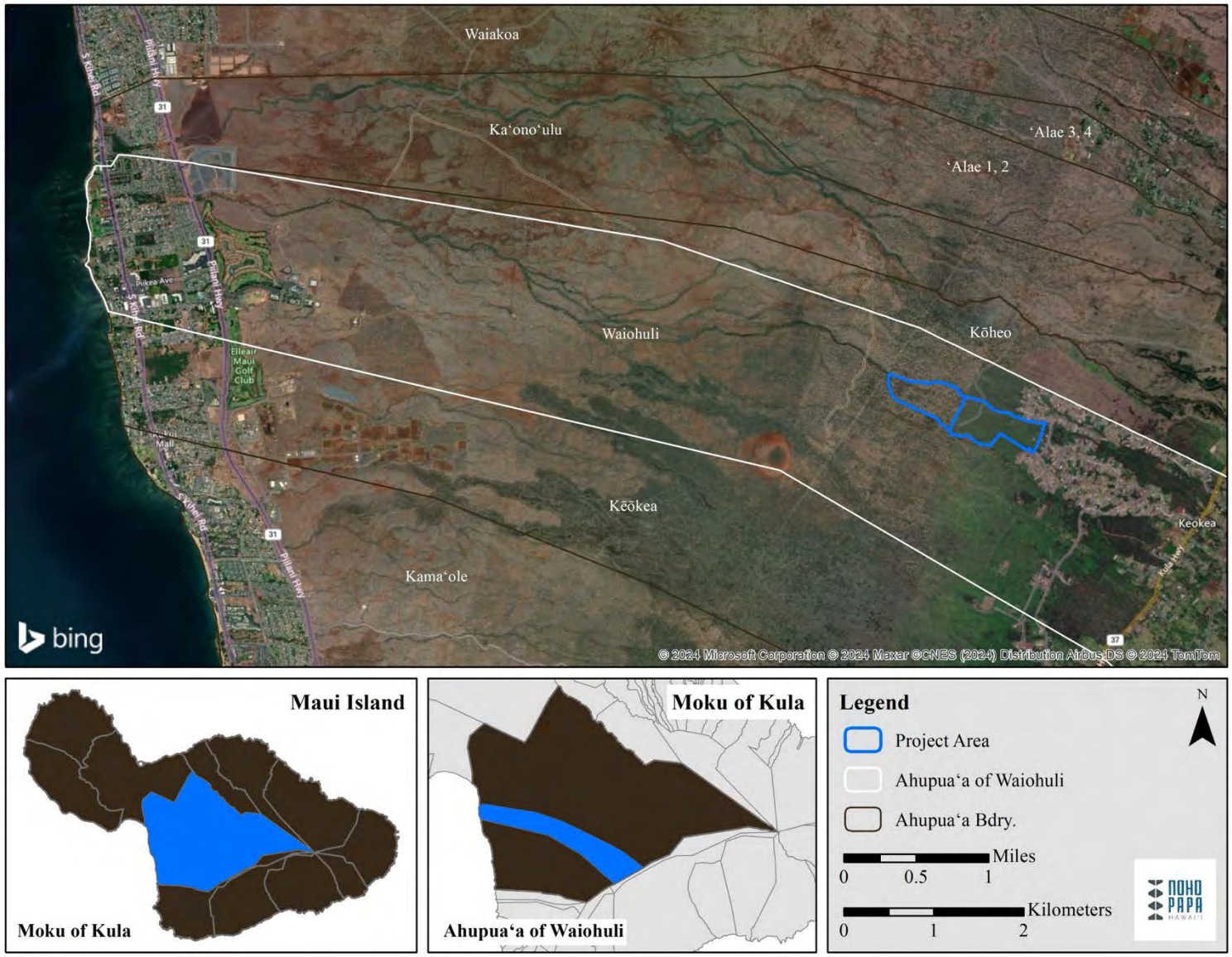


Figure 2. Aerial overview of the study area outlined in blue. Located in the Waiohuli Ahupuaʻa, Kula Moku, Maui Mokupuni (TMKs (2) 2-2-028:181 and (2) 2-2-002:014) (Google Earth)

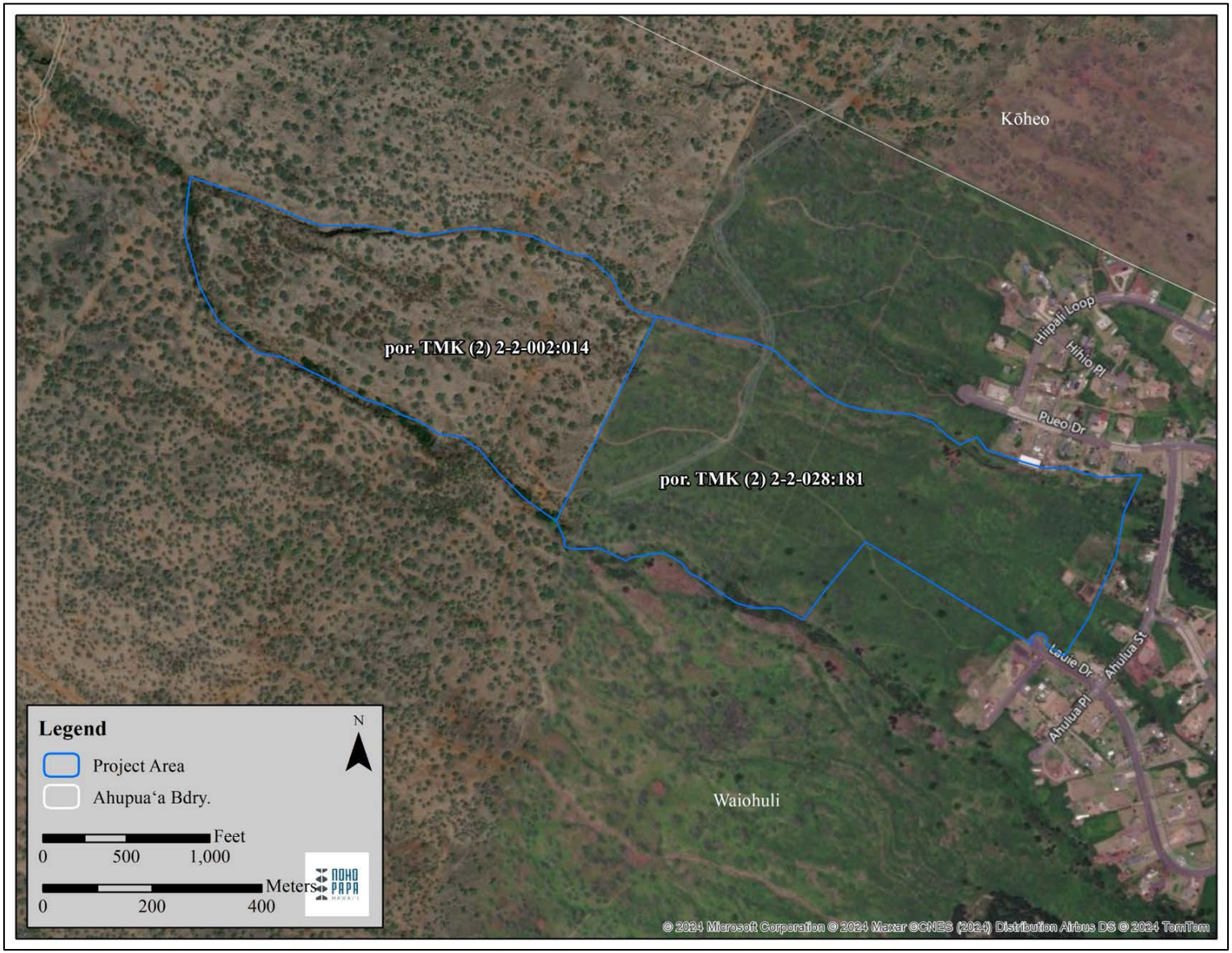


Figure 3. Aerial close up photo of the project area in Waiohuli Ahupua'a, Kula Moku, Maui Mokupuni, TMKs: (2) 2-2-028-181 and (2) 2-2-002:014 (Google Earth)

Waiohuli Homestead Association (WHHA) and Pueo Development LLC proposes to develop two parcels, TMKs: (2) 2-2-028-181 and (2) 2-2-002:014, totaling roughly 150-acres dedicated to increasing economic opportunities within the Waiohuli Homestead community. The project involves a public-private collaboration with WHHA and Pueo Development LLC that combines traditional construction of a master plan development with community-based job opportunities derived from development of infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for the Waiohuli community.

The goal of the project is to provide short and long-term economic opportunities that will foster greater self-sufficiency for the people of upcountry Maui through capacity building and jobs homegrown at the roughly 150-acre site. With the primary goal of creating community-based economic opportunities, the project includes the development of a master plan that incorporates a variety of land uses to support the community.

Proposed Land Use Include:

- Community Support Training Facilities
- Infrastructure Training Sites
- Agricultural Development Training Sites
- Renewable Energy Development/Training Sites
- Natural Drainage Gulch Areas

Document Purpose and Regulatory Context

This purpose of this CIA is to inform an Environmental Assessment per the requirements of the Hawai‘i Environmental Policy Act (HEPA) and its implementing legislation Hawai‘i Revised Statutes §343. This study is intended to support the proposed project’s environmental compliance review.

The State constitution, state laws and courts require government agencies “to promote and preserve cultural beliefs, practices, and resources of native [sic] Hawaiians and other ethnic groups. Chapter 343 also requires environmental assessment of cultural resources, in determining the significance of a proposed project,” (State of Hawai‘i Environmental Council 1997; Appendix A). As noted by the State of Hawai‘i Environmental Council (1997), “[a] cultural impact assessment analyzes the impact of a proposed action on cultural practices and features [collectively termed ‘cultural resources’] associated with the project area.”

The proposed project requires compliance with the Hawai‘i environmental review process per HRS Chapter 343. HRS 343 requires consideration of a proposed project’s effect on cultural resources (defined as cultural practices and features).

At the request of the Waiohuli Homestead Association (WHHA) and the Department of Hawaiian Home Lands (DHHL), Nohopapa Hawai‘i, LLC, completed this CIA in support of the Environmental Assessment for the WHHA and Pueo Development LLC proposed development of two parcels, totaling 150-acres. Through ethnohistorical background research and consultation, this CIA provides an assessment of the proposed project’s potential impacts to cultural resources, defined as practices and features, which may include Traditional Cultural Properties of ongoing cultural significance that may be eligible for inclusion on the Hawai‘i Register of Historic Places, in accordance with Hawai‘i Revised Statutes Chapter 6E guidelines for significance criteria (AR §13-284) under Criterion E.

Using a combination of background research and community consultation , this CIA study documents cultural resources (defined as practices and features) present in or associated with the project area and vicinity. It provides a platform for the community's ʻike (knowledge) and manaʻo (thoughts) on the impacts posed by the proposed project to cultural resources present in or associated with the project area and vicinity by assessing the impacts of the proposed action, identifying alternatives to the proposed action, and desired mitigation measures, on the cultural resources, practices, and beliefs identified. The structure and content of this Cultural Impact Assessment is in compliance with HEPA, §HRS 343, the 1997 Hawaiʻi Environmental Council's Guidelines for Assessing Cultural Impacts, and "A Bill for Environmental Impact Statements" and Act 50.

The CIA combines ethnohistorical background research of English and Hawaiian-language resources, historical maps, photographs, from archives, repositories, the State Historic Preservation Division, and online and a compilation and summary of various community consultations related to traditional cultural practices and land use. Contents of the study include:

- A discussion of the methods utilized for ethnohistorical research and review, and community engagement.
- A general description of the natural landscapes and resources of Waiohuli Ahupuaʻa including geology, soils, climate, water resources, traditional ecological zones, native flora and fauna, and traditional subsistence practices.
- A compilation of cultural traditions such as inoa ʻāina, moʻolelo, ʻōlelo noʻeau, oli, and mele.
- An examination of the traditional land uses of Waiohuli and a historical overview of land use changes including historical maps, visitor recollections, and Māhele information.
- A review and summary of the archaeological and cultural resources within Waiohuli Ahupuaʻa.
- A compilation of interview summaries from community participants with a discussion concerning the cultural beliefs, practices and resources identified, and if they are affected directly or indirectly by the proposed project.
- A presentation of final recommendations regarding the future management and stewardship of the study areas and a brief conclusion.

Methods

This Cultural Impact Assessment consisted of four primary tasks: (1) ethnohistorical background research; (2) community consultation, summaries, and recommendations; (3) cultural impacts assessment; (4) synthesis and recommendations. The study spanned a 6-month period from May 2024 through October 2024. While conducting this study, Nohopapa Hawaiʻi's research team incorporated a set of living values and beliefs to help guide our research, analysis, behavior, perspective, and overall frame of reference. The core values directing our hui included:

- *Aloha ʻĀina- to have a deep and cherished love for the land which created and sustains us*
- *Haʻahaʻa- to be humble, modest, unassuming, unobtrusive, and maintain humility*
- *Hoʻomau- to recognize, appreciate, and encourage the preservation, perpetuation, and continuity of our wahi pana and kaiāulu*
- *ʻImi Naʻauao- to seek knowledge or education; be ambitious to learn*

» *Kuleana- to view our work as both a privilege and responsibility*

These values represent the underlying foundation, spirit, and structure for this study. It was our hope that by providing a frame of reference and guiding values, the teams' efforts would be better understood in the context of our being indigenous researchers genuinely believing in and practicing aloha ʻāina and aloha lāhui.

Ethnohistorical Research Methods

Ethnohistorical information is the foundation for understanding the natural, cultural, and historical background of Waiohuli. To begin to provide a more comprehensive understanding of Waiohuli and its surrounding areas, this research looked at the cultural and historical overview of the Kula Moku landscape, as well as the environmental setting, places names, moʻolelo, land use, ownership, and management history of Waiohuli Ahupuaʻa and its surrounding areas. This task encompassed a search in various archives, repositories, and online databases.

Background research included a review of previous archaeological studies on file at the State Historic Preservation Division, and a review of documents from the Hawaiʻi State Archives Digital Collection, the University of Hawaiʻi at Mānoa's Online Maps, Aerial, Photograph and GIS (MAGIS) library.

Information on the environmental setting or natural landscape and resources as they relate to cultural and historical activities was gathered primarily through reviewing previous archaeological studies and various reports and books for the project area.

Historic maps, reports, photographs and accompanying information were gathered from the Nohopapa internal database were also examined. In addition, Māhele records were derived from various databases such as Papakilo Database, Ulukau, AVA Konohiki, the Buke Māhele, and Boundary Commissions. Inoa ʻāina (place names), moʻolelo (stories), and ʻōlelo noʻeau (proverbs) were compiled from Hawaiian language and English sources in books, newspapers, available through the aforementioned online databases and archives.

The literal (or provided figurative) meanings of the place names were obtained online from various Hawaiian Language Dictionaries, and online through Nā Puke Wehewehe ʻŌlelo Hawaiʻi.

To have a deeper understanding of place names as applicable to Waiohuli, moʻolelo, oli, and ʻōlelo noʻeau were compiled from Hawaiian language and English sources in books, newspapers, and online databases such as Lloyd Sohrens Hawaiʻi Place Name Database, Hawaiian Legends Index, Institute of Hawaiian Language Research and Translation and Nupepa.org.

Historical accounts which include Kingdom of Hawaiʻi land use and resource management practices, early visitor and plantation era accounts were derived from historical and documents such as Māhele records found on AVA Konohiki, and Waihona databases. Māhele information included looking at Boundary Commission Testimonies, Land Commission Awards, Native & Foreign Testimonies and Registers, Government Land Grants, Crown lands, and Government Surveys. Information about Māhele documents was accessed through Waihona ʻAina, Kipuka, and Papakilo databases. To accompany these historical accounts, this research included a search for historic photographs at the Hawaiʻi State Archives and the Archives of the Bishop Museum.

Community Consultation Methods

Community consultation efforts involved engaging with community members to record and acknowledge their historical connections to Waiohuli and document the visions they have for this place. Community consultation was conducted from May 2024 through to July 2024. The ethnographic process consisted of identifying appropriate and knowledgeable individuals, reaching out to them to participate (Appendix C: Community Participation Letter) conducting community consultation questionnaires (Appendix D: Interview Themes/Questions), summarizing the questionnaires, analyzing the data, and preparing this report.

Scoping and Interviewee Selection

Initial scoping methods included emailing letters (Appendix C: Community Participation Letter) to inform individuals of the project, then following up with emails and phone calls to secure participation. Participants were selected because of their familiarity with, or knowledge of the project area. A total of five individuals participated in consultation by completing a questionnaire (Appendix D: Interview Themes/Questions) (Table 4).

Knowledge Sources

During the study, project staff learned that kamaʻāina who participated in the interviews acquired their knowledge about the ahupuaʻa of Waiohuli and the broader landscape of Kula Moku from the following sources:

1. ʻOhana knowledge or personal, historical knowledge and information passed on within the ʻohana from one generation to the next, as well as raising their own families.
2. Knowledge gathered through personal experience, observations and practices growing up in the area (such as knowledge acquired through cultural work and practices within or near the project area).
3. Knowledge obtained from individuals outside their ʻohana such as teachers, cultural practitioners, and kūpuna.
4. Knowledge obtained through written sources such as books, documents, newspapers, reports, and studies.

Generally, the kamaʻāina that participated in the interviews acquired their knowledge about the Waiohuli ahupuaʻa through growing up in the upcountry Kula area, gained experience and pilina as current Waiohuli residents, personal experience and observations, and/or knowledge from written sources.

Community consultation

Nohopapa utilized questionnaires for this CIA consultation process. The questionnaires were themed while also leaving space for the freedom to encourage open-endedness for sharing other manaʻo as the consultee felt necessary. The interview questions were derived from primary themes identified to obtain an understanding of Waiohuli's historical and contemporary significance and to document concerns and recommendations. Community manaʻo is organized in four overarching themes relating to:

1. Moʻokūʻauhau – genealogy and family history, ʻohana and individual connections and relationships to the area
2. Moʻokūʻauhau ʻāina, ʻĀina Mauli Ola – genealogy of the land, traditional and historic land use and ownership; natural resources and ecosystems including changes over time
3. Moʻolelo – traditional accounts including place names, mele, oli, hula, ʻōlelo noʻeau
4. Recommendations, concerns, and suggestions regarding impacts the project might have to any wahi kūpuna or practices within or around the project area

Data Integration

The questionnaires were summarized and then sent to the participants for review, an accuracy check, and to confirm they were comfortable with the thoughts, information, and comments being shared. Nohopapa worked hard to ensure that the voices of the community were honored, respected, correctly heard, and properly conveyed.

Ethics

Throughout the study, all participants were informed that their involvement in the study was voluntary. An informed consent process was initiated and completed, including providing ample project background information. The informed consent form (Appendix C) included the participant's rights including notification that participants could choose to remain anonymous. Project background information included explaining the study focus and the purpose and importance of the study. After proper notification and discussion, the interview participants voluntarily provided signed consent for Nohopapa to use their manaʻo for this CIA.

Cultural Impact Assessment Methods

Consultation summaries were reviewed and synthesized for information, perspectives, and opinions regarding:

- 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;
- 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;
- An explanation of confidential information that has been withheld from public disclosure in the assessment; and,
- A discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs.

An assessment of impacts posed by the proposed project to cultural resources – defined as practices and resources – within the project area was then performed. The scope of the analysis was commensurate to information yielded during consultation regarding cultural resources associated with the project area and potential impacts posed by the proposed project. In this instance, the effort included consideration and discussion 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.

NATURAL LANDSCAPE AND RESOURCES

Environmental Setting

This section describes the environmental landscape of the project area, including its topography (general elevations, distance inland, and general terrain patterns), geology and soils, vegetation, climate (including rainfall and winds), and hydrology.

The project area is located in the Waiohuli Ahupuaʻa, Kula Moku of Maui, at an elevation of 590 m (1,935.7 ft) above mean sea level (Google Earth 2023). The project area is situated ma kai (seaward) of the Kula Highway in the zoned Waiohuli Hawaiian Home Lands area. The general area has an average temperature of 20.2° C (68.36° F) and receives approximately 530.8 mm (21 inches) of rain per year (Giambelluca et al. 2014; Giambelluca et al. 2013). Waiohuli is an ahupuaʻa flanked by the ahupuaʻa of Kōheo and Kaʻonoʻulu to the north and Kēōkea to the south. The low-lying coastal plains below Waiohuli host the town of Kīhei and ascend to broad uplands that comprise the slopes of Haleakalā.

The moku of Kula that encompasses Waiohuli is an arid region whose vast and stony lands are devoid of streams (Handy, Handy, and Pukui 1972:510-511). According to the U.S. Department of Agriculture (USDA) Soil Survey Geographic (SSURGO) database (2001) and soil survey data gathered by Foote et al. (1972), the project area's soils consist predominantly of Kula very rocky loam (KxbE). (Figure 3) Kula series soils are volcanic, originating in volcanic ash, found on Maui in an array of topographies and elevations, and described as "well-drained soils on uplands" (Foote et al. 1972:76). Foote et al. (1972:76) further describe Kula series soils as "used for pasture, truck crops, orchard crops, and wildlife habitat." Kula very rocky loam soils are characterized by Foote et al., who write:

> In a representative profile the surface layer is dark reddish-brown loam about 8 inches thick. The subsoil, about 46 inches thick, is dark-reddish-brown loam, silt loam, and silty clay loam that has subangular blocky structure. The substratum is slightly weathered basic igneous rock. The soil is slightly acid in the surface layer and slightly acid to neutral in the subsoil.
>
> Permeability is moderately rapid. Runoff is medium, and the erosion hazard is moderate. The available water capacity is about 1.8 inches per foot of soil. In places roots penetrate to rock. [Foote et al. 1972:76-77]

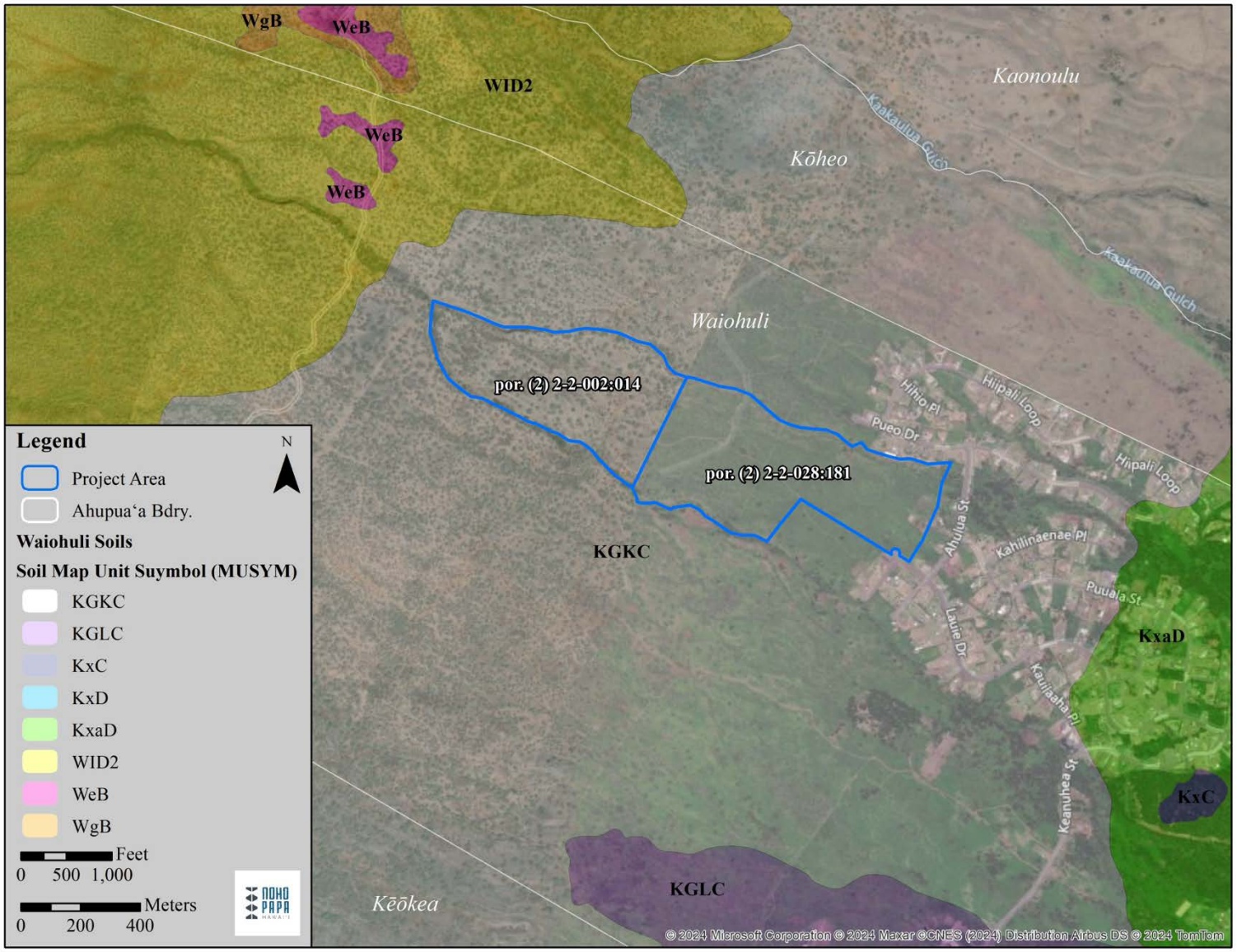


Figure 4. Overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972), indicating soil types within and surrounding the project area (U.S. Department of Agriculture Soils Survey Geographic Database [SSURGO] 2001)

Biocultural Landscape

Kula is part of an extensive dry environmental zone–one of the largest in the archipelago that spreads across multiple ahupuaʻa on the flanks of Haleakalā, including the project area of Waiohuli. Hawaiian settlement and land use in the dry, unique, and bountiful district of Kula was oriented towards its rich pelagic fishing grounds and emphasis on sweet potato cultivation (Handy, Handy and Pukui 1972:276). Handy, Handy and Pukui (1972:272) describe Kula, including the uplands occupied by the current project area in Waiohuli, as one of Maui's five ancient population centers. They write:

> On the south coast of East Maui, from Kula to ʻUlupalakua, a consistently dry and lava-strewn county, Makena and Keʻoneoʻio were notable for good fishing; this brought many people to live by the shore and inland. There were some patches of upland taro, not irrigated; but this was a notable area for sweet potato, which, combined with the fishing, must have supported a sizable population although it cannot be counted as one of the chief centers. [Handy, Handy, and Pukui 1972:272]

The authors also describe Kula as part of "the great ʻuala [*sweet potato*] area of Maui," (Handy, Handy, and Pukui 1972:336-337) and theorize "the fishermen in this section must have depended for vegetable food mainly on *poi* brought from the wetlands of Waikapu and Wailuku to westward across the plain to supplement their usual sweet-potato diet," (Handy, Handy and Pukui 1972:511).

Vegetation

Invasive plants associated with the Kula very rocky loam soils of the project area include: bermudagrass (*Cynodon dactylon*), black wattle (*Acacia mearnsii)*, Natal redtop (*Malinus repens*), rattail grass (*Sporobolus indicus*), and yellow foxtail (*Setaria pumila*) (Foote et al. 1972:76; CTAHR 2023; Invasive Plant Atlas of the United States 2023). Due to the arid and dry conditions of Kula, wetland cultivation of kalo *(Colocasia esculenta)* was not particularly prevalent in the area and instead only some patches of unirrigated upland kalo existed in Kula (Handy, Handy, and Pukui 1972:272). The Kula moku itself was most notable for the cultivation of ʻuala *(Ipomoea batatas)*. Wiliwili *(Erythrina sandwicensis)* is an endemic plant that can be found in the Kula Moku.

No Ka Ua a me Ke Ao (Regarding Rain and Clouds)

The intimacy developed by Kānaka ʻŌiwi (Native Hawaiians) in relation to the natural environment is evident in the practice of naming natural features, resources, and environmental elements. Hawaiians honored and celebrated the world around them by the careful, thoughtful, and intentionality of giving a name, and therefore, mana (authority or power) to a person, place or thing. Natural features of the landscape, oceanscape, and skyscape were observed intimately by those who were of, and frequented a place so deeply, that the particularities of the natural elements were understood and named affectionately to honor, describe, and celebrate its connection. Authors of *Hānau Ka Ua: Hawaiian Rain Names*, Leimomi Akana and Kiele Gonzalez, further describe this intimacy specific to rain:

> Our kūpuna had an intimate relationship with the elements. They were keen observers of their environment, with all of its life-giving and life-taking forces. They had a nuanced understanding of the rains of their home. They knew that one place could have several different rains, and that each rain was distinguishable

> from another. They knew when a particular rain would fall, its color, duration, intensity, the path it would take, the sound it made on trees, the scent it carried, and the effect it had on people. [Akana and Gonzalez 2015:xv]

Hānau Ka Ua is a comprehensive publication that delves into the richness of rain names associated with various places throughout Hawai‘i. The author Akana, and translator Gonzalez are Native Hawaiian scholars and teachers whose publication honors the unique rains of Hawai‘i and the places they are associated with. The collection of rain names included in this publication is often paired with a mele, or song, that references the rain and its association to a featured place. This section utilizes Akana and Gonzalez's *Hānau Ka Ua* and the cited sources included in their work in order to identify the rains associated with the project area in Kula, Maui. This section includes the description of each rain and the mele or referenced source associated with it as compiled by Akana and Gonzalez.

The primary rains found associated with the Kula moku of Maui are the Nāulu, ‘Ūkiu, and ‘Ulalena rains. Akana and Gonzalez (2015:191) name Nāulu as a "rain of East Maui" and associate it specifically with the Kula moku. Akana and Gonzalez share a kanikau or lament chant honoring an individual by the name of L.L. Ua composed by the students of Lāhainaluna Seminary (2015:191,192). Reflected in the Akana and Gonzalez's translation of this kanikau, Nāulu is described as the cold, misty rain of Kula.

> Ke ho‘i nei ka ‘uhane i ka malu niu o Lele
> I ka malu kuawa o Wailuku
> I ka ua Nāulu noe anu o Kula
> I ka ua noe uahi moe i ke pili
> I pili ‘ia ka ua me ka lā
> Ke anu ho‘i me ke ko‘eko‘e
>
> *The spirit is returning to the shade of the niu trees of Lele*
> *To the shelter of Wailuku Valley*
> *To the cold, misty Nāulu rain of Kula*
> *To the smoky, misty rain that rests upon the pili grass*
> *Joined are the rain and the sun*
> *The cold and the chill*
> [Akana and Gonzalez [trans.] 2015:191,192]

The Nāulu rain also appears in a mele associated with the ‘Alae ahupua‘a of Kula. ‘Alae is the ahupua‘a north of Waiohuli that borders the ahupua‘a of Ka‘ono‘ulu. The mele reads: "Ho‘opu‘upu‘ua nā kahawai o ‘Alae i ka wai a ka Nāulu. *The streams of ‘Alae choke in the water from the Nāulu rain"* (Akana and Gonzalez 2015:191). Ethnohistorical records relay that Nāulu is also a type of cloud. Josua Ahulii shared oral traditions regarding the Nāulu rain with Thomas K. Maunupau, who published Ahulii's oral mana‘o (insights, perspectives) in the Hawaiian language newspaper *Ka Nupepa Kuokoa* in 1922 (Maunupau [Mary Kawena Pukui and Malcolm Naea Chun, trans.] 1998:108). Ahulii defined the rain as: "Ua Nāulu–he ua i ka wā mālie hele i ke kuahiwi; he ao Nāulu me ka ua. *(Nāulu rain–a rain that falls when it is calm and goes to the mountains; a Nāulu cloud with rain)*," (Ahulii 1922 in Akana and Gonzalez [trans.] 2015:191). This account references Nāulu as both a rain and a cloud.

Similarly, a kanikau composed for the renowned and beloved Hawaiian patriot, politician, historian, teacher, lawyer, writer, newspaper editor, and artist, Joseph Nāwahīokalani‘ōpu‘u, describes Nāulu as a type of cloud in Kula that lingers near Haleakalā. The mention of the ‘Ūkiu

rain is woven in the composition of this chant and is identified as a rain belonging to an area named Liliko‘i in the Kula moku of Maui (Akana and Gonzalez 2015:256).

> Uhi ka ‘ohu kūpouli, ne‘e i ka piko kaulana o Haleakalā
> He lā ho‘okē ‘ai kā nā ao Nāulu e ho‘oulukū nei
> ‘O kā ke kilokilo ia a ka ‘Ūkiu e nihi hālo‘ilo‘i a‘ela i loko o Liliko‘i
>
> *A day of fasting for the agitated Nāulu shower clouds*
> *This was foretold by the ‘Ūkiu rain that, welling with tears,*
> *softly moves about in Liliko‘i*
> [Akana and Gonzalez [translator] 2015:256]

A mele kālau‘āina (political chant) for ‘Emalani Keleleonālani, also known as Queen Emma, associates the ‘Ūkiu and ‘Ulalena rain with Kula, Maui (Akana and Gonzalez [trans.] 2015:192; Nogelmeier 2001:179,180). Akana and Gonzalez ([trans.] 2015:262) translate ‘Ulalena as “yellowish-red.” The excerpt from the mele kālai‘āina for ‘Emalani Kaleleonālani containing reference to rains of Kula reads:

> Ō mai ‘o ‘Emalani, ke ali‘i i nona ia inoa
> Ia ho‘onu‘anu‘a i uka, ka uahi o Kula
> Ua hāli‘i ke kūmoena wai a ka Nāulu
> ‘A‘ohe hana a ka ua ‘Ūkiu e la‘i nei
> E ho‘okō ‘ia ana e ka Ua ‘Ulalena
> E ka ua kahiko kukui o Liliko‘i ē, eia ‘oe e
>
> *Emmalani responds, the chiefess for whom is the name*
> *That conflagration in the uplands, the smoke of Kula*
> *The watery may of the Nāulu rain has been spread out*
> *There’s no action by the ‘Ūkiu rain, now peaceful*
> *It shall be carried out by the golden-red rain ‘Ulalena*
> *O rain that adorns the kukui trees of Liliko‘i, here you are, oh*
> [Nogelmeier 2001:179-180]

As portrayed in the composition of the mele and accounts described above, the named rains associated with Kula are Nāulu, ‘Ūkiu, and ‘Ulalena. Particular to this region, Nāulu is understood by the people of the area to be the name of both the rain and the cloud of Kula. In regard to other clouds associated with the project area, American writer, A.von Tempski, shares an account that identifies ‘Ūkiukiu as another cloud of Kula that accompanies Nāulu. In this description, Nāulu and ‘Ūkiukiu are characterized as warrior clouds that battle one another over Haleakalā:

> I listened avidly while Makalii told me about the Cloud Warriors, Naulu and Ukiukiu—trade-wind-driven clouds split by the height and mass of Haleakala into two long arms. Naulu traveled along the southern flank of the mountain, Ukiukiu along the northern and they battled forever to possess the summit. Usually Ukiukiu was victorious, but occasionally Naulu pushed him back. Sometimes both Cloud Warriors called a truce and withdrew to rest, leaving a clear space between the heaped white masses of vapor looming against the blue of the sky. The space, Makalii told me, was called Alanui o Lani–The Highway to Heaven. [Tempski n.d. in Sterling 1998:243]

No Ka Makani (Regarding Winds)

In the same thoughtful regard kānaka imparted to the naming of the rains and clouds, winds were also observed intimately so that their nuances were understood, and they too were warranted the mana of a given name. This section explores oral traditions, moʻolelo, and ʻōlelo noʻeau that name the winds associated with Kula, Maui. Three winds were identified with reference to the Kula moku; Hau, Nau, and Kēhau.

The Wind Gourd of Laʻamaomao, translated by retired Hawaiian language and history instructor, Esther T. Mookini and Hawaiian language instructor and knowledge holder, Sarah Nākoa, is a significant resource that inventories the makani (winds) of Hawaiʻi found throughout the archipelago. The wind names are preserved in this account through the form of moʻolelo and chant.

During the 16th century, Keawenuiaʻumi was the ruling chief of Hawaiʻi (Nakuina 2005:1). His kahu iwikuamoʻo, or trusted chiefly attendant, was Kūanuʻuanu (Nakuina 2005:1). Keawenuiaʻumi cared deeply for his kahu, and just as so, Kūanuʻuanu cared deeply for his aliʻi (chief). In this moʻolelo, Kūanuʻuanu longs to travel to the other islands and is granted the blessing of Keawenuiaʻumi to do so, with the agreement that should the time come for when he is needed, Kūanuʻuanu must return to Hawaiʻi and fulfill his kuleana as kahu iwikuamoʻo. With this blessing, Kūanuʻuanu departs from Hawaiʻi and settles on the island of Kauaʻi. There, he meets Laʻamaomao, the proclaimed beauty of Kapaʻa (Nakuina 2005:2). Together, Kūanuʻuanu and Laʻamaomao have a son named Pākaʻa. However, before Pākaʻa is born, the aliʻi, Keawenuiaʻumi begins to yearn for his kahu iwikuamoʻo and sends an ʻelele (messenger) to retrieve Kūanuʻuanu from Kauaʻi. Honoring their agreement, Kūanuʻuanu departs Kauaʻi to return to his aliʻi, leaving behind his wahine (wife), Laʻamaomao and son, Pākaʻa. Pākaʻa grows to be a young, intuitive, and skilled child (Nakuina 2005:5). Unaware of the true identity of his father, Pākaʻa develops a thirst to travel in search of him. His mother, Laʻamaomao sees this desire growing in Pākaʻa and gifts him a gourd. This treasured gourd belonged to her grandmother, Laʻamaomao, who she is named for (Nakuina 2005:14). This gourd was unlike any other for it possessed the cherished bones of her grandmother and all the winds from Hawaiʻi to Kaʻula (Nakuina 2005:14). Laʻamaomao gives Pākaʻa this gourd and entrusts him with its care. Laʻamaomao teaches Pākaʻa the pule (prayers), chants, and mele for each of the winds, that in doing so, he could call forth all the winds of Hawaiʻi and wield its powers. The epic tale of Pākaʻa journeys throughout Hawaiʻi where he uses his wits and the wind gourd of Laʻamaomao to succeed in his affairs during his travels.

In a section of this moʻolelo, Pākaʻa finds himself in a quarrel and cries out to his father to call forth the winds of Maui and Molokaʻi (Nakuina 2005:54-55). The excerpt shared here is but a fragment of an over 100-lined chant recited in this moʻolelo. This chapter of Pākaʻa's journey was published in its original Hawaiian language text in the newspaper, *Ke Au Okoa*, in 1867. The article printed in this issue is titled, "Kaahele ma Molokai," and was authored by J. H. Kanepuu (Kanepuu 1867:4). What is of value to this study and is brought to the forefront here, is the wind names identified in this composition that are associated with the moku of Kula on the island of Maui. This section shares the excerpt of the chant in its original Hawaiian text as it appeared in *Ke Au Okoa* penned by Kanepuu. The English translation as read in *The Wind Gourd of Laʻamaomao*, is provided below and is accredited to Kānaka ʻŌiwi scholars, kumu, and translators Esther T. Mookini and Sarah Nākoa.

Hina ka hau i ka uka o Kula,	*Hau descends from the uplands of Kula,*
Ke noke mai la i ke pili,	*It's the wind of that place, searching the pili*
Ka makani o Kula o ka Nau	*Nau is the wind of Kula*
[Kanepuu 1867:4]	[Nakuina 2005 (Mookini and Nākoa, translator):55]

The segment of the chant recited by Kūanuʻuanu names the makani Hau and Nau as the winds belonging to Kula. An 1865 oral account published in the Hawaiian language newspaper, *Ke Au Okoa*, describes Kula as a land famed for "the Hau wind that blows the columns of smoke of Kula low over the ground, that go by so silently and swiftly" (Nailiili 1865 in Sterling 1998:243). The makani, Kēhau, and its association to Kula is described in the ʻōlelo noʻeau: "Kokolo ka uahi o Kula, he Kēhau. *The smoke of Kula creeps along when the Kēhau breeze blows.* When there is smoke there is fire" (Pukui 1983:197, #1824).

CULTURAL LANDSCAPE

Hawaiian oral traditions have been passed down by word of mouth from one generation to the next and recorded in more contemporary times. Hawaiian oral traditions are important; they convey a general sense of Kanaka ʻŌiwi (Native Hawaiian) history, people's connection to land, how they lived, and their traditional land tenure. Hawaiian oral traditions are relayed in the form of mele (songs), ʻōlelo noʻeau (proverbs), pana noʻeau (sayings), moʻolelo (stories), moʻokūauhau (genealogies), and accounts in nūpepa (historic newspaper articles). These forms of oral traditions can be woven into each other. For instance, a moʻolelo may present a mele about a moʻokūʻauhau. Hawaiian oral traditions are vehicles for the intergenerational transmission of knowledge. They serve as a timeless bridge to cultural insights and beliefs that have guided Hawaiians across centuries and generations.

Today, through written form and English translations, these cultural traditions persist as sources of ancestral wisdom. Hawaiian oral traditions tell of the resources of the land, akua (gods), kupua (supernatural deities), ʻaumākua (familial guardians), aliʻi (chiefs), and ka poʻe kānaka (the Hawaiian people) whose stories weave a unique and treasured history of this ʻāina. This section of the report draws from a variety of oral and documented resources to present an overview of the cultural and historical background of the current study area. The goal of this broad overview is to contextualize the study area of Kahului, as well as the greater landscape of Wailuku in which the study area exists, through the compilation of place names, wind and rain names, ʻōlelo noʻeau and associated moʻolelo.

Wahi Kūpuna

Wahi kūpuna are special ancestral spaces and places where Native Hawaiians maintain relationships to the past and foster their identity and well-being in the present (The Kaliʻuokapaʻakai Collective 2021:4). As cultural anchors to place, ancestral knowledge and practices, wahi kūpuna are strikingly similar to Traditional Cultural Properties defined by the National Park Service as places with "association with the cultural practices or beliefs of a living community that are (a) rooted in a community's history, and (b) are important in maintaining the continuing cultural identity of the community," (Parker and King 1998:1).

Wahi kūpuna and wahi pana (storied places) comprise component parts and/or entire contiguous Hawaiian cultural land, sea, and skyscapes (Pukui, Elbert, and Mookini 1974:x- xii; Oliveira 2014:78-79; The Kaliʻuokapaʻakai Collective 2021). Place names embody and perpetuate Hawaiian cultural history, knowledge, and practices. As explained by Oliveria (2014:78): "To Kānaka and other indigenous peoples who share a close connection to their land and use oral traditions to record their history, place names and landmarks serve as triggers for the memory, mapping the environment and ultimately the tradition and culture of a people." Wahi pana and wahi kūpuna are special places and spaces. As noted by Maly and Maly (2022:14-15): "Names would not have been given to–or remembered if they were–mere worthless pieces of topography." Traditional nomenclature indicates the variety of functions that named localities served, such as describing a particular feature of the landscape; indicating a site of cultural and ceremonial significance; recording particular events or practices that occurred in that given area; revealing the source of a natural resource or other materials necessary for a cultural practice; marking trails and trailside resting places; signifying triangulation points for cultural practices; giving notice of residences; showing the use of an area; and recording a notable event that occurred in the area (Maly and Maly 2022:14-15).

Pukui, Elbert, and Mookini (1974:226) describe Waiohuli as a "land division, gulch, and village" whose literal translation is said to mean "water of change," though the environmental conditions of the Kula region are arid and is acknowledged as a place devoid of water (Handy, Handy, and Pukui 1972:510-511). Despite the lack of water present in the project area, several accounts attest to Waiohuli as a storied wahi kūpuna whose lands have been cultivated abundantly by ʻuala. The accounts described in the later sections of this document reveal stories of the cultivated upland regions of Waiohuli that sustained its people with the necessary resources to survive. The cultivated lands along with an array of wahi kūpuna, such as numerous heiau (religious sites) outlined here, provide more points of reference across the landscape to further reinforce the cultural themes and interconnectivity of the project area to its surrounding landscape. Wahi kūpuna of Waiohuli and the broader region of Kula revealed during background research are featured below in Table 1 and Figure 4, which illustrate the contiguous, interrelated, layered nature and significance of the Hawaiian cultural landscape. What is presented here is not a comprehensive inventory; for more wahi pana and wahi kūpuna undoubtedly exist, await discovery or revelation. What is presented below is a surface overview of what was revealed during research at this time and is encouraged as a catalyst for further exploration.

Table 1. Wahi Kūpuna of Waiohuli Ahupuaʻa, Kula Moku, Maui Mokupuni

Inoa (Name)	Type	Description and Location
Kaimupeelua	Heiau	Described by Walker (1931:279) as "a small heiau on a rocky knoll. The natural level of the top has been used and the northeast side built up of stone to 10 feet. A true wall has been built on the southeast and forms an enclosure for a house at the south corner. Interior measurements could only be taken as the edges of the walls and terraces has been destroyed by cattle. The interior measures 53 x 55 feet. There is a high platform in the center, 11 x 20 feet and 4 feet high. A pit is found on top. The front of the heiau toward the sea is open but natural levels may have served as terraces. Construction is of aa blocks and some coral is present." Location: "about a half a mile below the county road and just south of the second tank," (Walker 1931:279).
Kaumeheiwa	Heiau	Described by Walker (1931:278) as "a small walled notched shaped heiau. It measures only 50 x 41 feet. The walls are 3 and 4 feet high and 4 feet thick. There is a suggestion of a pavement in the east end, but the small enclosure at the outside looks modern. Coral was found by no pebbles." Location: "About a mile northeast of heiau Kaumiumimua in a stretch of ʻaʻā," (Walker 1931:278).
Kaumiumimua	Heiau	Described by Walker (1931:276) as "[a] notched walled heiau 83 x 90 feet. It faces west to the sea but has a wall 9 feet thick across this end. Elsewhere it is about 6 feet thick and 4 to 5 feet high. Construction is of Aa blocks and it has no iliili [sic], pebbles, or coral. The interior

Inoa (Name)	Type	Description and Location
		has been much disturbed but the rough pavement in the northern end indicates a platform here. There is also what appears to be one near the entrance." Located "[b]elow heiau Molohai still in line with Haleakala Church and Puu Kali," (Walker 1931: 277). Note: Regarding the location of Molohai heiau, Walker (1931:276), states that it is "below heiau Papakea several hundred yards," however, the location of Papakea is unclear.
Kaunuopahu	Heiau	Described by Thrum (1917:59) as one of two large heiau at Ōmaʻopio.
Mahia	Heiau	Described by Thrum (1917:59) as one of two large heiau at Ōmaʻopio.
Mana	Heiau	Described by Thrum (1917:59) as a heiau at Ōmaʻopio "of large size and platform character... was found to be now used as a burial place though in a cactus field."
Nininiwai	Heiau	Described by Thrum (1917:59) as a heiau of medium size at Pulehu still standing.
Ōmaʻopio	Ahupuaʻa	"Land division, homesteads, and road, Mākena qd., Maui. Perhaps *lit*., whistling thrush," (Pukui Elbert, and Mookini 1974:170).
Pulehu	Ahupuaʻa	"Land division, road, and gulch, Puʻu-o-kali qd., Maui. *Lit.,* broiled," (Pukui Elbert, and Mookini 1974:193).
Pauhu	Heiau	Described by Walker (1931:279) as a "large heiau that was destroyed when the present road was built. 60 x 66 feet with two divisions."
Poonahoahoa	Heiau	Described by Thrum (1917:59) as a medium heiau in size at Ōmaʻopio.
Puʻu o Kali	Puʻu	Pukui, Elbert, and Mookini (1974:203) write: that this site is a "Quadrangle and hill (1,481 feet height), believed once a moʻo, the wife of nearby Puʻu-hele; their child, Puʻu-o-inaina (hill of wrath) was place on Ka-hoʻolawe and later was a lover of Pele's sweetheart, Lohiʻau." Literally translated to mean "hill of waiting," (Pukui et al. 1974:203).
Waiohuli	Ahupuaʻa	"Land division, gulch, and village," (Pukui et al. 1974:226). Translated to mean "water of change," (Pukui, Elbert, and Mookini 1974:226).

ʻŌLELO NOʻEAU

ʻŌlelo noʻeau or Hawaiian proverbs and poetical sayings are valuable in perpetuating Hawaiian cultural knowledge, presenting kaona (concealed reference), and illustrating creative expressions that incorporate observational knowledge with educational values, history, and humor. They can be reflected upon to inform an individual of the conditions or characteristics of a place, group of people, or event in history. They can be looked towards to glean insight on the peculiarities of a given landscape or behavior of people, and oftentimes provide guidance in understanding the wisdom and warnings left to us by those of the past. Today, ʻōlelo noʻeau serve as a traditional source to learn about kaona, people, places, and the environment of Hawaiʻi. As one of the many celebrated works penned by Pukui during her time, the 1983 publication of *ʻŌlelo Noʻeau: Hawaiian Proverbs and Poetical Sayings*, is one of which holds no end in its relevance and richness as it relates to an epistemological worldview that is Hawaiian. Although few direct ʻōlelo noʻeau could be found during this study for the immediate project area of Waiohuli, the ʻōlelo noʻeau included below bring attention to the surrounding area of Waiohuli highlighting resources, cultural significance and renowned traditions within the Kula District of Maui. Though these sayings do not speak directly to the project site boundaries, the holistic understanding of the cultural and environmental landscape as a whole, inclusive of the border region is paramount to fully, and properly grasp the significance of the project area. To analyze the cultural context of the project area isolated from the cultural significance of the region it is situated upon and has coexisted within, disconnects the wealth of history that is embedded within the landscape. This section brings attention to the nearby and surrounding areas of Waiohuli, highlighting the ʻōlelo noʻeau that illuminates the resources, cultural significance, and traditions of the district of Kula, Maui.

88 ʻAi puaʻa a Kukeawe.
The pork-eating of Kukeawe.
Said of a person who is not satisfied with the number of his own pigs and so robs his neighbors of theirs.
[Pukui 1983:12, #88]

1824 Kokolo ka uahi o Kula, he Kēhau.
The smoke of Kula creeps along when the Kēhau breeze blows.
When there is smoke there is fire.
[Pukui 1983:197, #1824]

1911 Kula unahi pikapika heʻe.
Kula people, scalers of the suckers on the tentacles of the octopus.
Said in fun of the people of Kula, Maui. A Kula chiefess who lived inland did not know what the suckers on an octopus were and tried to scale them as one scales fish.
[Pukui 1983:205, #1911]

In a conversation between Pukui and Daisy Kalaaupa, a kamaʻāina (native resident) of Kula, the two speak of the context of the ʻōlelo noʻeau, "Kula unahi pikapika heʻe." In their dialogue, Kalaaupa identifies Keʻanae as the place where she was born and Kula as the place where she was raised. In her mention of Kula she remarks, "...Kula, said to be the place for scaling (pikopiko) the suction cups of the octopus tentacles" and begins to sing a mele:

He aina o Kula ua kaulana	*Kula is a land that is famous*
Mai na alii kahiko	*From the days of the ancient chiefs*

Kau na nahi i ka pikopiko i ka he‘e *For the scaling of the suckers of the octopus*
[Kalaaupa and Pukui n.d. in Sterling 1998:243]

After Kalaaupa recites this mele, Pukui comments that similarly to the Kula people’s unfamiliarity with how to properly handle an octopus, she remarks that another saying associated with the people of Kula comments on their inability to appropriately use a paddle. Pukui states, “They knew how to make a paddle, but they didn’t know how to use the paddle. Because they had the wood to make the paddle, but they don’t know how to use the paddle” (Kalaaupa and Pukui n.d. in Sterling 1998:243). The following ‘ōlelo no‘eau demonstrate this characteristic of the people belonging to Kula:

2339 No Kula ia po‘e ke hoe hewa nei.
To Kula belong the people who are such poor paddlers.
Kula, Maui, people are ignorant. Also, never mind the talk of fools.
[Pukui 1983:254, #2339]

2473 O Kula i ka hoe hewa.
Kula of the ignorant canoe-paddlers.
Said of Kula, Maui, whose people did not know how to paddle canoes because they were uplanders.
[Pukui 1983:270, #2473]

Other ‘ōlelo no‘eau associated with Kula are listed below:

2170 Moe kokolo ka uahi o Kula, he hau.
Said of one who is swift in movement. Also, in love and war much depends on swiftness and subtlety.
[Pukui 1983:236, #2170]

2238 Na keiki uneune m**ā**mane o Kula.
The lads of Kula, who tug and pull the māmane up by the roots.
An expression of admiration for the people of Kula, Maui, who accomplish whatever they set out to do.
[Pukui 1983:245, #2238]

2447 O ka wai kau no ia o Ke‘anae; o ka **‘ū**lei ho‘owali ‘uwala ia o Kula.
It is the pool on the height of Ke‘anae; it is the ‘ūlei digging stick of the potato [patch] of Kula.
A handsome young man of Kula and a beautiful young woman of Ke‘anae, on Maui, were attracted to each other. She boasted of her own womanly perfection by referring to her body as the pool on the heights of Ke‘anae. Not to be outdone, he looked down at himself and boasted of his manhood as the digging stick of Kula.
[Pukui 1983:267, #2447]

These ‘ōlelo no‘eau presented in this section characterize the people of Kula as innovative and prosperous as well as isolated by their landlocked environment and unfamiliar with the sea, canoe paddling, and ocean resources.

Mo‘olelo and Ka‘ao

Dr. Kekuewa Kikiloi (2010:78) defines Hawaiian oral traditions as “verbal testimonies or reported statements concerning the past,” and ‘ike kūpuna (ancestral knowledge) and divides them into two types. One group of Hawaiian oral traditions identified by Kikiloi (2010:79) include oli, mele, and ‘ōlelo no‘eau which are short, reproduced through strict protocol, and often “part of sacred learning or tradition.” Mo‘olelo (narratives) and ka‘ao (histories), which are more flexible in structure, version, and meaning, are the second type of Hawaiian oral traditions that concern the past and demonstrate the wealth of ‘ike kūpuna. (Kikiloi 2010:78).

‘Aipua‘a a Kūkewa

Pukui (1983:12, #88) relays the mo‘olelo about an uprising of Kula people and country folks from other districts against a greedy party of raiding chiefs that inspired the ‘ōlelo no‘eau “‘Ai pua‘a a Kukeawe,” (*The pork-eating of Kukeawe)*:

> Kukeawe was a friend of Kahekili who was allowed to help himself to any of Kahekili's pigs in Kula, Maui. But Kukeawe also took the pigs belonging to the people of Kula, Honua‘ula, and Kahikinui and plundered their possessions. These people rose in rebellion, led by ‘Opū, and surprised the followers of Kukeawe while they were ascending Haleakalā on the way to Kula. Kukeawe's party retreated but found their way blocked by other parties led by Kawehena, Kaho‘oluhina, and Kuheana. Kukeawe was killed and his body set up at Palauea for all to see. [Pukui 1983:12, #88]

Nineteenth century Kānaka ‘Ōiwi scholar and historian Samuel Mānaiakalani Kamakau’s relays his earlier version of this mo‘olelo. Kamakau published a rich account of Hawai‘i’s history regarding prominent and pivotal moments in time, ranging from subject areas such as, the birth of Kamehameha, his reign and acquisition into power, the formation of the Hawaiian nation, and other momentous events influential to Hawai‘i’s history. As one of Kamakau’s many scholarly works, this series of historical accounts appeared in the Hawaiian language newspaper, *Ka Nupepa Kuokoa*, in 1866. The series ran for two years, with the last publication printed in 1868. Regarding the mo‘olelo of Kūkeawe and the uprising of Maui’s people living in Kula, Kamakau writes that, ‘Aipua‘a a Kūkeawe, refers to the battle that took place because of the uprising that occurred. Kamakau writes:

> Aole ma o Oahu wale no ke kaua kuloko, ma Maui no hoi kekahi kaua kuloko iwaena o na makaainana. O Kukeawe ke poo o keia kaua makaainana, he kanaka kaukaualii no oia, he aikane hoi na Kahekili. O Kahekili nae, ua haawi aku no oia i kana puaa e holo ana ma ka moku o Kula, oia ka puaa a Kukeawe e kalua ai nana e like me kona makemake, aka, ua hao pu ia ka puaa a na makaainana o Kula, Honuaula, Kahikinui a hiki i Kaupo. Ua hele o Kukeawe me na kanaka he lehulehu loa e hao wale ana i ka waiwai o na makaainana, me ke kaua pu aku no hoi. A no keia mea, ua ala like mai na makaainana a kaua. Ua kapaia ka inoa o keia kaua, o ke kaua Aipuaa a Kukeawe. [Kamakau 1867:1]

Puakea Nogelmeier, a renowned scholar, Hawaiian language advocate and translator, is celebrated for his contribution to the Hawaiian language speaking community and Hawaiian language learners for compiling and translating many extensive and influential mo‘olelo. Composed originally in Hawaiian, Nogelmeier compiled and translated Kamakau’s recollection of Hawai‘i’s history in the work, *Ke Kumu Aupuni: The Foundation of Hawaiian Nationhood.* This

section references Kamakau's historic accounts, honoring the original Hawaiian language it was penned in, while also offering the English translation provided by Nogelmeier. Offered below is Puakea's translation of Kamakau's account of the battle of ʻAipuaʻa a Kūkeawe:

> Civil war did not only happen on Oʻahu; there was also an uprising on Maui among the common people. Kūkeawe, a lesser-ranking chief and companion of Kahekili, was the leader of this commoners' battle. Kahekili had granted all of his pigs roaming in the district of Kula as pigs that Kūkeawe could bake as he pleased. But he also seized the pigs of the common people of Kula, Honuaʻula, and from Kahikinui to Kaupō. Kūkeawe and his multitude of men went along plundering the resources of the common people and battling with them. Because of this, the common folk rose up to fight. The name of this battle was ʻAipuaʻa a Kūkeawe. [Kamakau 2022:203, translated by Nogelmeier]

At the time of the uprising, the ruling chief of Maui was Kahekilinuiʻahumanu. He had come to reign as aliʻi nui of Maui in 1766. This famed aliʻi, celebrated throughout history as one skilled in the art of warfare and whose half of the body was tattooed from head to toe, was also known in history by the shortened name, Kahekili. He was the younger brother of Kamehamehanui and the child of Kalanikuʻihonoikamoku Kekaulike (Kamakau 2022:53). During the uprising of Kula's people against the lesser chief, Kūkeawe, Kahekili and his chiefly attendants were on Oʻahu. Having heard of the egregious treatment of his people, compassion for the people surged in Kahekili. Kahekili gathered his men and chiefs that had accompanied him on Oʻahu and ordered Kalanikūpule to return to Maui and regain rule (Kamakau 2022:203). Kamakau characterized Kalanikūpule's embrace towards his people writing that he was an aliʻi "greatly admired for his humble way of life, who loved the common people, who would mingle with even the humblest of folks, and who was not an arrogant chief…" (2022:203).

Ka Moʻolelo o Kiha-a-Piʻilani

One of the main food crops grown and cultivated in Kula was the ʻuala *(Ipomoea batatas)* or sweet potato. Waiohuli, along with the other central and northeastern ahupuaʻa of Kula such as, Kēōkea, Kōheo, Kaʻonoʻulu and Waiakoa, where the rainfall of Haleakalā gathered on the slopes and increased towards Makawao were known to have large, cultivated areas of ʻuala (Handy, Handy, and Pukui: 1972:161). Kamakau writes of the history of Kiha-a-Piʻilani and his ascent to rule as aliʻi nui over the island of Maui. A segment of this history reveals a story of Kiha-a-Piʻilani's contributions to establishing the ʻuala patches of Kula.

Kamakau's account of Kiha-a-Piʻilani's history first appears in the Hawaiian language newspaper, *Ke Au Okoa,* in 1870. The compilation of Kamakau's recorded history printed in the Hawaiian language newspaper, was later reprinted and published in *Ruling Chiefs of Hawaiʻi* and was translated by Mary Kawena Pukui in 1961 (Revised version: 1992). The famed aliʻi nui of Maui was Piʻilani. Many chants, moʻolelo, and ʻōlelo noʻeau celebrates Piʻilani and his connection to Maui. One ʻōlelo noʻeau of such is the poetic phrase, *Nā hono a Piʻilani*, which translate to; "The bays of Piʻilani" (Pukui 1983:243, #2218). Regarding the ʻōlelo noʻeau, Pukui elaborates the meaning of the phrase: "The realm of Piʻilani, a powerful ruling chief of Maui, included the islands of Molokaʻi and Lānaʻi, as well as all the bays of Maui whose names begin with hono" (Pukui 1983:243). Kamakau writes that Piʻilani had many chiefly children. They included, Lono-a-Piʻilani, Piʻikea, Ka-la-ʻai-hema, and Kiha-a-Piʻilani (Kamakau 1992:22). When Piʻilani passed, his eldest son, Lono-a-Piʻilani succeeded him as aliʻi nui and ruled over the kingdom of Maui. Kiha-a-Piʻilani, the youngest of the chiefly children, fell under his brother's rule during this new reigning era. Lono-a-Piʻilani cared for Kiha (shortened name referring to Kiha-a-Piʻilani); and

thus, Kiha cared for the maka‘āinana (common people) by ensuring that the people were provided for and had food. Lono-a-Pi‘ilani and Kiha had taro patches located in Waihe‘e (Kamakau 1992:22). Kiha began cultivating patches that superseded in size that of Lono-a-Pi‘ilani’s. Over time, Lono-a-Pi‘ilani took this as an insult and became threatened by Kiha, believing that Kiha’s generosity and care for the common people stemmed from the desire to seize the kingdom for himself. Lono-a-Pi‘ilani sought to kill his brother, so Kiha fled Maui and found refuge on Lāna‘i. Eventually, Kiha returns to Maui in secret living a humble life to conceal his true chiefly identity so as to avoid being captured by his brother, Lono-a-Pi‘ilani. Thus begins the epic mo‘olelo of Kiha-a-Pi‘ilani and his enduring feats that will eventually lead him to obtain rule over Maui.

While living in secret on Maui, Kiha-a-Pi‘ilani and his wife lived close to the boundary of Kula and Makawao (Kamakau 1992:23). Kamakau writes that there was a famine so the people had to sustain themselves with weeds; laulele *(Asclepias curassavica)*, pualele *(Sonchus oleraceus)*, and pōpolo *(Solanum nigrum)*. Acknowledging the scarcity of food, Kiha-a-Pi‘ilani single-handedly labored to cultivate large patches of ‘uala. Kamakau describes Kiha-a-Pi‘ilani’s endeavors:

> One night Kiha-a-Pi‘ilani went to clear a patch of ferns to plant sweet potatoes, and on that same night he made a large one that would naturally require the labor of eighty men to clear. When morning came, the huge patch was noticed, an immense one indeed. [Kamakau 1992:24]

Having opened the patches for ‘uala to grow, large amounts of ‘uala slips were needed in order to plant and fill the patches. Kiha-a-Pi‘ilani traveled to Hamakuapoko and Hāli‘imaile asking for ‘uala slips (Kamakau 1992:24). Wherever he traveled and to whomever he inquired, the people gave freely to him the slips to replant as well as the ‘uala itself to bring back to the people of Kula to consume. Kamakau writes:

> He pulled up the vines and whatever potatoes adhered to them, and allowed them to wilt in the sun. After they had wilted he laid out the morning-glory vines to bind them, laid the sweet-potato vines on them, and tied them. He went on doing this until he had enough loads for ten men to carry. Then he made a carrier *(‘awe‘awe)* of morning-glory vines, placed the bundles of slips in it, and lifted it with great strength onto his back. The sunshine beat down on his back, the *‘uki‘ukiu* breeze below in front of him, the ‘Ulalena rain added its share, and intense heat reflected from the *‘ulei* vines. [Kamakau 1992:24]

He Mo‘olelo Ka‘ao No Namakaokapaoo

In 1894, John K. Hihia writes to *Ka Nupepa Kuokoa* and shares the mo‘olelo ka‘ao of Namakaokapaoo. This story appears in several issues of the newspaper, with its first appearance documented in May of 1894. Hihia begins this mo‘olelo by introducing some of the main characters for whom this story is accounted for, beginning with the father and mother. In the mo‘olelo, Namaka is an ali‘i of Kula and Kupulanikea is his wife (Hihia 1894:4). Kupulanikea is not of ali‘i rank, but rather, is a maka‘āinana of common ancestry. However, it is her sheer beauty that captures the attention of the ali‘i, Namaka. Together, the two lay as man and wife and have a child named, Namakaokapaoo. Namaka, the ali‘i of Kula, is described to be a very strong and capable man, unmatched in his skill for farming. Specifically, within the Kula moku, a land described by Hihia as one without water, Namaka was acknowledged for planting large fields of ‘uala. Hihia writes:

> He kanaka ikaika o Namaka i ka mahiai, oia ka oi iwaena o na kanaka ma Kula ma ka ikaika, he hookahi no la, pau he mala, a pau aku ana he mala, a pau aku ana he awawa nui i ka mahiai ia e keia kanaka, a o ka mea e kanuia aku ai iloko o keia mau mala ame na auwaha nunui, o ia no ka uala, oiai he aina wai ole o Kula. [Hihia 1894:4]
>
> Namaka was a strong man in farming. He was the strongest of all the people in Kula. In a single day, whole cultivated fields, patches, and an entire large valley of farming could be completed by this man. What was planted in these fields and the large cultivated trenches were sweet potatoes since Kula was a land without water. [Translated by R. Kalena Lee-Agcaoili]

The moʻolelo of Namakaokapaoo is a long epic tale filled with insightful gems of Hawaiʻi of old. This study focuses on but a small fragment of this larger tale. The portion of the moʻolelo that this section brings to the forefront is the description of the great cultivated areas of Waiohuli and how they came to be. Recounted in this moʻolelo as told by Hihia, Namaka and his wahine (wife) are said to have these great, long ʻōʻō or digging sticks used for farming. Thrusting their ʻōʻō into the soil, slips of ʻuala would be planted all over the region by the two of them.

> ...o ka hele kanu hoi keia o laua nei la a iho iloko o na awawa, pii ma kela aoao, a iho aku ana he awawa, pii ma kela aoao, ke hele nei ke kanu ana hele iuka, hele ma kela aoao a huli ma keia aoao o ka mala, ae, o ka mahinaai a keia kanaka a Namaka i mahi ai me kana wahine, he mahinaai nui, a eia no ke waiho nei a hiki i keia la, o Waiohuli ka inoa o ia wahi, he wahi makaikai ia ia. [Hihia 1894:4]
>
> ...and so they both continued on planting, descending into the valleys, climbing up on that side and going down another valley, climbing up this side and continued to plant in the uplands, traveling to that side and turned to this side of the patch, crossed over, and there was the crop field that Nāmaka and his wife tended to, which was a large field, and it is still there today and this place goes by the name Waiohuli and it is a visited place. [Translated by R. Kalena Lee-Agcaoili]

In this moʻolelo kaʻao, the Kula moku and more specifically, the ahupuaʻa of Waiohuli area is acknowledged as an area heavily cultivated by ʻuala because of the labors of Namaka and his wife, Kupulanikea.

HISTORICAL LANDSCAPE

Early Historic Period

The Kula Moku and the Waiohuli Ahupua‘a location of the project area appear on the earliest Hawaiian cartographic representations of the traditional land divisions like moku and ahupua‘a. The Kula Moku is depicted in an 1837 map of the pae ‘āina (archipelago) engraved by Kalama at Lahainaluna Seminary, Maui (Kalama 1837; Forbes 2012:150; Figure 5 and Figure 6). The Waiohuli Ahupua‘a appears on Kalama’s 1838 map engraving of the pae ‘āina (Kalama 1838; Forbes 2012:150; Figure 7). The primary use for the Kula lands was dedicated to farming. As a result of the dry and arid conditions of Kula, dryland cultivation was favored in the area as opposed to wetland lo‘i kalo (Handy, Handy, and Pukui 1972:272). Though kalo was a crop that was grown in this moku, ‘uala was most prevalent in the Kula moku as it was a reliant crop that farmers could yield successfully given the terrain and natural environment offered in Kula.

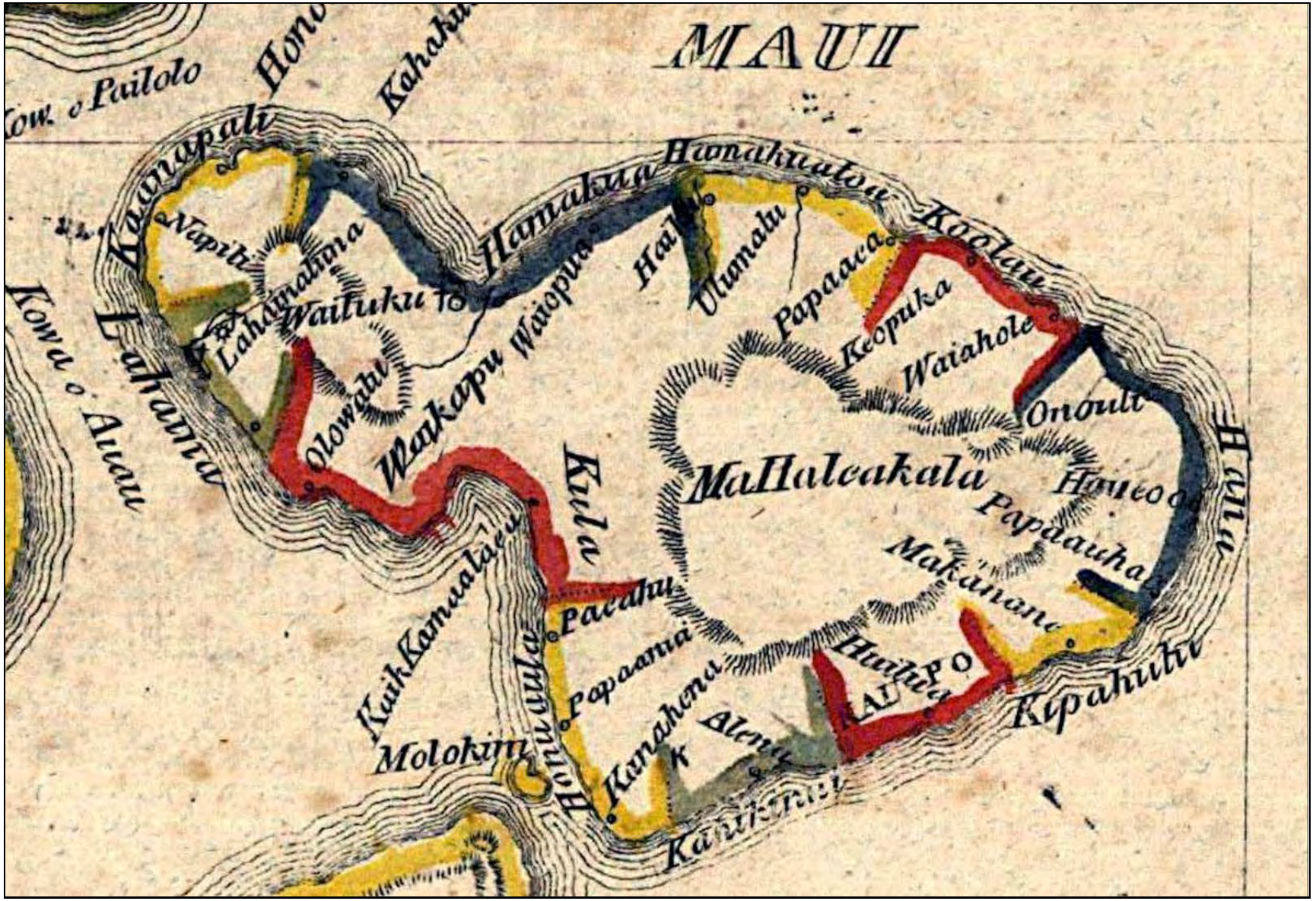


Figure 5. Kalama's 1837 map engraving of the pae ʻāina (*archipelago*) entitled "Ka Mokupuni o Hawaii Nei" (*The Islands of Hawaiʻi*) depicting Kula Moku, Maui (Kalama 1837; Forbes 2012:150).

The Māhele and the Kuleana Act

The 1848 Māhele was established to guide Hawai‘i in its transition from a traditional system of land use to a western model of privatization of property during the reign of King Kamehameha III Kauikeaouli (Van Dyke 2008:30). The traditional Hawaiian land system previously existed within the context of a highly stratified hierarchy and social order, a self-sustaining model of ahupua‘a management and use, and a communal and subsistence based economy which worked effectively for the people for generations (Van Dyke 2008:1,11). The traditional land tenure system was based on a reciprocal relationship which derives from the lesson of mālama ‘āina (to care for the land). It is derived from a cosmological worldview that Hawaiians have a genealogical connection to the land. This relationship is defined by the kaikaina-kua‘ana (younger sibling-older sibling) reciprocal relationship (Kame‘eleihiwa 1992:25). The land and water were not owned in any legal sense, but revocable rights to its use were allocated and reallocated from the mō‘ī (king or paramount chief) down through the ranked system of ali‘i (chiefs) and finally to the maka‘āinana (people on the land). Therefore, this historical event introduced the foreign concept of private property and fundamentally changed people's relationship to land (Kame‘eleihiwa 1992:10-11). During this process tenants of the land were required to document their claims to specific parcels to gain permanent title. The application process required claimants to provide a native testimony, foreign testimony, and native or foreign registrar. These records of the historical Land Commission Award (LCA) documents provide firsthand accounts of residency, resources, land use, access, traditional and customary practices of the lands they lived and actively cultivated from late pre-contact history into the period of the Kingdom of Hawai‘i.

Historical land documents from the Māhele contain useful and relevant information about understanding traditional Hawaiian land tenure and the transformation of this system into one based on land privatization. The Land Commission Awards documented the size of the land, the sale of the land, award number, and royal patent number. The Native and Foreign Registers document oral testimonies made by land claimant(s) and provide information about the land(s) being claimed. The Native and Foreign Testimonies document oral testimonies by other people (not the claimant), who acted as witnesses for or against a claim. The section below provides information on the Māhele proceedings specifically for the project area.

During the Māhele process, at least 34 ‘āpana, or parcels of kuleana lands in the Waiohuli Ahupua‘a were awarded to thirteen different individuals: Eeka, Hoopiopio, Kahulukaai, Keawe, Kekeleiaku, Konoia, Luheluhe, Ohai, Paele, Palekai, Puana, Uli, and Wahinealii, (Table 2. Land Commission Awards (LCA) within the Waiohuli Ahupua‘a). According to the Māhele records, the majority of the ‘āpana awarded were described as kula or open country, pastoral lands. Other LCAs awarded in Kula describe pā hale, or house dwellings, and ‘uala li‘ili‘i, or small patches of sweet potato as resources claimed on the individuals' landholdings. These claims include the follow LCAs: LCA (No. 6738) granted to Luheluhe which awarded this individual three ‘āpana. The first ‘āpana which is described as a one-acre parcel located in the ‘ili ‘āina of Kahilinaenae is noted to be a kula parcel and a pā hale, or house dwelling (Figure 8). Luheluhe's third ‘āpana is located in the ‘ili ‘āina of Pueo and is noted as an "uala liilii" that is 2.25 acres in size (Figure 9). In the context of Waiohuli, related to this ‘āpana, uala liilii could be interpreted as a small ‘uala patch for which sweet potato was grown. The LCA (No. 6705) granted to Ohai, awarded this individual three ‘āpana. The second ‘āpana that Ohai was granted is a 0.43-acre parcel located in the ‘ili ‘āina of Luakini. This ‘āpana is described as a pāhale. Figure 10 is a map that depicts the location of the project area with the locations of the Māhele LCA distributed in the Waiohuli Ahupua‘a.

Table 2. Land Commission Awards (LCA) within the Waiohuli Ahupua‘a

Claimant Name	LCA No.	Award Year	Royal Patent No.	‘Āpana No.	Acreage	‘Ili ‘Āina	Cultural & Natural Resources
Eeka	6041	1856	2813	1	12.8	Waieli	kula
				2	0.37	Pilipili	kula
Hoopiopio	6543	1873	6497	1	3.7	Kohelepo	kula
				2	1.3	Waieli	kula
				3	2.16	Kukuihanau	kula
				4	1.3	Hiipali	kula
				5	3	Paaiki	kula
Kahulukaai	7971	1873	6421	1	1.8	Ohia	kula
				2	1.4	---	kula
Keawe	6414	1858	4099	1	7.25	Luakini & Puuala	kula
				2	4.03	---	kula
Kekeleiaku	8808	1856	3103	1	---	---	---

Claimant Name	LCA No.	Award Year	Royal Patent No.	ʻĀpana No.	Acreage	ʻIli ʻĀina	Cultural & Natural Resources
Konoia	3108	1880	7478	1	4.3	Pueo	kula
				2	2.7	Waieli	kula
Luheluhe	6738	1873	6493	1	1	Kahilinaenae	kula, pā hale
				2	1.3	Laie	kula
				3	2.25	Pueo	ʻuala liʻiliʻi
Ohai	6705	1879	7238	1	2.93	Waiohuli	kula
				2	0.43	Luakini	pā hale
				3	2.2	Luakini	kula
Paele	5332	1873	6536	1	1.9	Paanaiwi	kula
				2	2.1	Pukohale	kula
				3	8.2	Pueo	kula
				4	3.8	Kohelepo	kula

Claimant Name	LCA No.	Award Year	Royal Patent No.	ʻĀpana No.	Acreage	ʻIli ʻĀina	Cultural & Natural Resources
Palekai	5279	1873	6523	5	1.86	Ahulua	kula
Puana	6592	1886	7808	1	0.44	Kukuihanau	kula
				2	0.94	Kukuihanau	kula
				3	1.5	Pahakiloa	kula
				4	1.06	Pueo	kula
				5	1.03	Kakuihanau	kula
Uli	6656	1865	5548	1	3.13	Laie	kula
				2	3.06	Waikalua	---
				3	3.15	Waieli	kula
Wahinealii	11022	1888	7873	1	4.5	Pueo	kula

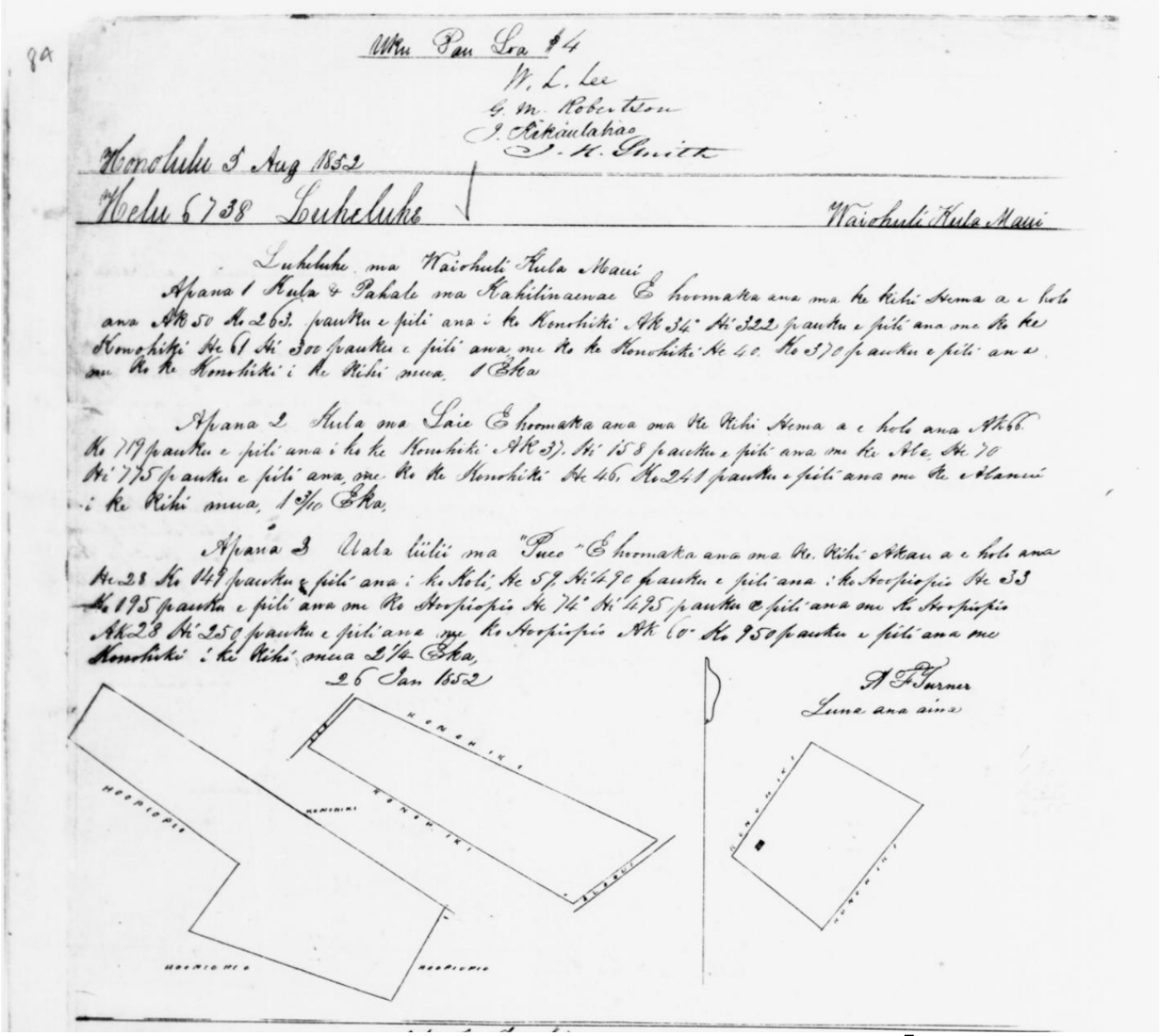
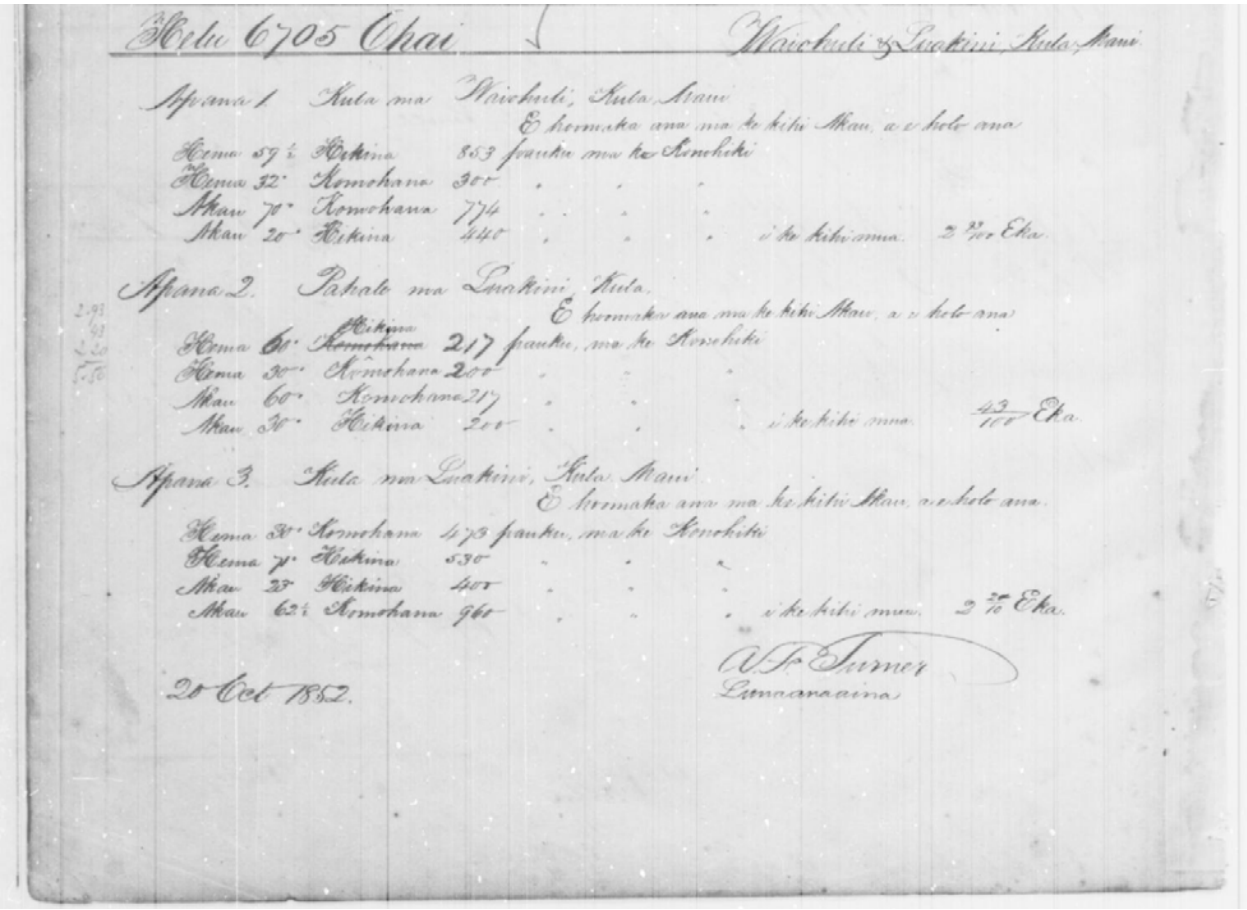


Figure 6. Land Commission Award No. 6738 Granted to Luheluhe. Note, ʻĀpana 1 is described as “Kula & Pahale” in Kahilinaenae, ʻĀpana 2 is described as a Kula parcel in Pueo, and ʻĀpana 3 is listed as “Uala liilii” in Pueo.



Helu 6705 Ohai. Waiohuli & Luakini Kula Maui

Apana 1 Kula ma Waiohuli, Kula Maui
E hoomaka ana ma ke kihi Mauu, a e hele ana
Hema 57½ Hikina 853 kaukau ma ke Komohiki
Hema 32° Komohana 300 . . .
Akau 70° Komohana 774 . . .
Akau 20° Hikina 440 . . . i ke kihi mua. 2 70/100 Eka

Apana 2. Pahale ma Luakini, Kula
E hoomaka ana ma ke kihi Mauu, a e hele ana
Hema 60° ~~Hikina~~ ~~Komohana~~ 217 kaukau, ma ke Komohiki
Hema 30° Komohana 200 . .
Akau 60° Komohana 217 . . .
Akau 30° Hikina 200 . . . i ke kihi mua. 43/100 Eka

Apana 3. Kula ma Luakini, Kula Maui
E hoomaka ana ma ke kihi Mauu, a e hele ana
Hema 30° Komohana 473 kaukau, ma ke Komohiki
Hema 7° Hikina 530 . . .
Akau 23° Hikina 405 . . .
Akau 62½ Komohana 960 . . . i ke kihi muua. 2 75/100 Eka

20 Oct 1852.

W. P. Turner
Luna-nana aina

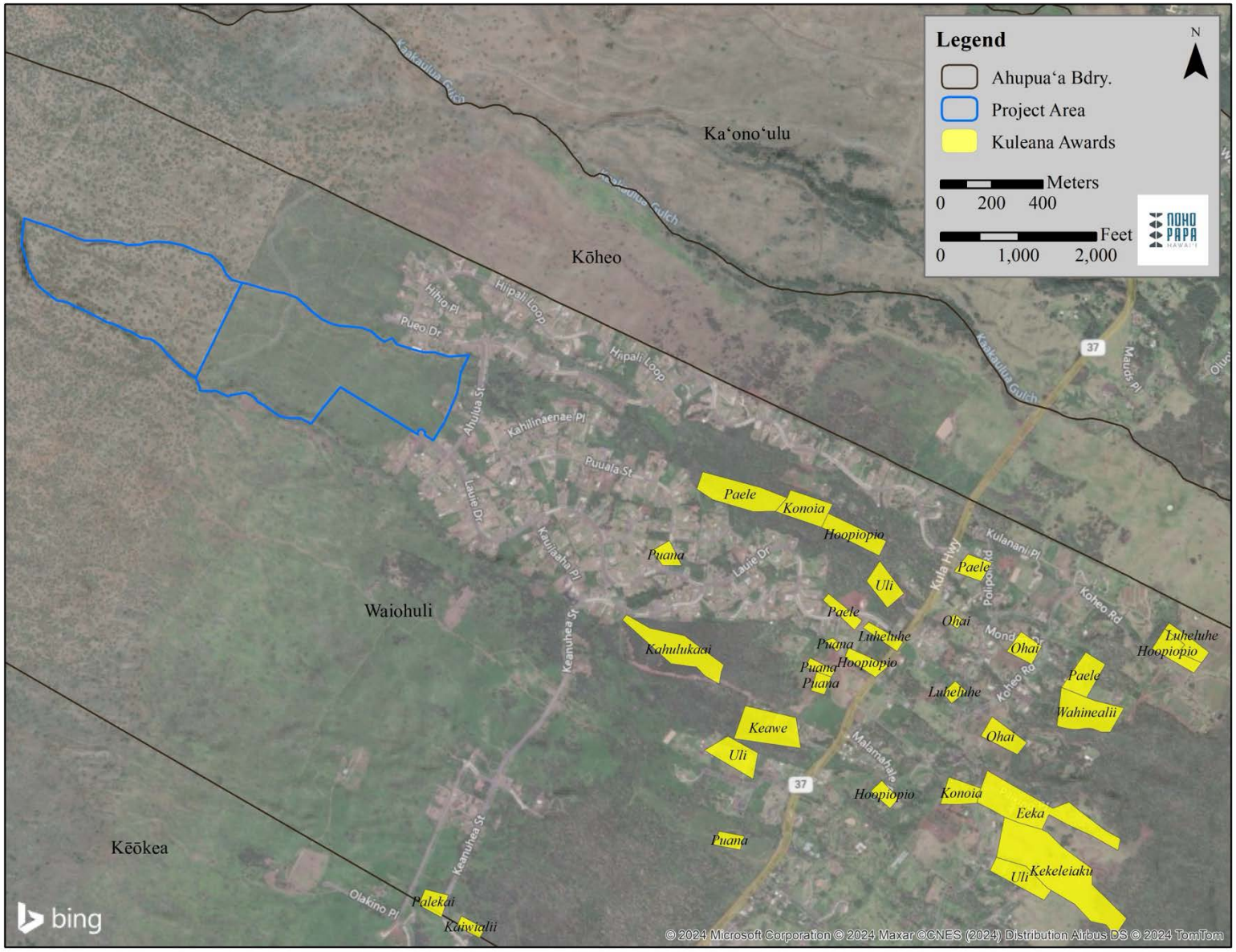


Figure 8. Map depicting the location of the project area with locations of the Māhele LCA distributed in the Waiohuli Ahupua‘a

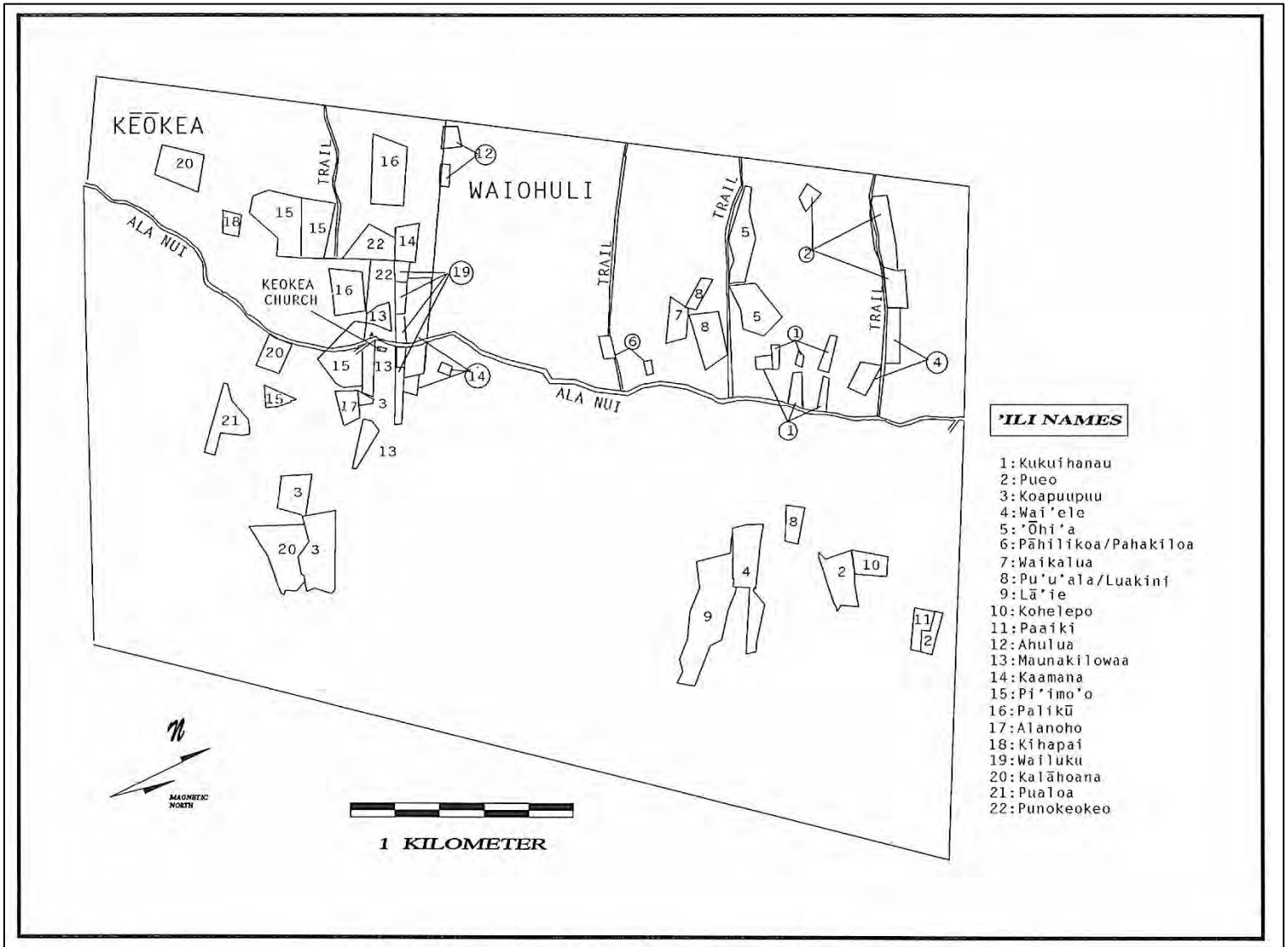


Figure 2.4 'Ili and 'ili lele of Waiohuli and Kēōkea

Figure 9. Map of ‘ili and lele in Waiohuli and Kēōkea from Kolb et al. 1997:63

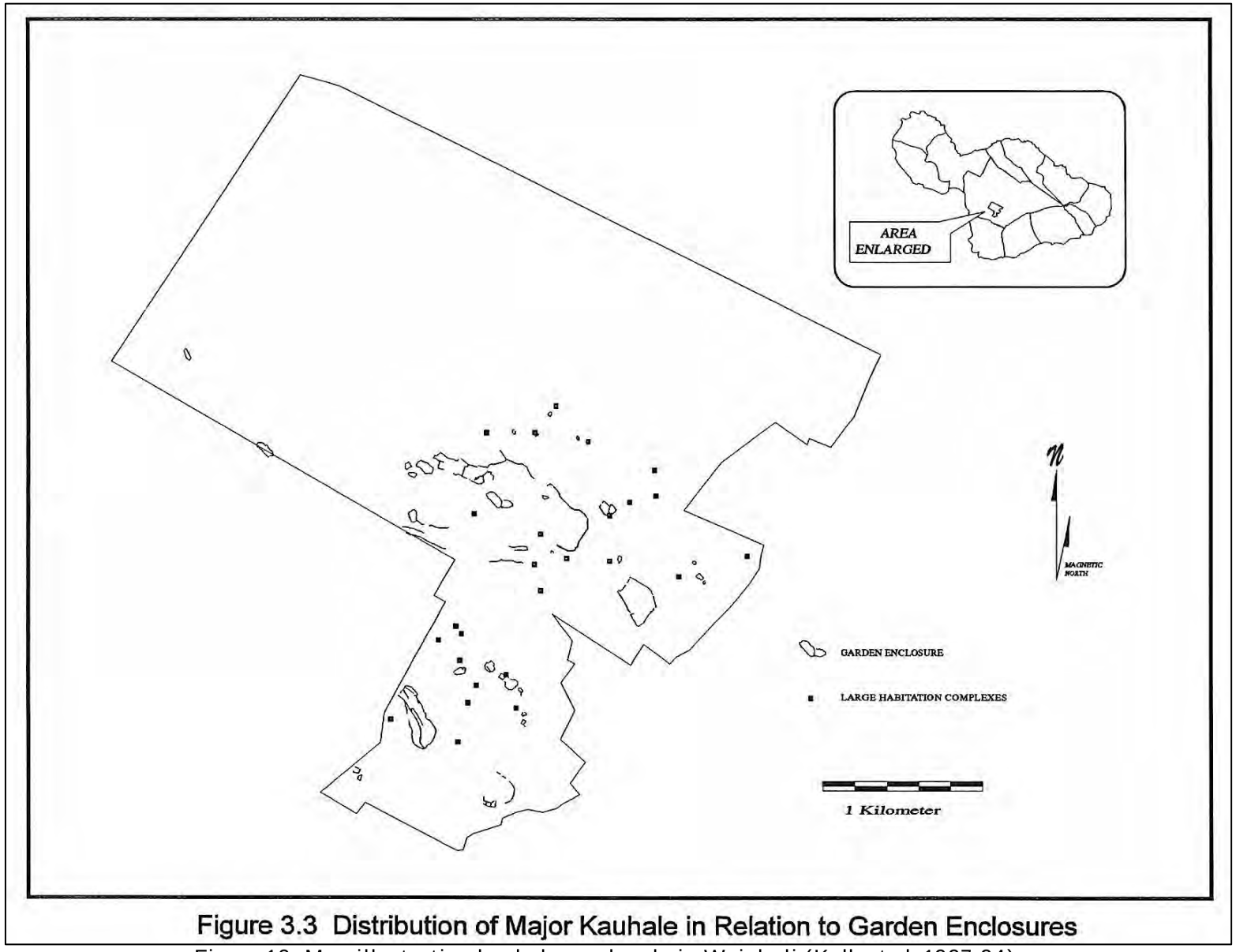


Figure 3.3 Distribution of Major Kauhale in Relation to Garden Enclosures

Figure 10. Map illustrating kauhale aned mala in Waiohuli (Kolb et al. 1997:94)

Mid-to Late 1800s

Settlement, land use, and commerce in the nineteenth century, Waiohuli and the neighboring ahupua‘a of Kēōkea was heavily influenced by the establishment and growth of the Pacific whaling industry, the California goldrush and mining boom, and establishment and growth of the sugar industry (Clark 1989:47; La Croix 2019:102; (Mark 1975:1-2). From 1825 through 1870, Native Hawaiians, and other Pacific islanders played a pivotal role in the Pacific whaling industry (LaCroix 2019:69). As the whaling industry expanded in the Pacific, Polynesians came to comprise sizable percentages of Pacific whaling fleet crews (Rosenthal 2018:60-65; Lebo n.d.). The Papahānaumokuākea Marine National Monument (PMNM) attests that “at one-point, Native Hawaiians comprised nearly one-fifth of the sailors in the Pacific-based American whaling fleet (PMNM 2023b). Whaling ships were serviced, supplied, and manned in the growing port cities of Honolulu, Hilo, and Lahaina as well as smaller stations throughout the Hawaiian Islands (Clark 1989:47; La Croix 2019:102-104; Rosenthal 2018:50,62,73,74).

In Kula, and presumably the project area, the whaling industry prompted the establishment of agricultural industries focused on potatoes and other produce in-demand by foreigners, and the migration of maka‘āinana to settlements for employment opportunities (Clark 1989:47; La Croix 2019:102). Predominantly Hakka Chinese from Kwangtung Province became established in Kula as farmers in two primary waves, both of which influenced the growth of settlement and land use in and around the project area (Mark 1975:33). Between the 1840s and 1850s, Chinese farmers subleased Hawaiian Government Crown Lands in Kula from Hawaiians or haole ranchers to grow Irish potatoes which were then shipped to California to supply the mining boom, earning Kula the nickname “Nu Kaleponi,” (New California) (Mark 1975:1-3). Between the mid-nineteenth and early twentieth centuries, over 45,000 Chinese immigrated to Hawai‘i, predominantly to work on sugar plantations and also to farm (Mark 1975:1-2). Writes Mark (1975:33) of the multi-ethnic communities of farming families: “Over the years, the Chinese and Hawaiian people in Kula developed a close rapport, both economically and socially.”

During the 1880s, Kula Crown Lands including the project area became cattle ranches and pasturelands. Two Hawaiian Government Survey Map of Kula, Maui depicts Waiohuli and Kēōkea as Crown Lands, one in 1879 and another in 1885, (Dodge and Alexander 1885; Figure 11 and Figure 12). In his 1894 *Biennial report of the Commissioners of Crown Lands* Curtis, published in the year following the illegal overthrow of the sovereign Hawaiian Kingdom by the United States, Piehu Iaukea described the 6,003 combined acres of Waihouli and Kēōkea Ahupua‘a as both “the choices land in this district,” and “the most valuable” Crown Lands on Maui. He wrote:

> These two tracts comprise some of the choicest land in this district, and of the Crown Lands, are the most valuable on the Island of Maui. They lie adjacent and extend from the sea at the Kalepolepo landing to the Kahikinui boundary at a point called Kalepeamoa, distant 13 miles. The elevation here is about 9000 feet. The upper government road through Kula crosses the lands at an altitude of about 3000 feet. Above this lies a stretch of fine corn and potato land and all below it is excellent grazing. The area of agricultural land is estimated between 2500 and 3000 acres, worth $25.00 an acre. A good road also crosses the lands near the sea which connects with the Maalaea landing, distant 4 miles, and Makena 6 miles. Kalepolepo landing, once a calling place of whaleships for supplies, is on the boundary line of Waiohuli and adjoining land. Keokeo[sic] comprises an area of 5332 acres and Waiohuli 10,734. [Iaukea 1894 in Kīpuka Database 2023]

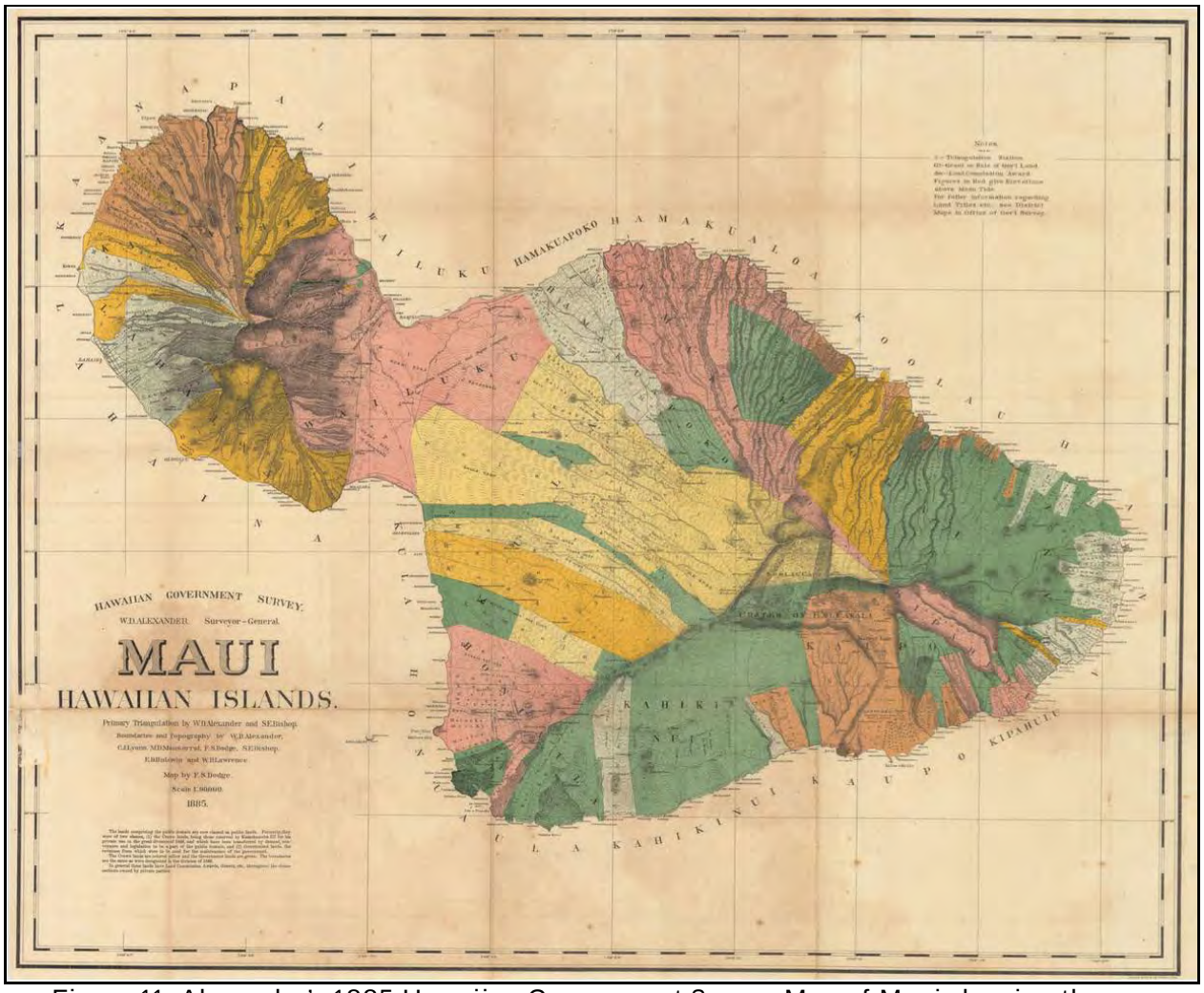


Figure 11. Alexander's 1885 Hawaiian Government Survey Map of Maui showing the distribution of Māhele land awards by ahupuaʻa. Note, Waihouli and Kēōkea Ahupuaʻa are Crown Lands (Dodge and Alexander 1885).

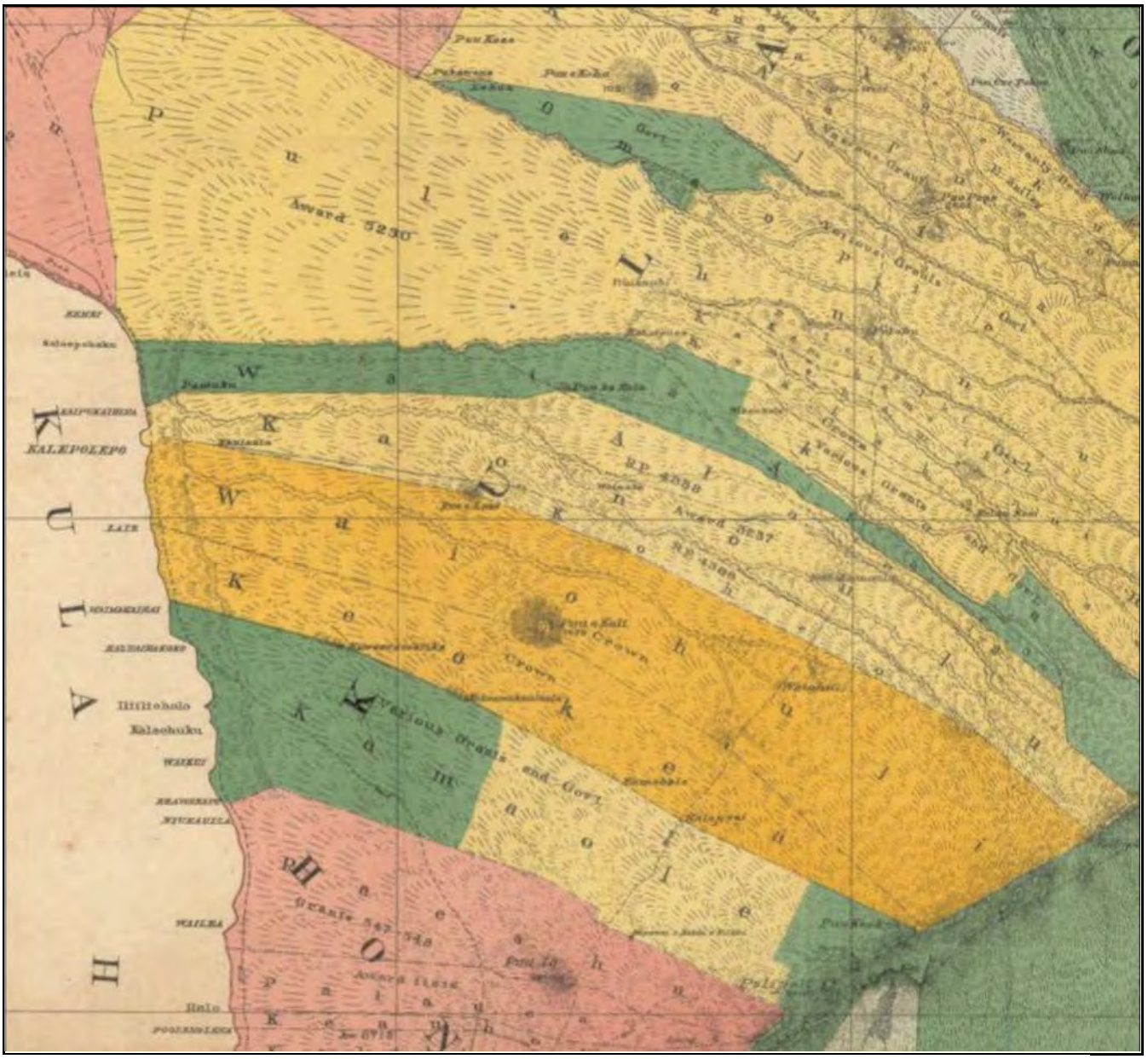


Figure 12. Close-up of Kula ahupua‘a from Alexander’s 1885 Hawaiian Government Survey Map of Maui. The distribution of Māhele land awards by ahupua‘a are depicted, with Waiohuli and Kēōkea Ahupua‘a as Crown Lands (Dodge and Alexander 1885).

1900s to Present Day

During the mid-late 1800s, much of the Kula lands were leased for grazing cattle and used as ranch lands, however, "at the end of World War I, the Territorial government released a large amount of land to the public for purchase," (Department of Hawaiian Home Lands 2010:11). As a result, homestead lands were made available in the moku of Kula. In 1911, Kula lands leased predominantly by Hawaiian and Chinese families were opened for purchase by the Territorial Government of Hawai'i. Combined with catastrophic drought, the policy prompted the out-migration of many Chinese families and influx of settlers into the community (Mark 1975:34). Ranching is still prevalent in Kula and surrounds the project area. Ka'ono'ulu Ranch, Haleakalā Ranch and Ulupalakua Ranch are the existing ranches that are located in the Kula Moku and border the project area of Waiohuli. With the transition from ranch lands to homesteads, 6,112 acres of the Waiohuli Ahupua'a were designated as homelands as part of the Department of Hawaiian Home Lands (Department of Hawaiian Home Lands 2010:13). The Department of Hawaiian Home Lands, Waiohuli Homestead lots are located ma kai of the Kula Highway, and today, is a significant footprint in the upper Kula community as many Native Hawaiian families have settled in the area and made Waiohuli home.

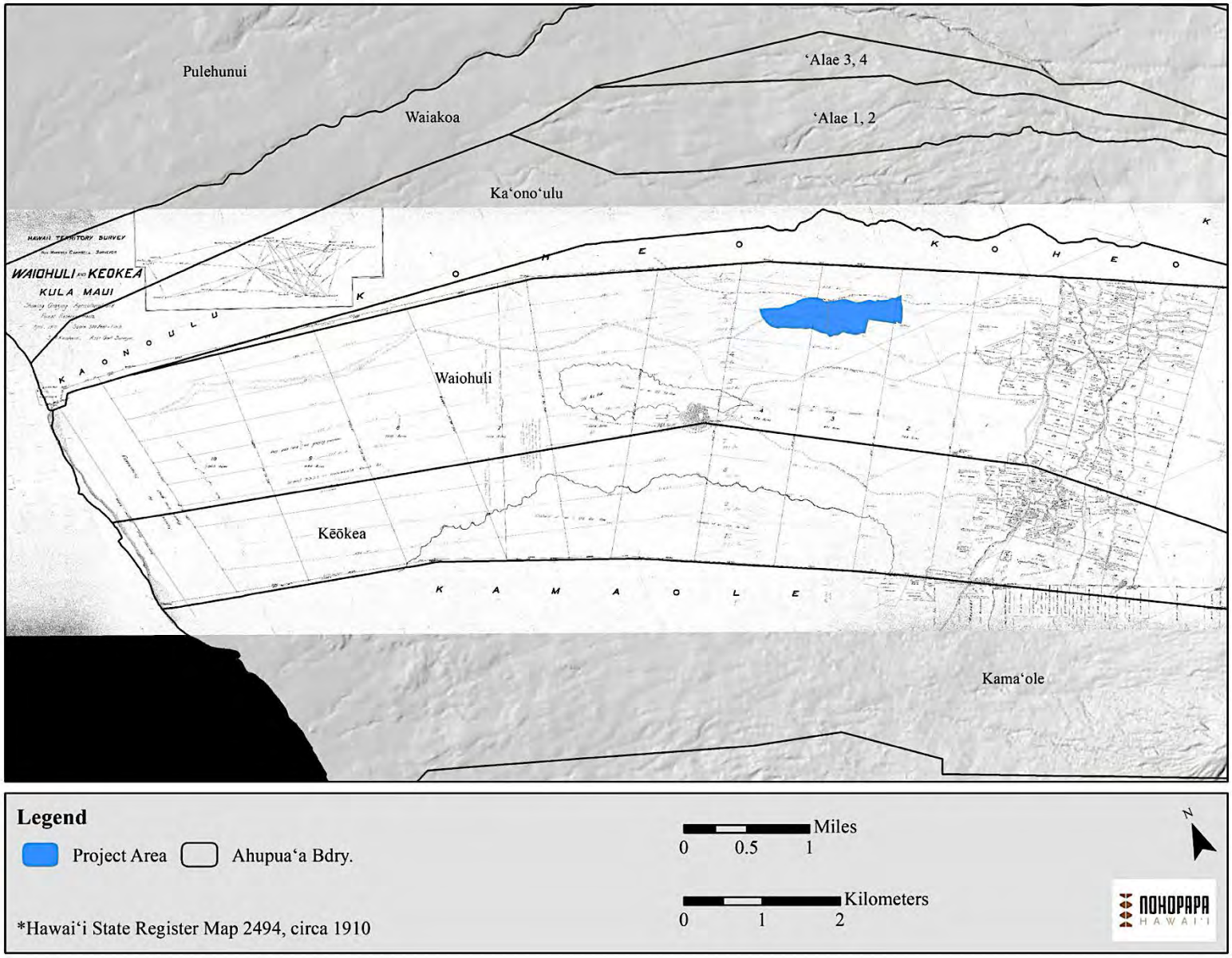


Figure 13. Circa 1910 map (Register Map 2494) illustrating the project area highlighted in blue and surrounding ahupua'a.

Figure 14. Zoom in of circa 1910 map (Register Map 2494) illustrating the project area highlighted in blue and surrounding ahupua‘a.

PREVIOUS ARCHAEOLOGICAL STUDIES

This section summarizes and synthesizes previous relevant academic and compliance archaeological studies within the project area, the surrounding ½ mile vicinity, and beyond through an archaeological lens in order to develop an understanding of land use, settlement, change, and development through time. It begins with a synthesis overview discussion of the results of previous archaeological studies associated with the project area and vicinity. Data and information derived from the studies and presented is disclosed, then in the next section of this report (see "Background Research Summary and Predictive Model") used to formulate a predictive model of the potential for the presence of surface and subsurface wahi kūpuna/historic properties within the current project area.

Results of Nohopapa's public records search indicates a total of thirteen compliance archaeological studies have occurred within the 150-acre project area located in the Waiohuli Ahupua'a and the vicinity of the project area. Figure 13 illustrates the locations of previous archaeological studies associated with the project area vicinity. The types of studies conducted within the project area vicinity include:

- four Archaeological Inventory Surveys (AIS)–one of which was a Revised AIS,
- two Archaeological Monitoring Plans,
- an Archaeological Monitoring Report,
- an Archaeological Monitoring and Reconnaissance Survey,
- an Archaeological and Historical Settlement Survey,
- an Archaeological Data Recovery,
- and three Preservation Plans–which consisted of a Draft Preservation Plan,
- a Revised Preservation Plan,
- a Final Preservation Plan

Five archaeological studies were found that were associated with the project area boundaries of TMK: (2) 2-2-002-014. The types of studies associated with this portion of the project area include:

- an Archaeological Inventory Survey,
- an Archaeological Monitoring Plan,
- an Archaeological Monitoring Report,
- and two iterations of a Preservation Plan which included a Draft Preservation Plan,
- a Final Preservation Plan

No archaeological studies were found to have occurred within the TMK (2) 2-2-028-181 of the project area.

At least eight previous archaeological studies have occurred within the vicinity of the current project area. The types of studies include:

- three Archaeological Inventory Surveys (AIS),
- an Archaeological Monitoring Plan,
- an Archaeological Monitoring and Reconnaissance Survey,
- an Archaeological and Historical Settlement Survey,
- an Archaeological Data Recovery, and a Preservation Plan

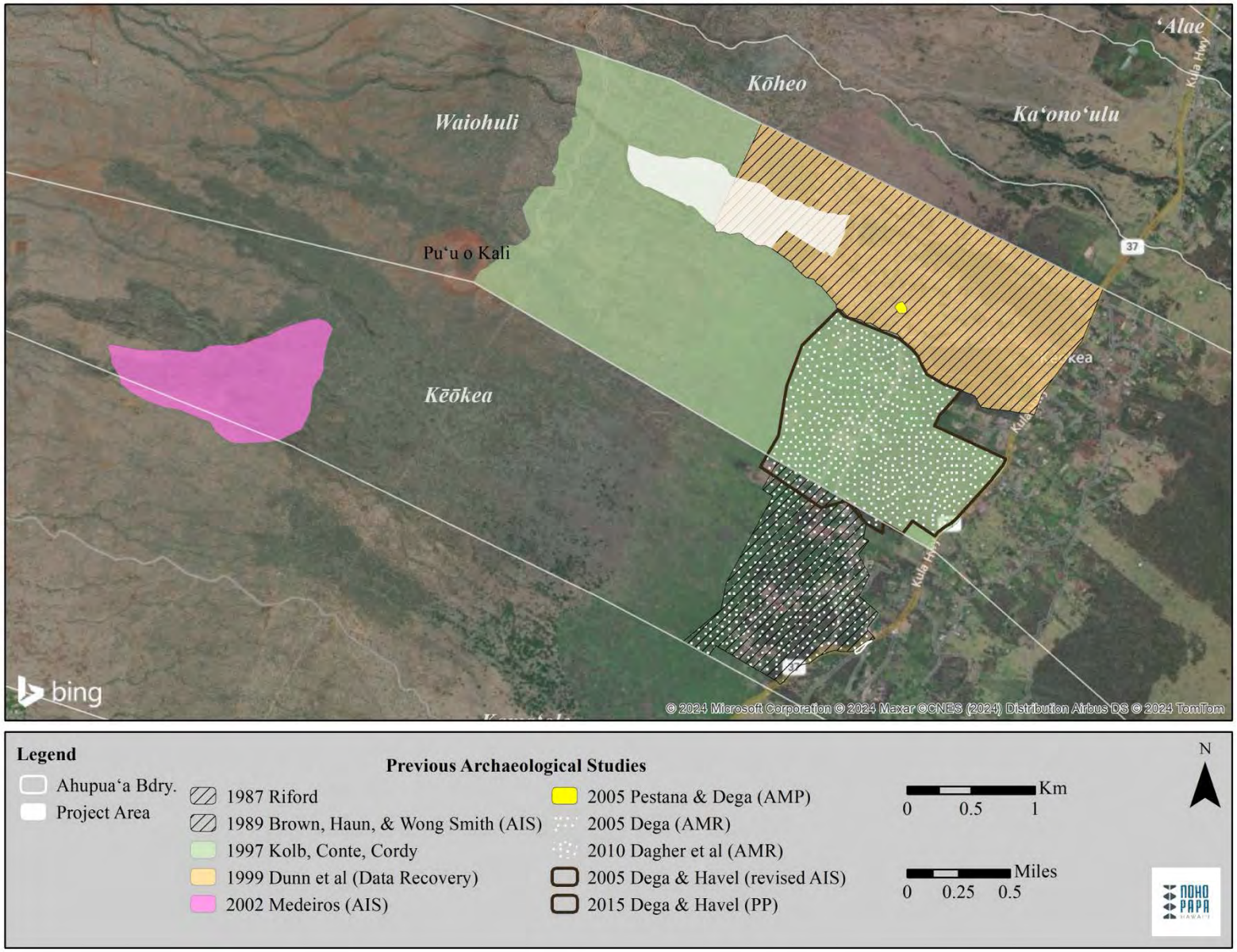


Figure 15. Aerial photo overlain with the boundaries of previous archaeological studies, labeled by author(s) and year conducted in the project area and vicinity

Previous Archaeological Studies Within the Project Area

Background research performed for this study yielded five archaeological studies associated with the project area boundaries of TMK: (2) 2-2-002-014. No archaeological studies were found to have occurred within the TMK (2) 2-2-028-181 of the project area. The archaeological studies complied in this section associated with the project area boundaries; TMK: (2) 2-2-002-014, include an Archaeological Inventory Survey which examined a portion of the identified TMK, an Archaeological Monitoring Plan which examined TMK 2-2-02-005 and a portion of the project area TMK 014, an Archaeological Monitoring Report which primarily examined TMK 2-2-002-071 and highlighted a portion of TMK 005 and a portion of the project area TMK 014, as well as two iterations of a Preservation Plan for TMK 2-2-002-014; which consisted of a Draft Preservation Plan and a Final Preservation Plan. Summaries of each of the previous archaeological studies associated with the project area are presented below.

Study Title: *An Archaeological Inventory Survey of a Parcel of Land in Keokea Ahupua'a, Kula District, Island of Maui (TMK: 2-2-2: Por. of 14)*
Study Type: Archaeological Inventory Survey
Author(s): Erik M. Fredericksen and Demaris L. Fredericksen
Year: 2002
Firm or Organization: Xamanek Researchers
Project Area Location: TMK: 2-2-2: Por. of 14
Project Area Acreage: 236 acres
Methods: The survey was carried out on an intermittent basis from late June through September 2001 (Fredericksen and Fredericksen 2002:1) Field work was done in two phases, the first being an initial pedestrian inspection of the 236 acres. The survey sweeps were spaced 5 to 10 meters apart and oriented NE-SW (Fredericksen and Fredericksen 2002:15). No subsurface testing was conducted. Standard recordation methods were followed utilizing metric survey tapes and hand-held compasses for mapping. The sites were located with a portable GPS and the coordinates were plotted by a U.S.G.S. personnel. Photos were digitally captured in 35mm color film formats (Fredericksen and Fredericksen 2002:15).
Results: Fourteen previously unrecorded archaeological sites were located during the archaeological inventory survey which included, "enclosures, a stepping stone path with an associated terrace, rock shelters, rock pile markers, possible burials, possible temporary habitation areas, and a ranch-era boundary wall," (Fredericksen and Fredericksen 2002:16). The sites were designated SIHP numbers 50-50-10-5214 through 5227. Ten of the sites were determined as having existed pre-contact to 1850. It is noted that impacts to these sites were likely associated with the ranch and/or military era activities (Fredericksen and Fredericksen 2002:35). Three of the sites are associated with the post-contact, ranch and military era. Site 5217 is interpreted as a dry land agricultural site and is thought to potentially contain one or more burial features (Fredericksen and Fredericksen 2002:35). All 14 of the sites are classified as significant for having yielded or being likely to yield important information for research on prehistory or history under the Federal and State historic preservation guidelines (Fredericksen and Fredericksen 2002:36). Features and portions of sites 5216, interpreted as a stepping stone trail and terrace, and site 5217, interpreted as a possible dry land agriculture site that was determined to contain two burials are additionally significant and considered under the Historic Preservation Review elevations as having met Criterion "e"– having important traditional cultural value to the native Hawaiian people (Fredericksen and Fredericksen 2002:36).
Mitigation Commitments/Historic Preservation Next Steps: Due to the significance of the sites, "passive preservation is recommended for all of them. While the ranch era walls and possible military sites could be considered potentially no longer significant in other situations,

these sites are part of a relatively well-preserved complex of sites in this portion of Maui. Because of the nature of this native plant preservation project, there is an important opportunity to preserve more marginal archaeological resources such as the walls and other post-contact sites that are part of the cultural landscape in the Pu'u o Kali area" (Fredericksen and Fredericksen 2002:37).

Study Title: *An Archaeological Monitoring Plan for Work During Infrastructure Improvements in Department of Hawaiian Home Lands Agricultural Lots and Residential Lots, Keokea Ahupua'a and Waiohuli Ahupua'a, Kula District, Maui Island, Hawai'i [TMK 2-2-02: Portion of 005 and 014]*
Study Type: Archaeological Monitoring Plan
Author(s): Michael Dega
Year: 2005
Firm or Organization: Scientific Consultant Services Inc.
Project Area Location: TMK: 2-2-02: Portion of 055 and 014; Waiohuli portion of the project area covers the southern extent of the Waiohuli Ahupua'a, the Kēōkea portion of the project area is situated immediately adjacent and south of Waiohuli Ahupua'a.
Project Area Acreage: 751 acres
Methods: Qualified archaeologists monitored the ground altering activities. If any features or cultural deposits identified on site, work ceased to commence so proper evaluations could occur. Feature and deposits were documented by "plotting its location on an overall site map, illustration a plan view map of the feature/deposit, profiling the deposit in three dimensions, photographing the finds (with the exception of human burials), artifacts and soil sample collection, and triangulation of the finds" (Dega 2005:11). Any human remains encountered triggered a halt of work and proper burial protocols were conducted. Stratigraphy in association with subsurface cultural deposits was noted and photographed. Coordination meetings between the archaeologists and contractors were conducted prior to the project.
Results: Based on the previous archaeological work in the area, it was concluded that additional archaeological features, burials, and cultural deposits may be present in the area (Dega 2005:11). Likely features and sites anticipated in the area include long-term habitation sites such as rock shelters, enclosures, terraces, and platforms, as well as agricultural features which may consist of enclosure walls, mounds and terraces (Dega 2005:11).
Mitigation Commitments/Historic Preservation Next Steps: It was recommended that an SCS archaeologist (or team) should "survey the corridors to assess the presence/absence of previously unidentified sites or features within each Keokea corridor," (Dega 2005:13). If cultural features of deposits are encountered during fieldwork, an evaluation of the site is necessary and the Archaeological Monitoring Report would be drafted and finalized and submitted to SHPD and the client (Dega 2005:13).

Study Title: *An Archaeological Monitoring Report for the Construction of Roadway Corridors, Department of Hawaiian Home Lands Agricultural Lots and Residential Lots, Keokea Ahupua'a and Waiohuli Ahupua'a, Makawao District, Maui Island, Hawai'i [TMK: (2) 2-2-002: 071, Por. 014, and Por. 055]*
Study Type: Archaeological Monitoring Report
Author(s): Cathleen A. Dagher, Leigh Anne Ellison, Donna M. Shefcheck, Elizabeth Pestana, David Perzinski, David Dillon, and Michael F. Dega
Year: 2010
Firm or Organization: Scientific Consultant Services Inc.
Project Area Location: TMK: (2) 2-2-002: 071, Por. 014, and Por. 055; Department of Hawaiian Home Lands Kēōkea Agricultural Lots and the Waiohuli Residential Lots Subdivision
Project Area Acreage: 1,502 acres

Methods: Archaeological monitoring was conducted intermittently from September 2006 to April 2008. Meetings were coordinated with the project contractors prior to mechanical excavation to convey proper protocols should any archaeological cultural remains be encountered. During mechanical excavation activities, archaeological monitoring was allowed to determine the presence or absence of historic properties both on the ground surface and in the exposed subsurface area (Dager et al. 2010:12). Documentation occurred to identify any archaeological sites and features as well as the compilation of stratigraphic profiles including the depth of subsurface deposits (Dager et al. 2010:13). Archaeological sampling was conducted (with the exception of human burials) to gather data regarding the nature, location, age, and extent of cultural deposits when cultural properties were identified. Archaeological investigations were documented in a daily log. When features were identified, construction activities were halted so proper evaluations could occur. Features were plotted on a site map and described in field notes. During inadvertent discoveries of human skeletal remains, work in the immediate areas ceased and SHPD were notified. Documentation of the burials included profile drawings, plan view maps, and illustrative documentation of the remains (Dager et al. 2010:13). The disturbed and excavated soil around the vicinity of the burials were hand-raked and screened through a ⅛ inch wire mesh screen in efforts to recover any skeletal material and any materials with direct association to human burials were screened through ¼ inch and 1/8 mesh screens (Dager et al. 2010:13-14). With any artifacts found in the backfill matrices, efforts were made to identify associated cultural deposits and depth of excavation. All materials recovered from the field were curated at SCS, Inc. facilities on Maui. All photographs, maps, notes, and illustrations were filed at the SCS Laboratory in Honolulu.

Results: Fifteen new surface and subsurface features were discovered as well as ten isolated Traditional-type artifacts were identified in the project area. Fourteen of the fifteen features were newly identified features. The fourteen features along with the ten isolated artifacts were affiliated with the pre-contact period and indicated the presence of agricultural/habitational communities who populated the area and worked the land (Dager et al. 2010:1). Ten of the fifteen newly identified features were designated as five new sites (Dager et al. 2010:15). These sites include two subsurface fire pits (Sites 50-50-10-468 and 6487), inadvertently identified human skeletal remains representing at minimum five individuals (50-50-10-6470), inadvertently identified partially in situ human skeletal remain and a single partial human femur suggesting a minimum of two individuals (50-50-10-6630), and an enclosure and subsurface fire pit (50-50-10-6672) (Dager et al. 2010:15,16). Four of the features identified in this survey was incorporated into existing sites, 50-50-10-3280 and 3272 (subsurface fire pits), 50-50-10-3239 (inadvertent human skeletal remains and subsurface fire pit), and 50-50-10-2325 (ovoid enclosure) (Dager et al. 2010:16). Human skeletal remains representing a minimum of eight individuals were inadvertently identified. Five of the burials were consolidated as Site 50-50-10-6470 and were interpreted as being pre-contact burials and of Native Hawaiian ancestry. Additionally, burial (50-50-10-3239) was determined to be of Polynesian ancestry, a traditional style and pre-contact burial. Another human remains identified was interpreted as an individual of Chinese or Chinese/Hawaiian mixed ancestry and was determined post-contact (Dager et al. 2010:16).

Mitigation Commitments/Historic Preservation Next Steps: After its completion, no further work was recommended for this project. As a result of the findings that occurred during this survey, particularly the discovery of human remains, it was recommended that a program of Archaeological Monitoring for future permitted actions that involve ground alterations occur within the Waiohuli-Kēōkea Subdivisions (Dager et al. 2010:48).

Results: “Please note that treatment, preservation, and mitigation measures for the human skeletal remains representing a minimum of eight individuals (MNI=8) inadvertently identified during the current Archaeological Monitoring program are discussed in Burial Treatment Plans for State Site 50-50-10-3239 (Dega 2006), State Site 50-50-10-6460 (Dega 2008) and State Site

50-50-10-6630 have been prepared under separate cover and are discussed in Pestana and Dega (2010)" (Dager et al. 2010:48).

Study Title: *Draft A Preservation Plan for the Department of Hawaiian Home Lands (DHHL), Kula Residential Lots in the Waiohuli Subdivision, Waiohuli and Kēōkea Ahupua'a, Makawao District, Maui Island, Hawai'i [TMK: (2) 2-2-002:014 por.]*
Study Type: Preservation Plan
Author(s): Michael Dega
Year: 2010
Firm or Organization: Scientific Consultant Services Inc.
Project Area Location: TMK: (2) 2-2-002:014 por.; Department of Hawaiian Home Lands Waiohuli Subdivision
Project Area Acreage: Unreported
Methods: Standard procedures outlined in the Hawai'i Administrative Rules, Title 13 Department of Land and Natural Resources, Subtitle 13 State Historic Preservation Division Rules, Chapter 277 Rules Governing Minimal Requirements for Archaeological Site Preservation and Development (DLNR/SHPD 2003) were followed for this study (Dega 2010:1).
Results: A total of twenty-five sites with 262 features are represented in the Waiohuli Preservation Plan. This includes: 158 agricultural features (terraces, mounds, garden enclosure), 67 permanent habitation features (platforms, enclosures, terraces), 14 temporary habitation loci (rock shelters, terraces), 3 ceremonial sites (heiau, enclosure), 18 boundary features (walls) and 2 features with unknown functional ascriptions (Dega 2010:7,11).
Mitigation Commitments/Historic Preservation Next Steps: Development in Waiohuli was planned around the formation of the HPA area. Roads and residences that were formally proposed for the southeastern portion of the HPA were terminated to open up more area for the HPA (Dega 2010:11). Sites 3269 and 3283 will be preserved in the form of conservation. No excavation nor construction will be conducted. There will be a 3-meter buffer zone for the sites (Dega 2006:10,11). Preservation of the HPA sites will take the form of preservation and conservation. No construction as well as heavy equipment will be allowed within the HPA (Dega 2006:11).
Notes: This document is a revision to the originally accepted Preservation Plan. Dega (2010:ii) notes that, "Both the number of sites/features being subject to Preservation have changed from the original plan, the boundaries of the HPA are more clearly demarcated herein (metes and bounds), and a slight alteration to the western portion of the HPA is also offered herein, per infrastructural concerns."

Study Title: *A Preservation Plan for the Department of Hawaiian Home Lands (DHHL), Kula Residential Lots in the Waiohuli Subdivision, Waiohuli and Kēōkea Ahupua'a, Makawao District, Maui Island, Hawai'i [TMK: (2) 2-2-002:014 por.]*
Study Type: Preservation Plan
Author(s): Michael Dega
Year: 2015
Firm or Organization: Scientific Consultant Services Inc.
Project Area Location: TMK: (2) 2-2-002:014 por.; Department of Hawaiian Home Lands Waiohuli Subdivision
Project Area Acreage: Unreported
Methods: "The present Preservation Plan follow procedures outlined in the Hawai'i Administrative Rules, Title 13 Department of Land and Natural Resources, Subtitle 13 State Historic Preservation Division Rules, Chapter 277 Rules Governing Minimal Requirements for Archaeological Site Preservation and Development (DLNR/SHPD 2003)" (Dega 2015:2).

Results: A total of twenty-five sites with 262 features are represented in the Waiohuli Preservation Plan. This includes: 158 agricultural features (terraces, mounds, garden enclosure), 67 permanent habitation features (platforms, enclosures, terraces), 14 temporary habitation loci (rock shelters, terraces), 3 ceremonial sites (heiau, enclosure), 18 boundary features (walls) and 2 features with unknown functional ascriptions (Dega 2015:11,12).
Mitigation Commitments/Historic Preservation Next Steps: Development in Waiohuli was planned around the formation of the HPA area. Roads and residences that were formally proposed for the southeastern portion of the HPA were terminated to open-up more area for the HPA (Dega 2015:13). Sites 3269 and 3283 will be preserved in the form of conservation. No excavation nor construction will be conducted. There will be a 3-meter buffer zone for the sites (Dega 2015:15). Preservation of the HPA sites will take the form of preservation and conservation. No construction as well as heavy equipment will be allowed within the HPA (Dega 2015:16).
Notes: Dega (2015:ii) notes that "The current document represents a revision to the originally accepted Preservation Plan. Both the number of sites/features being subject to Preservation have changed from the original plan, the boundaries of the HPA are more clearly demarcated herein (metes and bounds), and a slight alteration to the western portion of the HPA is also offered herein, per infrastructural concerns."

Previous Archaeological Studies Within the Project Area Vicinity

At least eight previous archaeological studies have occurred within the vicinity of the current project area and are cataloged below. The types of studies conducted within the project area vicinity include three Archaeological Inventory Surveys (AIS)—one of which was a Revised AIS for TMK 2-2-2: Portion of 056, an Archaeological Monitoring Plan, an Archaeological Monitoring and Reconnaissance Survey, an Archaeological and Historical Settlement Survey, an Archaeological Data Recovery, and a Preservation Plan for TMK 2-2-02:56. Summaries of each of the previous archaeological studies associated with the vicinity of the project area are presented below.

Study Title: *Archaeological Service for Department of Hawaiian Homelands: Waiohuli and Keokea Subdivisions, Kula Makawao, Maui*
Study Type: Archaeological Monitoring and Reconnaissance Survey
Author(s): Mary F. Riford
Year: 1987
Firm or Organization: Bernice Pauahi Bishop Museum
Project Area Location: TMK: 2-2-02, 04, 05; Portions of Kēōkea and Waiohuli ahupua'a
Project Area Acreage: ~800 acres
Methods: Methods included monitoring fence line, trailblazing, reconnaissance survey in the upper lots in the agricultural subdivision and reconnaissance survey in the remaining portion of the agricultural subdivision and the residential subdivision.
Results: This study confirmed 113 archaeological sites which composed of more than 252 features, and 13 sites that contained building materials during the historic period as well as artifacts representing habitation and/or ranching activities (Riford 1987:iv). Other findings included, "stone structures representing possibly prehistoric agricultural, habitation, and religious activities are located throughout the project area," (Riford 1987:iv).
Mitigation Commitments/Historic Preservation Next Steps: Mitigation and historic preservation next steps include monitoring during land-altering activities and if possible burial features are located, they must be tested during the Phase I intensive survey (Riford 1957:44). If human remains are found interred at the sites, preservation is recommended and "if preservation

is not feasible, then Phase II excavations will proceed and curation of the remains at a recognized repository such as Bishop Museum or reinterment in the vicinity of origin will be recommended," (Riford 1987:47).

Study Title: *Interim Report: Archaeological Inventory Survey Keokea and Waiohuli Subdivisions. Lands of Keokea and Waiohuli Makawao (Kula) District, Island of Maui (TMK: 2-2-02:55, 56).*
Study Type: Archaeological Inventory Survey
Author(s): Roderick S. Brown
Year: 1989
Firm or Organization: Paul H. Rosendahl, Ph.D., Inc.
Project Area Location: TMK: 2-2-02:55, 56
Project Area Acreage: 1,025 acres
Methods: Field work was conducted in five phases: 1) preliminary field inspection which was conducted by Dr. Alan E Haun to access the terrain and vegetation of the project area, 2) aerial helicopter survey in which 38 sites in Kēōkea and for in Waiohuli were identified, flagged, and recorded, 3) variable-intensity pedestrian survey which a group of five archaeologies surveyed transects spaced at 15-40 meter intervals, 4) site recording which two teams of three, a recorder, mapper, and rover described, photographed, recorded, and sketch mapped the sites, and 5) limited surface collections and excavations which "surface collection was limited to the recovery of a few temporally or functionally diagnostic artifacts. Limited excavations were undertaken to recover charcoal for radiocarbon dating and to assess the depth of cultural strata in selection features (Brown 1989:7)." Data management, cartography, and the production of the report were documented on computers and preliminary site and feature data gathered during the ground survey were recorded in field notebooks.
Results: Previous to this study, 113 sites comprising 252 features were associated with the project area. A total of 159 sites consisting of over 335 features were identified during this survey. 107 of the sites were located in Kēōkea and 52 were identified in Waiohuli. Sites included platforms, enclosures, walls, alignments, cairn, modified outcrops, and other types associated with early historic ranching. Preliminary functional interpretations for sites and features include permanent and temporary habitation, agricultural, boundary, ceremonial, burials and possible burial sites, storage, ranching, and undetermined functions.
Mitigation Commitments/Historic Preservation Next Steps: Ninety of the 107 sites in Kēōkea were recommended that further data collection was needed, nine sites were significant for information content and cultural value and were recommended for further data collection and preservation "as is," (Brown 1989:9). Six of the sites were "assessed as significant for information content as an excellent example of a site type, and for cultural value," (Brown 1989:9). Four of the six sites were recommended for further data collection and preservation with interpretive development, while one site was recommended for further data collection. Two of these sites were assessed as significant for information content and an excellent example of a site type, and one of the sites was recommended for further data collection and preservation with interpretive development, and the other site is recommended for further data collection and preservation "as is" (Brown 1989:9). Forty-three of the sites in Waiohuli were assessed as significant for information content and further data collection is recommended. Five sites were assessed as significant for information content and for cultural value. Four of the five sites were recommended for further data collection and preservation "as is", and one of the five sites were recommended for further data collection and preservation with interpretive development. Three of the nine sites were assessed as significant for information content, as an excellent example of site type and as culturally significant. These three sites were recommended for further data collection and preservation with interpretive development. One of the nine sites were assessed for significance

for information content, an excellent example of a site type, and as culturally significant. This site was recommended for further data collection and preservation with interpretive development.
Notes: The recommendations made in this report are noted to be based on preliminary information and are all tentative. Further analysis of the sites will allow for refinement of assessments.

Study Title: *Archaeological Inventory Survey Keokea and Waiohuli Subdivisions. Lands of Keokea and Waiohuli Makawao (Kula) District, Island of Maui (TMK: 2-2-02:55, 56).*
Study Type: Archaeological Inventory Survey
Author(s): Roderick S. Brown, Alan E. Haun, and Helen Wong Smith
Year: 1989
Firm or Organization: Paul H. Rosendahl, Ph.D., Inc.
Project Area Location: TMK: 2-2-02:55, 56
Project Area Acreage: 1,025 acres
Methods: Field work was conducted in five phases: 1) preliminary field inspection which was conducted by Dr. Alan E Haun to access the terrain and vegetation of the project areas, 2) helicopter survey in which aerial reconnaissance was conducted of the project areas 38 sites/features were identified from the air in Kēōkea and four in Waiohuli. These sites were flagged, labeled, and plotted, 3) variable-intensity coverage ground survey in which a group of five archaeologies surveyed transects spaced at 15-40 meter intervals, 4) site recording which two teams of three, a recorder, mapper, and rover described, photographed, recorded, and sketch mapped the sites, and 5) limited surface collections and excavations was conducted. Data management, cartography, and the production of the report were documented on computers and preliminary site and feature data gathered during the ground survey were recorded in field notebooks. Data was entered in dBASE IV files.
Results: One hundred fifty-nine sites consisting of 274 features were identified. 53 previously identified sites were relocated and reassigned PHRI temporary numbers. 61 sites were complexes. Nine of the complexes in Waiohuli comprised of 21 features. 52 complexes in Kēōkea comprised of 156 features. 98 sites were identified as single features; 42 in Waiohuli and 56 in Kēōkea. Features of these sites included, wall, enclosure, terrace, mound, overhang, upright, wall, lithic scatter, alignment, cave, platform, bridge, and burial. Interpretation of sites were habitation, religious, burials, or potential burials and agriculture.
Mitigation Commitments/Historic Preservation Next Steps: Forty-two of the 51 sites found in Waiohuli were assessed as "significant solely for information content," (Brown et al. 1997:28-29). Of the 42 sites, 33 of the sites were recommended for further data collection while nine required no further work (Brown et al. 1997:28-29). Three sites were assessed as "significant for information content, as excellent examples of a site type, and as culturally significant," and "further data collection and preservation with interpretive development" were recommended for them (Brown et al. 1997:28-29). Two sites were assessed as "significant for information content and provisionally assessed as having cultural value," and further data collection an preservation with interpretive development was recommended (Brown et al. 1997:28-29). Four sites were "assessed variously and require various recommended treatments," (Brown et al. 1997:28-29). Eighty-nine of the sites found in Kēōkea were recommended for further data collection, while no further work were recommended for five sites (Brown et al. 1997:28-29). Four sites were assessed as "significant for information content, as an excellent example of a site type, and for cultural value," and was recommended for "further data collection and preservation with interpretive development" for them (Brown et al. 1997:28-29). Three sites were assessed as "significant for information content and as an excellent example of a site type," and recommended that "further data collection and preservation with interpretive development," be conducted (Brown et al. 1997:28-29). Three sites were assessed as "significant for information content and for cultural value" and recommended for further data collection and preservation as is (Brown et al. 1997:28-

29). Three other sites were assessed as “significant for information content” and were “tentatively assessed as significant for cultural value,” (Brown et al. 1997:28-29). These three sites were recommended for further data collection and were recommended for preservation as is. One site in Kēōkea was assessed as “significant for information content and as having cultural value,” and preservation "as is" was recommended (Brown et al. 1997:28-29).

Study Title: *Kula: The Archaeology of Upcountry Maui in Waiohuli and Kēōkea. An Archaeological and Historical Settlement Survey in the Kingdom of Maui.*
Study Type: Archaeological and Historical Settlement Survey
Author(s): Michael J. Kolb, Patty J. Conte, and Ross Cordy
Year: 1997
Firm or Organization: Historic Preservation Division Department of Land and Natural Resources
Project Area Location: Waiohuli and Kēōkea Department of Hawaiian Home Lands
Project Area Acreage: 1,644 acres
Methods: The basis of this study was conducted, examined, and discussed in sections which included: The Communities of Waiohuli and Kēōkea, the Political and Economic Landscape of Waiohuli and Kēōkea in the Nineteenth Century, the Archaeological Landscape of Upland Kula, Models of Community Settlement, the Material Cultural of Kula, and the Social Organization and Settlement in Kula. Methods regarding the Archaeological Landscape of Upland Kula consisted of pedestrian surveying over the 1,644 acres of Waiohuli and Kēōkea. Surveys included mapping and excavating of selected features. Cultural material such as midden and artifacts recovered were sorted, bagged, and categorized based on depth, layer, and level on location.
Results: The conclusion of this study yielded understanding of the Waiohuli and Kēōkea settlement and archaeology within the study area to determine that, “This area has archaeological ruins of agricultural fields on swales and ridge tops descending sets of terraces and large enclosures encompassing large garden areas. Ruins of houses (platforms, enclosures, and walled terraces) are scattered in and around the dryland fields, and within these ruins are food remains and tools which tell much about the diet and activities of the former residents. And eight medium-sized *heiau* impressive thick-walled notched enclosures are situated among these houses and served as places of worship for the residents, where pigs were offered up to various gods in late prehistory, Kolb et al. 1997:292).”
Mitigation Commitments/Historic Preservation Next Steps: Recommended that the best examples of the site discussed in this study be preserved and interpreted.

Study Title: *Archaeological Data Recovery of the DHHL Kula Residential Lots Unit 1 of Waiohuli Subdivision Waiohuli, Kula, Maui Island, Hawai‘i.*
Study Type: Archaeological Data Recovery
Author(s): Amy Dunn, Michael T. Carson. Michael F. Dega, and Robert L. Spear
Year: 1999
Firm or Organization: Scientific Consultant Services Inc.
Project Area Location: TMK: 2-2-02:56
Project Area Acreage: Unreported
Methods: Concerning field work methods: a walk-through of the project area was conducted to document micro-topographical regions and understand their connection to types of agricultural site in order to determine if particular agricultural features occur with particular landforms. Test units were placed within the features interior and adjacent walls to establish the position of the surface architecture in subsurface layers (Dunn et al. 1999:9). Excavations occurred to obtain charcoal samples for radiocarbon dating. Two samples from each feature; one from the basal layer and one from the upper stratigraphic layer, were tested. Historic artifacts that were recovered during excavation were documented with their specific layers and depth. Pig and dog

consumption patterns at house sites were evaluated by identifying provinces with their skeletal parties and structure. The method for social ranking evaluation of permanent habitation sites was conducted by evaluating the labor expenditure of the sites which included gathering data of the amount of stone volume in each structure and taking note of any special preparations performed to the site. Concerning post-field work methods: Plane view maps and profiles were sketched for each excavation unit with its descriptions recorded. Photographic documentation was conducted with the exception of burial sites. All artifacts and midden identified and recovered were taken to laboratories for analysis. Identified human remains were left *in situ.* Concerning laboratory methods: all data were recorded on standard laboratory forms and presented in tabular and graph forms within the project report. Archaeological site plan view and general maps and artifact location maps were drafted and presented for ready identification of features and locations.
Results: Eleven sites were identified/reidentified during this survey. Nine sites were formerly identified as permanent habitation structures, one site previously identified as an agricultural site, and one site was newly discovered and identified as a permanent habitation. Permanent habitation sites were dated between 1400s-1600s. This time period is thought to be associated with the first large-scale settlement to occur in upcountry Maui. Other sites were dated in the 1600s during a time-period where it is believed to be associated with increasing numbers of habitation sites, heiau, and garden enclosure that resulted in an increased population and intensified field system. Other house sites were constructed during the historic period. Sites are believed to be constructed and utilized by maka'āinana with no evidence of ali'i. Pig and dog remains were identified within 3/10 permanent habitation sites.
Mitigation Commitments/Historic Preservation Next Steps: Unreported

Study Title: *Waiohuli Road Corridor Survey: Revised Archaeological Inventory Survey Report for the Department of Hawaiian Homelands (DHHL) in Waiohuli Ahupua'a, Kula District, Island of Maui, Hawai'i [TMK: 2-2-2: portion of 056]*
Study Type: Revised Archaeological Inventory Survey
Author(s): Micahel Dega and BreAnna Havel
Year: 2005
Firm or Organization: Scientific Consultant Services Inc.
Project Area Location: TMK: 2-2-2: Por. of 056; Department of Hawaiian Home Lands Waiohuli Subdivision
Project Area Acreage: 400 acres
Methods: Fieldwork consisted of manual clearing of sites as well as mapping and recording of them. Systematic pedestrian surveys were conducted for each road corridor from centerline to right-of-way edge (Dega and Havel 2005:12). Sites and features were marked in the field and located on the project plan view map. Previously recorded sites were re-identified and evaluated to ensure that they were adequately recorded during the Inventory Survey. Any site or feature not previously mapped or recorded was done so during this survey. All unidentified sites/features found within the road corridor were fully mapped, described, and photographed (Dega and Havel 2005:12,13). Excavations were undertaken according to standard excavation procedures. Excavated sediments were screened with 6mm and 3mm wire mesh with any/all cultural materials recovered (Dega and Havel 2005:14). During the discovery of any human remains, all work ceased and proper protocols associated with burials were conducted. All field work documentation is curated at SCS facilities in Honolulu.
Results: Thirty-five previously unrecorded features associated with nine sites were documented. Eighteen sites were identified in the road corridors for this project. Of the nine road corridors, only one did not contain a site or feature (Dega and Havel 2005:2). These sites include: "enclosures, C-shapes, U-shapes, walls, terraces, mounds, alignments, platforms, lava tubes, rock shelters, and modified outcrops, these respectively related to habituation, agriculture, and boundary functions" (Dega and Havel 2005:112). One burial was identified in the road corridor.

The remains are protected *in situ*. All features identified during this survey were determined to be associated with traditional times.
Mitigation Commitments/Historic Preservation Next Steps: Of the 18 sites that occurred within the proposed road corridor, one site (3272) was recommended for further work and should be done so in the form of a burial treatment plan that will cover the entire project area. It was recommended that Archaeological Monitoring persist during the construction of the road corridors as various sites and cultural materials were recovered on site. Due to the possibility of inadvertent burials, monitoring was recommended to appropriately document and preserve the site/features.
Notes: The project area represented a larger portion of area previously surveyed by Kolb et al. in 1997 which documented 1,093 features comprising 213 sites across the 800 acres in Waiohuli (Dega and Havel 2005:2). This revised Inventory Survey focused only on the eastern 400 acres of the parcel.

Study Title: *An Archaeological Monitoring Plan for State Site 50-50-10-2375 At the Waiohuli Hikina Subdivision, Kula, Waiohuli Ahupua'a, Makawao District Island of Maui, Hawai'ai [TMK (2) 2-02:056 por.]*
Study Type: Archaeological Monitoring Plan
Author(s): Elizabeth Pestana and Michael F. Dega
Year: 2005
Firm or Organization: Scientific Consultant Services Inc.
Project Area Location: TMK (2) 2-02:056 por.; Department of Hawaiian Home Lands Waiohuli Hikina Subdivision lands (Lot I)
Project Area Acreage: 400 acres
Methods: Qualified archaeologists monitored the ground altering activities. If any features or cultural deposits identified on site, work ceased to commence so proper evaluations could occur. Feature and deposits were documented by "plotting its location on an overall site map, illustration a plan view map of the feature/deposit, profiling the deposit in three dimensions, photographing the finds (with the exception of human burials), artifacts and soil sample collection, and triangulation of the finds" (Pestana and Dega 2005:18). Any human remains encountered triggered a halt of work and proper burial protocols were conducted. Stratigraphy in association with subsurface cultural deposits was noted and photographed. Coordination meetings between the archaeologists and contractors were conducted prior to the project.
Results: Three historic sites were found within the project area which include: a temporary habitation (Site 2369), a permanent habitation (Site 2375), and an agricultural site (Site 2363). All three sites were previously recorded during the 1989 Inventory Survey by Brown (Pestana and Dega: 2005:1). It was determined that no additional archaeological work was needed for the sites.
Mitigation Commitments/Historic Preservation Next Steps: It was noted that permanent habitation sites often contained human burials and therefore, onitoring was recommended to mitigate any inadvertent discoveries during the construction work (Pestana and Dega 2005:1). As part of historic preservation next steps the Archaeological Monitoring Plan requires approval of the SHPD (Dr. Melissa Kirkendall, SHPD-Maui) before any ground altering activities associated with this project are to occur (Pestana and Dega 2005:1).

Study Title: *A Preservation Plan for the Department of Hawaiian Homelands (DHHL), Kula Residential Lots in the Waiohuli Subdivision, Waiohuli Ahupua'a, Kula District, Maui Island, Hawai'i [TMK:2-2-02:56 por.]*
Study Type: Preservation Plan
Author(s): Michael Dega
Year: 2006
Firm or Organization: Scientific Consultant Services Inc.

Project Area Location: TMK: 2-2-02:56 por.; Department of Hawaiian Homelands Waiohuli Subdivision
Project Area Acreage: Unreported
Methods: Standard procedures outlined in the Hawai'i Administrative Rules, Title 13 Department of Land and Natural Resources, Subtitle 13 State Historic Preservation Division Rules, Chapter 277 Rules Governing Minimal Requirements for Archaeological Site Preservation and Development (DLNR/SHPD 2003) were followed (Dega 2006:1).
Results: A total of twenty-five sites and 262 features are preserved within this plan. Twenty-three of the sites composed of 235 features cover a continuous landscape of over 65-acres and are categorized as non-burial sites. Two sites composed of 27 features occur on a different position of the project area. Six burial sites will be preserved in this plan. The features include: 158 agricultural features (terraces, mounds, garden enclosures), 67 permanent habitation features (platforms, enclosures, terraces), 14 temporary habitation loci (rock shelters, terraces), 3 ceremonial sites (heiau, enclosure), 18 boundary features (walls), and 2 features with unknown functional ascriptions (Dega 2006:9).
Mitigation Commitments/Historic Preservation Next Steps: Sites 3269 and 3283 will be preserved in the form of conservation. No excavation nor construction will be conducted. There will be a 3-meter buffer zone for the sites (Dega 2006:10,11). Preservation of the HPA sites will take the form of preservation and conservation. No construction as well as heavy equipment will be allowed within the HPA (Dega 2006:11).
Notes: Dega (2006:1) notes that "this plan also demarcates the location of the *c.* 65-acre Historic Preserve Area (HPA) that will preserve all but two of these sites. The HPA represents preservation of a large continuous swath of landscape containing all representations of site types and periods in Waiohuli. The HPA, in concert with one established on the neighboring Keokea parcel, preserves 49-multi-component sites over a *c.* 110-acre area."

Previously Identified Historic Properties Within the Project Area and Vicinity

According to the information available, at least 54 previously identified historic properties were located within the project area and vicinity (Table 3, Figure 14). Ten of the 54 sites were interpreted as heiau and for the function of ritual. Site 50-50-1040, Kaimupeelua Heiau is a site designated within the Historic Preservation Area (HPA) in (Dega 2015). Site 6470 and Site 6630 are classified as inadvertently identified human skeletal remains of which Site 6470 is believed to represent at minimum five individual burials, while the latter, Site 6630 is interpreted to represent at minimum two individuals consisting of one partially in situ human skeletal remain and a displaced single partial human femur (Dagher et al. 2010:20,35). The remaining historic properties associated with the project area vicinity consist of varying sites and functions. These include petroglyphs, enclosures, mounds, platforms, terraces, fire pits, permanent habitations, walls, garden enclosures, lava tubes, alignments, modified outcrops, rock piles, rock shelters, rock overhangs, paving, stepping stone trail, cobble and pebble rock concentrations, and a probable camp site. A total of 25 of the historic properties are preserved in perpetuity as indicated in the Preservation Plan for the Department of Hawaiian Home Lands composed for Waiohuli Subdivision (Dega 2015:2).

Table 3. Previously Identified Historic Properties in the Project Area and Vicinity

Site Number	Description	Function / Interpretation	Features
50-50-10-1035	Keahiʻāloa Heiau	Heiau, ritual (Riford 1987:10).	Small platform
50-50-10-1036	Papakea Heiau	Heiau, ritual (Riford 1987:10).	Platform, terraces
50-50-10-1037	Molohai Heiau	Heiau, ritual (Riford 1987:10).	Notched enclosure
50-50-10-1038	Kaumiumimua Heiau	Heiau (Riford 1987:10).	Notched enclosure
50-50-10-1039	Kaumeheiwa	Heiau (Riford 1987:10).	Notched heiau
50-50-10-1040	Kaimupeelua	Enclosure, terraces; Designated Waiohuli Preservation Site (Riford 1987:10).	Enclosure, terraces
50-50-10-1041	Pauhu Heiau	Enclosure (Riford 1987:10).	Enclosure
50-50-10-1042	Kōheo petroglyphs	Petroglyphs in a gulch (Riford 1987:10).	petroglyphs
50-50-10-1043	Kōheo Heiau	Notched enclosure (Riford 1987:10).	Notched enclosure
50-50-10-1044	Rice Camp Heiau	Heiau, ritual (Riford 1987:10).	Platform
50-50-10-1046	Kaʻonoʻulu Heiau	Heiau, ritual (Riford 1987:10).	Small platforms
50-50-10-3200	Enclosure, mound, platform, terrace, U-shaped wall	Agricultural, permanent habitation; Designated Waiohuli Preservation Site (Dega 2015:8).	Agriculture, 4 permanent habitations, 3 post-contact habitations
50-50-10-3201	C-shape, enclosure, terrace	Permanent habitation, agricultural, temporary habitation, boundary; Designated Waiohuli Preservation Site (Dega 2015:8).	4 permanent habitations, 3 agricultural, 1 temporary habitation, 1 boundary; traditional period
50-50-10-3211	terrace	Agricultural; Designated Waiohuli Preservation Site (Dega 2015:8).	2 agricultural; traditional period
50-50-10-3212	Enclosure, platform, terrace, garden enclosure	Permanent habitation, temporary habitation, agricultural; Designated Waiohuli Preservation Site (Dega 2015:8).	5 permanent habitations, 2 temporary habitations, 2 agricultural; traditional period
50-50-10-3217	Wall, terrace	Temporary habitation, agricultural, boundary; Designated Waiohuli Preservation Site (Dega 2015:8).	2 temporary habitations, 1 agricultural, 1 boundary; traditional period
50-50-10-3225	Platform, walled, terrace	Permanent habitation; Designated Waiohuli Preservation Site (Dega 2015:8).	4 permanent habitations; traditional period

Site Number	Description	Function / Interpretation	Features
50-50-10-3227	Enclosure, terrace, rock shelter	Permanent habitation; Designated Waiohuli Preservation Site (Dega 2015:8).	6 permanent habitations
50-50-10-3230	Platform, wall, terrace	Temporary habitation, agricultural, boundary; Designated Waiohuli Preservation Site (Dega 2015:8).	2 temporary habitations, 1 agricultural, 1 boundary; traditional period
50-50-10-3231	Enclosure, C-shape, platform, terrace, U-shape, wall	Permanent habitation, boundary, agricultural; Designated Waiohuli Preservation Site (Dega 2015:8).	6 permanent habitations, 3 boundaries, 2 agricultural; traditional period
50-50-10-3232	Enclosure, C-shape, platform, alignment, mound, wall, terrace	Agricultural, permanent habitation, boundary; Designated Waiohuli Preservation Site (Dega 2015:8).	4 agricultural, 3 permanent habitations, 2 boundaries
50-50-10-3233	Enclosure, C-shape, mound terrace	Agricultural, permanent habitation, temporary habitation; Designated Waiohuli Preservation Site (Dega 2015:8).	4 agricultural, 3 permanent habitations, 1 temporary habitation; traditional period
50-50-10-3234	Wall, enclosure, alignment mound	Agricultural, permanent habitation, boundary; Designated Waiohuli Preservation Site (Dega 2015:8).	5 agricultural, 2 permanent habitations, 1 boundary, 1 unknown; traditional period
50-50-10-3235	terrace	Agricultural, permanent habitation; Designated Waiohuli Preservation Site (Dega 2015:8).	3 agricultural, 1 permanent habitation; traditional period
50-50-10-3236	Enclosure, alignment, C-shape, garden enclosure, terrace, wall	Agricultural, permanent habitation, boundary; Designated Waiohuli Preservation Site (Dega 2015:8).	7 agricultural, 3 permanent habitations, 1 boundary; traditional period
50-50-10-3238	Walled terrace, terrace, L-shape	Permanent habitation, agricultural, temporary habitation; Designated Waiohuli Preservation Site (Dega 2015:9).	3 permanent habitations, 3 agricultural, 1 temporary habitation; traditional period
50-50-10-3243	Lava tube, wall	Ritual, boundary; Designated Waiohuli Preservation Site (Dega 2015:8).	1 ritual, 1 boundary; traditional period
50-50-10-3247	Terrace, wall, I-shape	Agricultural, permanent habitation; Designated Waiohuli Preservation Site (Dega 2015:9).	3 agricultural, 1 permanent habitation; traditional period
50-50-10-3248	Alignment, modified outcrop, terrace, wall	Boundary, agricultural, permanent habitation; Designated Waiohuli Preservation Site (Dega 2015:9).	2 boundaries, 2 agricultural, 1 permanent habitation; traditional period
50-50-10-3249	Enclosure, wall	3 boundary, 1 agricultural; traditional-historic period; Designated Waiohuli Preservation Site (Dega 2015:9).	3 boundaries, 1 agricultural; traditional-historic period

Site Number	Description	Function / Interpretation	Features
50-50-10-3250	Enclosure, terrace, rock shelter	Ritual, temporary habitation, agricultural; Designated Waiohuli Preservation Site (Dega 2015:8).	1 ritual, 1 temporary habitation, 1 agricultural
50-50-10-3251	Enclosure, terrace, alignment, rock shelter, garden enclosure, modified outcrop, paving	Permanent habitation, agricultural, temporary habitation, boundary; Designated Waiohuli Preservation Site (Dega 2015:9).	7 permanent habitations, 6 agricultural, 3 temporary habitations, 2 boundaries; traditional period
50-50-10-3269	C-shape, enclosure, modified outcrop, mound, I-shape, terrace	Agricultural, permanent habitation, temporary habitation, boundary; Designated Waiohuli Preservation Site (Dega 2015:9).	10 agricultural, 4 permanent habitations, 1 temporary habitation, 1 boundary; traditional period
50-50-10-3282	Roch shelter, enclosure, mound	Temporary habitation, agricultural; Designated Waiohuli Preservation Site (Dega 2015:9).	2 temporary habitations, 1 agricultural; traditional period
50-50-10-3283	Platform, enclosure, terrace	Permanent habitation, agricultural; Designated Waiohuli Preservation Site (Dega 2015:9).	6 permanent habitations, 5 agricultural; traditional period
50-50-10-5214	Small enclosure that lies on an exposed lava flow	Interpreted as a possible military-era structure (Fredericksen and Fredericksen 2002:16).	Enclosure
50-50-10-5215	L-shaped partial enclosure located on an ‘a‘ā lava flow	Two drainage features to the south of the site suggest that the site may have functioned as a temporary habitation area (Fredericksen and Fredericksen 2002:17).	Enclosure
50-50-10-5216	Stepping stone trail and terrace	The trail is 358 meters long and averages 0.5 meters wide. 349 stepping-stones were noted during inspection of the trail (Fredericksen and Fredericksen 2002:20).	Stepping stone trail and platform
50-50-10-5217	Complex of cobble and pebble rock concentrations	13 separate rock concentrations are contained in the site. Interpreted as a possible dry land agricultural site that may contain two burials (Fredericksen and Fredericksen 2002:20).	1 low oval shaped rock mound, 1 rectangular concentration of subangular cobbles and pebbles
50-50-10-5218	Rock overhang shelter	Interpreted as a probable temporary habitation area that could have been used during mauka-makai travel (Fredericksen and Fredericksen 2002:22).	Rock overhang
50-50-10-5219	Modified natural terrace	Function unknown (Fredericksen and Fredericksen 2002:23).	Modified natural terrace

Site Number	Description	Function / Interpretation	Features
50-50-10-5220	Rock pile/cairn	Interpreted as a possible marker. Could be related to military activities or represents an earlier trail maker (Fredericksen and Fredericksen 2002:24-25).	Rock pile/cairn
50-50-10-5221	Rock overhang shelter	Interpreted as a probable temporary habitation area that could be used during mauka-makai travel in pre-contact and early post-contact times (Fredericksen and Fredericksen 2002:25).	Rock overhang
50-50-10-5222	Two small rock overhangs	Interpreted as a probable temporary habitation area that could be used during mauka-makai travel in pre-contact and early post-contact times (Fredericksen and Fredericksen 2002:25).	2 small rock overhangs
50-50-10-5223	Rock pile/cairn that lies between two ʻaʻā flow finger ridges	Interpreted as a maker (Fredericksen and Fredericksen 2002:28).	Rock pile/cairn
50-50-10-5224	Two small C-shapes and one modified outcrop	The site lies at the top of the most prominent puʻu on the project area. Interpreted as temporary shelters and a windbreak (Fredericksen and Fredericksen 2002:29,30).	2 enclosures, 1 windbreak
50-50-10-5225	Rock pile/cairn	Located in a “conspicuous” part of the project area and clearly visible. Interpreted as a marker (Fredericksen and Fredericksen 2002:29,31).	Rock pile/cairn
50-50-10-5226	Two historic rock walls	Associated with Haleakalā Ranch, likely dated between 1930s-1940s (Fredericksen and Fredericksen 2002:29,32).	2 historic rock walls associated with ranching
50-50-10-5227	Probable campsite clear pile	Associated with informal camping in the project are during the last century (Fredericksen and Fredericksen 2002:29,32).	Rock pile
50-50-10-6468	Subsurface fire pit	Possible function for cooking, heat, or ceremonial purposes (Dagher et al. 2010:18).	Fire pit
50-50-10-6470	Inadvertently identified human skeletal remains representing five (MNI=5) individuals (Five burials)	Two individuals were determined as an adult female and a juvenile (Dagher et al. 2010:18). Burials were interpreted as per-contact (pre-1778) and of Native Hawaiian ancestry. Burials 1 and 2 were reinterred with Burial 5. Burials 3 and 4 were preserved in place (Dagher et al. 2010:20).	Five human burials

Site Number	Description	Function / Interpretation	Features
50-50-10-6487	Subsurface fire pit	Possible function for cooking, heat, or ceremonial purposes (Dagher et al. 2010:30).	Fire pit
50-50-10-6630	Inadvertently identified partially in situ human skeletal remains and a displaced single partial human femur; suggests two (MNI=2) individuals	Interpreted as Chinese or Chinese/Polynesian mixed ancestry; estimated internment during the 1880s to early 1900s (Dagher et al. 2010:35).	Human skeletal remains
50-50-10-6672	Low-walled rectangular enclosure and subsurface fire pit	Interpreted as a traditional style habitation enclosure associated with the pre-contact period (pre-1778) (Dagher et al. 2010:37).	Enclosure and fire pit

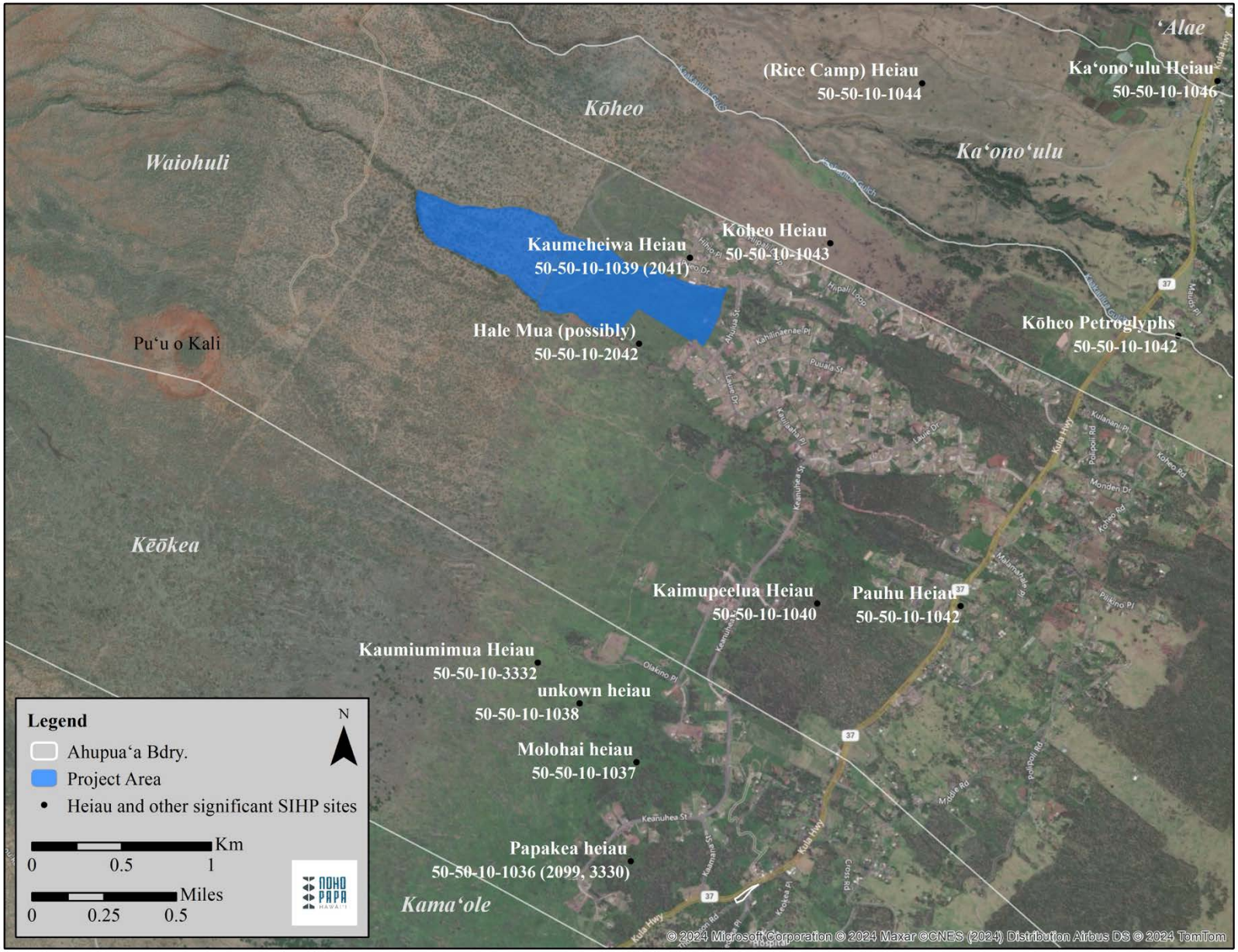


Figure 16. Previously Identified Historic Properties in the Project Area and Vicinity

BACKGROUND SUMMARY AND PREDICTIVE MODEL

Background research performed for this study evinces that an intertwined and contiguous array of significant cultural features and resources constitute the Hawaiian cultural landscape of the project area and vicinity in the Waiohuli Ahupuaʻa, Kula Moku, Maui Mokupuni. Multiple lines of primary cultural knowledge and evidence derived from Hawaiian oral traditions detailed in this study characterize Waiohuli, a wahi pana that can be translated to mean "water of change," (Pukui, Elbert, Mookini 1974:226) as populated by innovative and prosperous Hawaiian communities that were also isolated by their landlocked environment and unfamiliar with the sea, canoe paddling, and ocean resources. Despite the isolation from coastal resources, the people of upper Kula and the Waiohuli Ahupuaʻa appropriated the arid and rocky loam soil of their landscape to proficiently cultivate ʻuala in abundance (Handy, Handy, and Pukui: 1972:161).

The Kula Moku and the Waiohuli Ahupuaʻa location of the project area appear on the earliest Hawaiian cartographic representations of traditional land divisions such as moku and ahupuaʻa. Kula Moku is depicted in an 1837 map of the pae ʻāina engraved by Kalama at Lahainaluna Seminary, Maui (Kalama 1837; Forbes 2012:150), and the project area and the rest of the Waiohuli Ahupuaʻa were designated as Crown Lands in 1848.

Between the 1840s and 1850s, predominantly Hakka Chinese from Kwangtung Province became established in Kula as farmers that influenced the growth of settlement and land use in the moku around the vicinity of the project area, resulting in an intermixed Hawaiian and Chinese farming community (Mark 1975:1–3,33). During the 1880s, Kula Crown Lands became cattle ranches and pasturelands. In his 1894 *Biennial report of the Commissioners of Crown Lands* Curtis, published in the year following the illegal overthrow of the sovereign Hawaiian Kingdom by the United States, Piehu Iaukea described the 6,003 combined acres of Waiohuli and Kēōkea Ahupuaʻa as both "the choices land in this district," and "the most valuable" Crown Lands on Maui. At the close of the nineteenth century, the project area on the mauka side of a government road was considered "fine corn and potato land" bordering land used for cattle grazing. Crown Lands as cattle ranches and pasturelands in Kula persist as such for the next century or more (Riford 1987:5).

At the end of World War I, large amounts of land went to public purchase. As a result, homestead lands were made available in the Kula Moku and in 1911, the lands were predominantly leased by Hawaiian and Chinese families. Combined with catastrophic drought, the policy prompted the out-migration of many Chinese families and influx of settlers into the community (Mark 1975:34). With the transition from ranch lands to homesteads, 6,112 acres of the Waiohuli Ahupuaʻa were designated as homelands as part of the Department of Hawaiian Home Lands. As it stands today, Waiohuli Homestead lots are located ma kai of the Kula Highway and is a significant footprint in the upper Kula community as many Native Hawaiian families have settled in the area and made Waiohuli home.

Previous archaeological studies spanning at least 28 years further illustrate the settlement and presence of early Native Hawaiians in the Waiohuli Ahupuaʻa. At least 54 previously identified historic properties were located within the project area and vicinity which consisted of heiau, iwi kūpuna, petroglyphs, enclosures, mounds, platforms, terraces, fire pits, permanent habitations, walls, garden enclosures, lava tubes, alignments, modified outcrops, rock piles, rock shelters, rock overhangs, paving, stepping stone trail, cobble and pebble rock concentrations, and a probable camp site. Twenty-fine of the previously identified historic properties are preserved in perpetuity

as indicated in the Preservation Plan for the Department of Hawaiian Home Lands composed for Waiohuli Subdivision (Dega 2015:2).

Given the vicinity of the project area in relation to the designated Historic Preservation Areas in Waiohuli, and the undeveloped area in which the proposed project would take place, it is likely that historic properties may be present on the ground surface of the project area. The project area parcel, TMK (2) 2-2-002-014, coincides with previous archaeological studies where the study encompassed portions of this parcel. Though the second parcel of the project area, TMK (2) 2-2-028-181, was never studied or developed, the presence of wahi kūpuna could be likely given the settlement of Kula and the previous historic properties identified in the ahupua‘a.

Hawaiian oral traditions and historical records provide evidence of Hawaiian, Chinese, and later settler communities in Kula. Secondary to Hawaiian primary sources, archaeological evidence documents what has been interpreted as two inadvertent burials and human skeletal remains during the development of Waiohuli Hawaiian Homestead lots (Dagher et al. 2010:20,35). Following traditional Hawaiian habitation, the Kula very rocky loam soils of the project area, which are characterized by deep sedimentary deposits, were grazing and agricultural lands which also encouraged waves of settlement that occurred in the moku. For these reasons, background research indicates it is both possible and likely that subsurface iwi kūpuna and historic properties may be present in the project area.

COMMUNITY CONSULTATION

Community Consultation for this CIA was conducted from May 2024 to July 2024. The consultation process consisted of identifying appropriate and knowledgeable individuals, conducting community consultation, summarizing the consultation questionnaires, analyzing the data, and preparing the report. Fifteen individuals were contacted to participate in this study. Of the fifteen individuals, five committed to participating in consultation by completing an online survey questionnaire. Though unable to participate in an interview or survey to consult on this project, one individual contributed to the community ethnography process by graciously offering their recommendations on who should be contacted to participate in this study. The names and contact information provided by this individual were included in Nohopapa's engagement process. The table below lists the names (in alphabetical order), background information, and the dates of the individuals who were interviewed for this study.

Table 4. Community Interview Participants

Participant	Background/Affiliation	Notes
Perry Artates	» Waiohuli Hawaiian Homestead Resident » Born and raised in Kēōkea, Kula, Maui	Completed online survey questionnaire on June 19, 2024. Mana'o is included below.
Lokomaika'i Brown	» Waiohuli Hawaiian Homestead Resident » Grew up in the Moku of Kula, Maui	Completed online survey questionnaire on July 17, 2024. Mana'o is included below.
Kekai Kapu	» Waiohuli Hawaiian Homestead Resident » Cultural Practitioner	Completed online survey questionnaire on June 12, 2024. Mana'o is included below.
Clifford Santos Jr.	» Waiohuli Hawaiian Homestead Resident » Cultural Practitioner » Grew up in the Moku of Kula, Maui	Completed online survey questionnaire on July 18, 2024. Mana'o is included below.
Napua Silva	» Waiohuli Hawaiian Homestead Resident » Kumu Hula » Cultural Practitioner » Grew up in the Moku of Kula, Maui	Completed online survey questionnaire on July 14 2024. Mana'o is included below.

MAHALO

Nohopapa Hawai'i would like to mahalo the individuals and organizations who shared their precious time, memories, and mana'o for this study. Without their willingness to share personal recollections and stories, this important project would not have been possible. The mana'o that was shared will help to envision and guide the future of Waiohuli for the upcoming generations to better understand, appreciate, and cherish the uniqueness of this place.

Summary of Community Mana‘o

Mo‘okū‘auhau and Mo‘okū‘auhau ‘Āina (Background Information)

Kekai Kapu was born and raised on O‘ahu in the Papakōlea Homestead, “Tantalus Round Top.” His connection to Maui is tied to his father’s lineage rooted to Lahaina. Kekai shared that Lahaina is the birth place of his father, his father’s father, passed down for generations living and moving to Maui. His connection to Maui is interwoven into the many years having brought his father home to his birth place in Lahaina for countless occasions. While bringing his father home to Lahaina, Kekai shared that at the same time he would keep to the forefront of his mind the thought that the day would come when the many people who have waited some over 20 years to receive their Homestead lot, that he too would celebrate the day of when the infrastructure for his future home in Upcountry, Kula, Waiohuli would come to be.

Kekai received his Waiohuli Hawaiian Homestead lot in 1985 and constructed his home there in 2003. He has been a resident of Waiohuli for the past 21 years. Kekai commented that he has studied and followed the Homestead construction process for 17 years due to the many setbacks he had encountered during the process. He has contributed to the process by offering testimonies and has followed closely the process in order to see the opening of the Homestead Subdivision commencement come to fruition in 1998.

Regarding Kekai’s connection to Waiohuli, he shared that; “As for me, Waiohuli has always been my main focal point for the future of my ‘ohana (family), knowing the history of many families pili kōkō too, and the lifestyle they lived for generations.” Today, Kekai is a member of the Waiohuli Hawaiian Homestead Association–an organization that he loves and respects. Kekai shared that “when the time comes for traditional protocols in oli and respect to this Hawaiian Homestead I have lived my entire life for, from my birth place of my ancestors, I will continue to mālama kūpuna, Nā ‘Ōiwi o Kaua‘ula o Lahaina and Nā Moku o Waiohuli.” His dedication and aloha for the kūpuna and ‘āina like Waiohuli is persistent and embedded in the work he is involved in. Kekai’s background related to cultural knowledge is portrayed in the work and efforts he and his ‘ohana have been involved in. He remarked that he (now retired) was the Cultural Director for the Maui Ocean Center. He has dedicated his life to mālama the traditions of sustainability and restoration for historical burial sites. He commented that his dedication to this type of work is “for the future generations” and is done in order to “educate our young generation to take their place when that time comes.”

Kekai shared that his ‘ohana for years had close relationships within the State and Federal level when it comes to protecting the history of archaeological findings so that they are not desecrated. He commented that oftentimes our cultural and historic sites are overlooked within the State of Hawai‘i. Kekai and his ‘ohana have worked with many respected archaeologists such as Melissa Kurkendal, Mike Dega, and others. They have worked closely with the kuleana lands of their ancestors in Kaua‘ula in Lahaina. Kekai’s youngest brother, Ke‘eaumoku Kapu has been a part of the Maui Island Burial Council and is an historian. His nephew, Jonah Ikaika Kapu, is an archaeologist and the head of the Lahaina Restoration Cultural Monitor Lead Team Supervisor. Kekai proudly states that just as the work and dedication of his family, he too will continue to mālama the wahi pana of Waiohuli for the future of his ‘ohana and all that resides there.

Perry Artates was born and raised in the district of Kēōkea in Kula on the island of Maui. Kēōkea is the neighboring ahupua‘a that borders the ahupua‘a of Waiohuli. Perry described Kēōkea as a rural area that was rich with multicultural nationalities such as Chinese, Portuguese, Japanese

and Hawaiians. Perry explained, "We all depended on the resources around us because stores were minimum (2). The next stores were miles away so we relied on these stores for necessities. It was a self-sufficient and self-sustainable community." The upbringing Perry described was one reliant on being self-sufficient and sustainable with one's resources.

Napua Silva grew up in Kula on the island of Maui and currently resides in Waiohuli. She shared that her ʻohana is from Kula, which encompasses the ahupuaʻa of Waiohuli. Napua is the kumu hula of Nā Lei Kaumaka o Uka and carries with her a wealth of knowledge and cultural traditions. Her foundations grounded to hula practices, as well as, her own standing as a Kānaka ʻŌiwi tied to the upper Kula moku of Maui is cultivated in the ʻike and manaʻo she shares. With regard to Waiohuli, Napua is a beneficiary of the Department of Hawaiian Home Lands and resides in the Waiohuli Homestead. When reflecting on the significance of Waiohuli, Napua shared that,

> Waiohuli is significant to my ʻohana. This is where my son was born, this is where my iwi will be buried. Generations of my ʻohana will flourish here in Waiohuli. I value Waiohuli's culturally significant location. The full view of mountain to the ocean was and continues to be a vital position for our people.

The manaʻo that Napua shared, highlights the significance of Waiohuli's landscape and viewscape to the pe0ple of the area. Moreover, the intimate connection Napua described in noting Waiohuli as a place where her ʻohana will flourish for generations highlighting specifically this wahi being the place where her son will grow up and where her bones will be interred, demonstrates the living pilina that exists between her ʻohana and Waiohuli. This pilina is reciprocated as Napua explained that her and her ʻohana keep watch over the area, as well as, the area right below Waiohuli. Having been brought up in Kula, regarding stories of Waiohuli, Napua shared that from what she understood, "This area once was home to a healthy stream, this is why there is so much blue rock on this ʻāina. Just the name Waiohuli tells us that it once included water flow."

Edward Lokomaikaʻi Palenapa Brown grew up in many places throughout Maui and in others places throughout the island. His ʻohana comes from the whole paeʻāina of Hawaiʻi and notes that he has ʻohana everywhere. Lokomaikaʻi shared that he grew up in the Kula moku of Maui, Pulehu, Honokohau, Wailuanui, Keʻanae, as well as, Papakōlea. He now resides in Waiohuli next to the Kaʻonoʻulu Stream. Lokomaikaʻi describes his pilina to Waiohuli expressing how his ʻohana has been rooted to this place for many generations. He shared:

> I'm pili to this place because my ʻohana has been here for many generations. Waiohuli is very significant to us because we love this. We have been taking care since the beginning. My ancestors has been defending this place Kalaniʻōpuʻu brought his forces from Moku o Keawe. I value the people in this time.

The perspective that Lokomaikaʻi expresses highlights the significance of Waiohuli as a place intimately bound to the genealogy of his ʻohana. This pilina is highlighted as Lokomaikaʻi shared that he and his ʻohana helps to mālama Waiohuli by keeping the ʻāina clear at the Waiohuli Homestead Community Center, He Piko No Waiohuli.

Clifford Santos Jr. grew up in Kula on the island of Maui and currently resides in Waiohuli Hawaiian Homestead. He has been living in Waiohuli for the past 18 years when he and his ʻohana moved there on Lauʻie Drive in June of 2006. Clifford holds cherished pilina to this place and expresses the significance of Waiohuli in the following way;

> This place is very special as it is where I have made my home and raised my two daughters. I am a Hawaiian Cultural Practitioner and have taught many on how to

> make papa ku‘i ‘ai and pōhaku ku‘i ‘ai including my children. It is very important to me to pass on the traditions that I have learned. We also have cultivated kalo and other native foods on our one acre of Hawaiian Home Lands in Waiohuli.

The pilina that Clifford shares is one intimately bound to him and his ‘ohana as residents and cultural practitioners connected to the ‘āina of Waiohuli. This relationship is fortified even further in their care for Waiohuli as Clifford states that as residents of the area, he and his ‘ohana mālama their home on a daily basis.

Biocultural Landscapes, Resources, Uses and Practices

Inoa ‘Āina

Kekai Kapu shared that he has heard of another name for this wahi pana of Waiohuli. According to some of the kūpuna that have now passed, Kekai stated that kūpuna mentioned that Waiohuli could also be referred to by the name, “*Waioha*, because of the mist during many seasons throughout the year that lingers down the slopes of Haleakalā.” From what the kūpuna shared, Kekai remarked that “this mist is identified as the Breath of Haleakalā... cool, sometimes cold, misty, ‘uhane breeze that lingers down the slopes of Haleakalā.” In understanding the significance of Waiohuli and the naming of this wahi, Kekai offered this alternative inoa (name) as shared to him by the kūpuna stating that, “these were mo‘olelo once shared years past by many kūpuna not here today to tell their story and lifestyle of their ancestors that once thrived and lived a simple life.”

Waiohuli Lifestyle

Commenting on the lifestyle of the older generation, Kekai offered the following mana‘o; “Reflecting on the many oral testimonies from kūpuna that have passed, you can only wish we were living in these times that have passed.” Kekai stated that he is the genealogist of his ‘ohana, and for many like him that still exist, reflecting on the oral histories and mo‘olelo of the kūpuna is valuable. Kekai’s commitment to preserving history and place also extends to his efforts having worked closely with many archaeologists. He shared that he has worked with archaeologists throughout the many years in order to “protect our lineal descended kuleana rights to many of our ancestral identity, lands, protected moku, and to educate the future of our Hawaiian cultural and sustainability resources for the next generations to embrace.”

Regarding the Landscape of Waiohuli

Perry Artates shared that originally, Waiohuli was not known as Hawaiian Homestead Lands because it was all pastoral and utilized by Henry Rice for cattle. After many years went by, the land transitioned from pastoral cattle lands and was designated as a part of the Hawaiian Homelands. Waiohuli then became known to residents as Homestead Lands. Today, Perry and his ‘ohana are lessees in Waiohuli. Perry shared that he and his ‘ohana were one of the first lessees to reside in Waiohuli with the cattle, deer, turkeys, pigs and pueo being their only neighbors. He describes Waiohuli as a place where “I can put my head to rest and carry my ‘ohana forever on this ‘āina” and shared that he has intimately navigated this area to know what the environment is like.

Kekai stated that during the beginning stages of the development of Waiohuli it its transition to become Hawaiian Homestead, Kekai worked closely with many of the archaeologists who conducted the Archaeological Inventory Survey for both the Kēōkea and Waiohuli Subdivision in

the Makawao District of Maui. Briefly summarizing the context and scope of this particular archaeological survey, Kekai shared the following:

> Because of the years of setback for this future Homestead Division, at the request of DHHL, field investigations were conducted between January 17 1989 and March 30, 1989 under the Supervision of PHRI Supervisory Archaeologist Roderick S. Brown, and under overall direction of PHRI Senior Archaeologist Dr. Alan Haun, Paul H. Rosendahl Ph.D. Inc. (PHRI conducted an Archaeological Inventory Survey that was to provide appropriate and sufficient information satisfying the requirement of Chapter 6E, Historic Preservation, Hawai'i Revised Statutes.

Additionally, he shared that the basic purpose of the Archaeological Inventory Survey was to "identify, discover, and locate available maps, sites and features of potential Archaeological significance within these specified project areas formerly called the Reconnaissance Survey, Inventory Survey, of significance of ALL!" In regard to other archaeological work related to Waiohuli, Kekai summarized briefly the 1907 work of Thomas G. Thrum, the 1931 work of Winslow Walker, and the 1986-1987 work conducted by the Bernice Pauahi Bishop Museum on behalf of the Department of Hawaiian Home Lands. Regarding these archeological surveys, Kekai summarized them in the following way:

> The only early Archaeological Work conducted in this project area was by Thomas G Thrum (1907) and Winslow Walker (1931) that included Papakea, Kaumeheiwa, and Molokai Heiau on the listing of Maui Heiau Sites, also listed and described 26 other Heiau in the Kula Region. In 1986, DHHL contracted B.P. Bishop Museum to monitor fencing to conduct an Archaeological Reconnaissance Survey of both proposed Subdivisions (1987). Discovering 113 archaeological sites and more than 252 archaeological features during these studies, above mentioned Heiau! And a diversity of prehistoric and historic agricultural, residential, and ceremonial sites were recorded. These surveys were focused on areas where residential lot awards were proposed. More than 410 acres of a total 1,025 acres of this project area were not examined during this survey, that was pushed aside due to a 30 million dollar Ritz Carlton Resort finding of more than thousands of Iwi Kupuna remains being unearthed, that!

Reflecting on the process, Kekai stated that kānaka are always put on the back burner which contributes to the reason why the Department of Hawaiian Home Lands lists are in the tens of thousands still waiting to be awarded. For this reason, this gives him "the desire to value this wahi, to homolua and move forward. Twelve plus years in the waiting..." Kekai also referenced an Archaeological Data Recovery that was conducted in 1998 for the Kula Residential Lots and lower Kula and Waiohuli Water Systems Improvements. He shared that three research questions informed the work:

1. Clarification of nature and age of agricultural sites in the upland Waiohuli,
2. Evaluating pig and dog consumption patterns in permanent house sites,
3. Evaluating the population growth in upland of Waiohuli.

He shared that the research questions "formed the backbone of the Data Recovery. They were amended and evaluated. One of many sites was chosen as the representative site for testing the Waiohuli agricultural system feature. Many types of micro-topography presented, as many other permanent habitation sites were investigated to analyze for future references." Summarizing the survey, Kekai remarked that, "In all, when it comes to the identification of archaeological permanent habitation and burial sites, I can identify many iwi kūpuna burial sites."

Regarding the historical landscape of Waiohuli, Lokomaikaʻi mentioned that his great-grand uncle, Henry Enoka Palenapa Kekahuna, surveyed all the heiau in Hawaiʻi. Further research regarding historical maps associated with this project area could be explored when looking into the works of Kekahuna. According to Lokomaikaʻi freshwater resources associated with Waiohuli are used for both consumption and religion. The type of resource (rainwater, spring water, stream, etc.) was not specified, but the existence of it and its use is what was captured in this account. Additionally, Clifford stated that he has seen evidence of ravines and gulches that once had water flow through them which highlight the existence of freshwater resources connected to Waiohuli. Regarding seasonal changes, Napua stated that she is not aware of seasonal changes specific to the landscape of Waiohuli other than the usual seasonal changes that all of Up-Country experiences–greater rainfall in the winter months and near drought in our summers. Lokomaikaʻi stated that Waiohuli experiences seasonal changes to the natural landscape and hopes that they can bring it back to a place of abundance, not just sustainable use.

Flora and Fauna

According to Lokomaikaʻi, Waiohuli was historically not a dry ahupuaʻa. Instead, he stated that it was once a rainforest. Native plants that according to the Waiohuli residents, can be found in this ahupuaʻa are: ʻuhaloa *(Waltheria indica)*, wiliwili *(Erythrina sandwicensis)*, puakala *(Argemone mexicana)*, ʻaʻaliʻi *(Dodonaea viscosa)*, ʻuala (Ipomoea batatas), kalo *(Colocasia esculenta)*, ʻulu *(Artocarpus altilis)*, and ʻilima *(Sida fallax)*. Non-native plants that were observed in Waiohuli include haole koa *(Leucaena leucocephala)*, lantana *(Lantana camara)*, cactus *(Opuntia basilaris)*, and the Spanish needle *(Bidens alba)*. In the account shared by Napua, amongst the cultivation of canoe crops, Kula was an area known for its cultivation of ʻuala (sweet potato). As far as animal species, pueo, puaʻa, the chital/axis deer and cattle, and wild turkeys have been a part of this landscape for a long time and are commonly seen throughout Waiohuli. Perry stated that the pueo are at a minimum now but they still watch over Waiohuli.

Culturally Significant Sites and Burials

Perry Artates shared that studies were conducted by SCS to identify Archaeological Findings of Fact, inadvertently and previously identified burials. To his knowledge, he knows of one heiau referred to as, Kaumeheiwa, that was identified and registered. Napua Silva stated that to her knowledge, "there are few culturally significant sites," however, she is unsure if these sites were formerly used for worship, such as heiau. Though the function and type of these sites are uncertain, what was recounted in the information shared by Napua is that culturally significant places connected to Waiohuli do exist. Lokomaikaʻi stated that there are culturally important places and identified the following sites: He Piko No Waiohuli, Waieli, and Kaumeheiwa heiau. He also shared that there are many more heiau in the area, and though not specific on the precise whereabouts, to his knowledge, there are burial sites associated with Waiohuli. Lokomaikaʻi commented that; "The significance of these places are in its name and the ancestors that used to be here."

In regard to any known iwi kūpuna and burial sites revealed in the proposed project area and or vicinity, Napua Silva, Lokomaikaʻi Brown, and Clifford Santos Jr. stated that to their knowledge, they do not know of any.

Moʻolelo, Inoa ʻĀina, Mele, Oli, and ʻŌlelo Noʻeau

With regard to moʻolelo, inoa ʻāina, mele, oli, and ʻōlelo noeʻau associated with Waiohuli, each of the five participants consulted in this community ethnography were unaware of any that existed.

As a kumu hula, Napua Silva stated that she has searched previously and found very little mention of this area in oli or mele. She, as well as the others who were posed this question, do not know of any oli or mele written specifically for Waiohuli.

Cultural Practices

Traditional medicinal practices, referred to as lāʻau lapaʻau is a cultural practice that is associated with Waiohuli. Kekai commented that there are many stone structures and sites that relate to lāʻau lapaʻau. According to Kekai, lāʻau lapaʻau practices were "used widely across Waiohuli from mauka to makai. If many understand the traditional ahupuaʻa system, Waiohuli is a prime example of this system we live by today. Many have been plowed and removed due to the construction of many homes, and till today, a few traditional lāʻau lapaʻau practices still persist." Lāʻau lapaʻau traditions associated with the project area are consistent with the general cultural landscape of Waiohuli as Kekai shared that Waiohuli is known as a place of healing. According to Kekai, lāʻau lapaʻau in Waiohuli was not just grown throughout this wahi pana, but it was also grown and found in many people's own backyards and homes in the area.

Napua, Lokomaikaʻi, and Clifford stated that they are not aware of cultural practices that are exclusively associated with the Waiohuli area. Elaborating on this, Napua described that as hula practitioners, her practice is rooted to the school of hula and her practice "is not exclusive to Waiohuli." Though she is not aware of cultural practices associated exclusively with Waiohuli, Napua mentioned that "there are cultural practitioners who live here, but their practice is not specific to this area." Similarly, Clifford shared that he is a cultural practitioner and perpetuates his practices at home with his ʻohana. These practices include mahiʻai–planting Hawaiian foods, and wood and stone carving. Other practices include hunting and gathering resources in Waiohuli such as axis deer and pig. Echoing the manaʻo of mahiʻai, hunting, and gathering practices, Lokomaikaʻi shared that he gathers resources such as water, maiʻa, kalo, ʻuala, niu and kī from the area. In Waiohuli, he and his ʻohana engage in cultural activities such as farming and ceremonial rituals.

Though not specific with the type of practice, Lokomaikaʻi stated that there may be cultural practices associated with the Waiohuli ahupuaʻa and that he is still learning every day. Lokomaikaʻi believes that cultural practices can be integrated into the resource management and stewardship of Waiohuli and uses the example of the abundance our kūpuna managed to cultivate within their time. In the prospect of integrating cultural practices into the stewardship of Waiohuli, Lokomaikaʻi simply states, "just look at what our ancestors did. We can produce meaʻai too in this time."

Concerns and Recommendations

One concern voiced by a resident of Waiohuli was the need to continue growing projects within Waiohuli to allow the community to grow. Kekai Kapu shared:

> There is a need to further the growth of these future proposed projects that will bring individuals and organizations within this community to grow, to mālama, and to hana ka lima the future in store for Nā ʻOhana o Waiohuli. There are talented educators, practitioners of all fields–Hawaiian Cultural practitioners, kumus in the educational field, Hawaiian Language, Hawaiian Culture, Hawaiian Historian, as well as traditional kumu hula that are home to Waiohuli. There are many businesses wanting to holomua.

When asked to share any concerns that they might have regarding how the proposed project might impact any wahi kūpuna, cultural resources, or cultural practices within or around the project area, Napua, Lokomaikaʻi and Clifford stated that they did not have any concerns regarding cultural resources or practices. Napua added that she does not foresee any adverse impacts to cultural resources or practices.

Additional Manaʻo

The anticipated progress that the proposed project may yield for Waiohuli, Kekai sees as a welcomed and much needed opportunity for the Waiohuli and Upcountry Kula community, ʻohana, and business to come together with one another for the benefit and future of the generations to come. He shared his appreciation and mahalo for Waiohuli and looks forward to seeing "Waiohuli and the future building constructing a better tomorrow." As a closing remark, Kekai graciously comments; "My hale is always open to many that have the desire to learn and know the history of what was once thriving in this upland kulāiwi of Waiohuli, the wahi pana, Wao Akua, Nā Moku o Haleakalā, and Kula that flows down the slopes in the lands mauka and makai of Waiohuli."

Perry shared an intimate encounter he had that speaks to the pilina between himself and the ʻāina of Waiohuli. He shared:

> In closing, my true experiences with the pueo and puaʻa whom are ʻaumakua to Native Hawaiian families…I've seen a silhouette of a young calf on a full moon night, not to witness that it was a Kamapuaʻa. I froze in my tracks as it stared at me for a while then continued its journey. As for the pueo…I came across a deep ravine with a ledge dropping over 80 feet plus. As I overlooked this monumental bed, a gigantic golden pueo flew up from the bottom and hovered over me for a while then took its flight into its journey. In closing, Waiohuli Hawaiian Homesteads is a place and community that will be nourished not only by self-sustainability but our ancestors and ʻaumakua….

Regarding the proposed project in Waiohuli, the manaʻo shared by Perry is the reminder of ensuring that the community of Waiohuli is able to be nourished, self-sufficient, and self-sustained keeping in mind the well-being of the kūpuna and ʻaumakua of the region. In this way, the community can really thrive.

CULTURAL IMPACT ASSESSMENT

This section reviews and summarizes information, perspectives and opinions regarding:

- 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;
- 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;
- An explanation of confidential information that has been withheld from public disclosure in the assessment; and,
- A discussion concerning any conflicting information in regard to identified cultural resources, practices, and beliefs.

It then provides an assessment of impacts posed by the proposed project to cultural resources – defined as practices and resources – within the project area was then performed. The scope of the analysis was commensurate to information yielded during consultation regarding cultural resources associated with the project area and potential impacts posed by the proposed project. In this instance, the effort included consideration and discussion 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.

Background Research and Consultation Synthesis

Background research of available resources shows the project area in Waiohuli is situated within a greater, contiguous, cultural landscape of significant cultural features established by Native Hawaiians, within the Kula Moku and portions of the Waiohuli ahupuaʻa serving as a settled, agricultural landscape referenced in Hawaiian oral traditions and also a place of historical ranching. Waiohuli as a place name and its location associated with the project area appear on the earliest Hawaiian cartographic representations of traditional land divisions like moku and ahupuaʻa, underscoring the importance of the place in Hawaiian geographies. Notably, historical documents indicate that a number of Land Commission Awards were distributed throughout the Waiohuli Ahupuaʻa. Ranging in size, the parcels awarded varied between 0.37 acres, being the smallest in size, and 12.8 acres as the largest parcel awarded. Majority of the LCA in Waiohuli are described as kula lands, revealing the open country landscape of the upper Kula Moku and the project area vicinity. Two of the other LCAs awarded parcels that were distinctive of other features such as a pāhale, for which a house lot would exist and ʻulala liʻiliʻi for growing the celebrated crop of the moku, sweet potato. LCA 6705, awarded to Ohai was granted three ʻāpana; two in the ʻili ʻāina of Luakini that was described as a kula lot and a pāhale, and the other ʻāpana was more kula lands indicated to have been placed in Waiohuli. LCA 6738, awarded to Luheluhe, was rewarded three ʻāpana, a parcel in the ʻili ʻāina of Kahilinaenae that is described as a kula and a pāhale, a parcel in Laie; described as kula lands, and a parcel in Pueo described to be an "ʻuala liʻiliʻi." Each of these three ʻāpana whose locale is tied to Waiohuli, illustrate the lifestyle and resources that the project area supported– kula lands of open country, pāhale for which one would erect a house structure to live, and plots of land to grow ʻuala in abundance.

Beginning in the twentieth century, Kula lands transitioned largely from ranching and grazing cattle pastures to as include the leasing of homestead lands. These lands were leased predominantly by Hawaiian and Chinese families which contributed to the demographic and settlement population in the Kula Moku then, and now.

At least 54 previously identified historic properties were located within the project area and vicinity. These historic properties include the presence of heiau, iwi kūpuna, burials, petroglyphs, enclosures, mounds, platforms, terraces, fire pits, permanent habitations, walls, garden enclosures, lava tubes, alignments, modified outcrops, rock piles, rock shelters, rock overhangs, paving, stepping stone trail, cobble and pebble rock concentrations, and a probable camp site. Background research performed for this study indicated two appearances of iwi kūpuna, which consisted in total of at least seven burials. Site #-6470; human skeletal remains representing at minimum five individuals; two determined as an adult female and a juvenile. This burial site is interpreted as a pre-contact burial of Native Hawaiian Ancestry. Site #-6630; Human skeletal remains representing at minimum two individuals are interpreted as Chinese or Chinese/Polynesian mixed ancestry during the 1880s to early 1900s. Twenty-five of the previously identified historic properties are preserved in perpetuity as indicated in the existing Preservation Plan for the Department of Hawaiian Home Lands composed for Waiohuli Subdivision which occur in the project area TMK (2) 2-2-002-014. These studies show that the project area occupies within the proximity of a cultural landscape that comprises an array of significant features indicative of early Native and historic settlement.

Consultees identified several cultural resources, practices, and beliefs located within the project area and/or vicinity. These include cultural practices associated with lāʻau lapaʻau (traditional medicinal practices), agricultural traditions, stone and wood working practices, and hunting and gathering practices. Regarding cultural beliefs, it is noted that Waiohuli, as a wahi pana, is a place nourished by family ʻaumakua, such as the pueo that frequents the ahupuaʻa or Kamapuaʻa in the kino lau (body form) of the pig that is often seen in the area.

From Kekai Kapu in regard to lāʻau lapaʻau: "Lāʻau lapaʻau practices were used widely across Waiohuli from mauka to makai. If many understand the traditional ahupuaʻa system, Waiohuli is a prime example of this system we live by today. Many have been plowed and removed due to the construction of many homes, and till today, a few traditional lāʻau lapaʻau practices still persist." He continued stating that "There are many stone structures and sites that relate to lāʻau lapaʻau. Lāʻau lapaʻau in Waiohuli was not just grown throughout this wahi pana, but it was also grown and found in many people's own backyards and homes in the area."

From Clifford Santos Jr. regarding agricultural practices and wood and stone carving: "I am a Hawaiian Cultural Practitioner and have taught many on how to make papa kuʻiʻai and pohaku kuʻiʻai including my children. It is very important to pass on the traditions that I have learned. We also have cultivated kalo and other native foods on our one acre of Hawaiian Home lands in Waiohuli… I live here and do cultural practices at home including plating Hawaiian foods and wood/stone carving."

All other consultees commented on not being aware of cultural practices exclusive to Waiohuli but asserted the presence of practitioners who are residents of the project area; thus, Waiohuli should not be thought of as being void entirely of cultural practices. Napua Silva asserted: "I am not aware of cultural practices that are associated with the Waiohuli area, specifically. There are cultural practitioners who live here, but their practice is not specific to this area.

From Lokomaikaʻi Brown in regard to culturally significant sites: "There are culturally important places; He Piko no Waiohuli, Waieli, Kaumeheiwa heiau, and many more heiau, and

yes there are burial sites. The significance of these places are in its name and the ancestors that used to be here."

From Perry Artates regarding ʻaumākua: "In closing, my true experiences with the pueo and puaʻa whom are ʻaumakua to Native Hawaiian families…I've seen a silhouette of a young calf on a full moon night, not to witness that it was a Kamapuaʻa. I froze in my tracks as it stared at me for a while then continued its journey. As for the pueo…I came across a deep ravine with a ledge dropping over 80 feet plus. As I overlooked this monumental bed, a gigantic golden pueo flew up from the bottom and hovered over me for a while then took its flight into its journey. In closing, Waiohuli Hawaiian Homesteads is a place and community that will be nourished not only by self-sustainability but our ancestors and ʻaumakua…."

In regard to any known iwi kūpuna and burial sites revealed in the proposed project area and/or vicinity, consultees stated that to their knowledge, they do not know of any specific burials. It is understood by some that burials have inadvertently been discovered during the development of the Homestead Lots; however, all consultees commented that they do not know of any associated with the project area and/or vicinity.

From Napua Silva in regard to the perpetuation of cultural beliefs related to iwi kūpuna: "Waiohuli is significant to my ʻohana. This is where my son was born, this is where my iwi will be buried. Generations of my ʻohana will flourish here in Waiohuli. I value Waiohuli's culturally significant location. The full view of the mountain to the ocean was and continues to be a vital position for our people."

No consultee identified or suggested preferred alternatives to the proposed project. No suggested or preferred mitigation measures were identified.

Impact Assessment

Ethnohistorical and historical research, previous archaeological studies, and consultation efforts conducted for this study associate an array of cultural resources with the project area vicinity and greater landscape. A listing of cultural resource, pertinent details, and their locations in the project area and greater vicinity includes:

- Iwi kūpuna (*Native Hawaiian burials*), in the Waiohuli Homestead Subdivision project area vicinity.
- The Hau, Nau, and Kēhau winds, throughout the Kula Moku and project area and vicinity.
- The Nāulu, ʻŪkiu, and ʻUlalena rains, throughout the Kula Moku and project area and vicinity.
- The Nāulu and ʻŪkiukiu clouds, throughout the Kula Moku and project area and vicinity.
- Kaumeheiwa heiau, in the project area vicinity.
- Pre-contact and Historical Platforms, terraces, enclosures, walls, mounds, and alignments, in the project area and vicinity.
- Lāʻau lapaʻau stone structures and sites, in the Waiohuli Ahupuaʻa.
- Native vegetation such as ʻuhaloa, wiliwili, puakala, ʻaʻaliʻi, ʻuala, kalo, ʻulu, niu, ʻilima, koa, kī, etc., in the project area vicinity and possibly project area.
- Native pueo, in the project area and vicinity.
- Continuous undisturbed viewscapes from ma uka to ma kai, in the project area and vicinity.

No consultee identified any adverse impacts that would arise during the activities of the proposed project. When asked to share any concerns that they might have regarding how the proposed project might impact any wahi kūpuna, cultural resources, or cultural practices within or around the project area, consultees commented that they did not foresee any adverse impacts to cultural resources or practices.

Recommendations

This section summarizes the recommendations shared by consultees regarding the impacts of the proposed project to cultural resources within the project area and vicinity. Consultees did not foresee any impacts to wahi kūpuna and other cultural resources and practices as a result of the proposed project activities and similarly, they did not have any recommendations regarding the work.

One consultee, Lokomaikaʻi Brown, commented that "cultural practices can be integrated into the resource management and stewardship of Waiohuli." The example highlighted by Lokomaikaʻi was the parallel that existed between cultural practices related to agriculture and the stewardship of the resources that kūpuna upheld in order to cultivate food in abundance as well as care for the environment. In similar ways, considering ways to integrate cultural practices into the stewardship of the project area is recommended.

Kekai Kapu asserted that "There is a need to further the growth of these future proposed projects that will bring individuals and organizations within this community to grow, to mālama, and to hana ka lima the future in store for Nā ʻOhana o Waiohuli. There are talented educators, practitioners of all fields–Hawaiian Cultural practitioners, kumus in the educational field, Hawaiian Language, Hawaiian Culture, Hawaiian Historian, as well as, traditional kumu hula that are home to Waiohuli. There are many businesses wanting to holomua." It is recommended that through the growth of the proposed project in Waiohuli, should also come the growth and support of the Native Hawaiian community and the local businesses and families that reside in Waiohuli.

Considerations

Nohopapa Hawaiʻi advises several considerations regarding the proposed project's potential impacts to cultural resources (practices, features, and beliefs) associated with the project area and/or vicinity:

- Consultation early and often. Should the footprint or other characteristics of the proposed project change significantly as it unfolds, additional and expanded consultation is recommended to ensure community members have the opportunity to provide input on updated potential impacts of the proposed project to cultural resources per the requirements of the Hawaii Environmental Policy Act and its implementing legislation Hawaii Revised Statutes (HRS) §343 and 1997 Environmental Council Guidelines for Assessing Cultural Impacts.

- Cultural monitoring alongside archaeological monitoring is appropriate for this location given the proximity of the proposed project area to the Historic Preservation Area of Waiohuli and the noted historic properties and wahi kūpuna.

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APPENDIX A: COMMUNITY PARTICIPATION LETTER

NOHOPAPA
HAWAI'I

May 2024

Welina mai me ke aloha,

On behalf of the Waiohuli Hawaiian Homestead Association, Inc. (WHHA) and the Department of Hawaiian Home Lands (DHHL), Nohopapa, Hawai'i LLC, is conducting a Cultural Impact Assessment (CIA), and Hawai'i Revised Statutes (HRS) §6E Consultation supporting environmental and historic preservation compliance review for the proposed Waiohuli Economic Development Opportunities ("WE DO") in the Waiohuli Ahupua'a, Kula Moku, Maui Mokupuni on portions of TMK: (2) 2-2-028:181 and (2) 2-2-002:014 (Figure 1 and Figure 2).

The Project involves a public-private collaboration with WHHA and Pueo Development LLC that combines traditional construction of a master plan development with community-based job opportunities derived from development of infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for the Waiohuli community. The goal of the Project is to provide short and long-term economic opportunities that will foster greater self-sufficiency for the people of upcountry Maui through capacity building and jobs homegrown at the aforementioned site. With the primary goal of creating community-based economic opportunities, the Project includes the development of a master plan that incorporates a variety of land uses to support the community.

This CIA aims to gather and evaluate the proposed project's potential impacts on the Hawaiian cultural practices and resources associated with the project area in Waiohuli Ahupua'a. We would like to engage with individuals, 'ohana, and/or organizations with relationships to this area. In particular, we would like to gather information relating to:

- **Cultural knowledge of mo'olelo, ka'ao, inoa 'āina, mele, oli, 'ōlelo no'eau, and hula related to the project area**
- **Knowledge of wahi pana, wahi kapu, and wahi kūpuna and cultural practices associated with these wahi**
- **Knowledge of the 'āina, natural landscapes and resources, and associated cultural uses**
- **Concerns regarding how this project might impact any Hawaiian biocultural resources or practices within or around the project area**
- **Suggestions, impact mitigations, and recommendations regarding the management and stewardship of wahi kūpuna in and around the project area**
- **Referrals of kūpuna and kama'āina who are knowledgeable of the project area and might be willing to participate in this study**

Please let us know if you are interested and available to participate in consultation for this important project. You can participate by completing an online survey (**Link**), or by filling out the attached questionnaire by **Friday, June 28, 2024.**

We look forward to collaborating with you to document your mana'o and recommendations to assess any cultural impacts that might stem from this proposed project in Waiohuli.

Me ka ha'aha'a,
Kalena Lee-Agcaoili
kalena@nohopapa.com
Nohopapa Hawai'i, LLC website https://www.nohopapa.com/

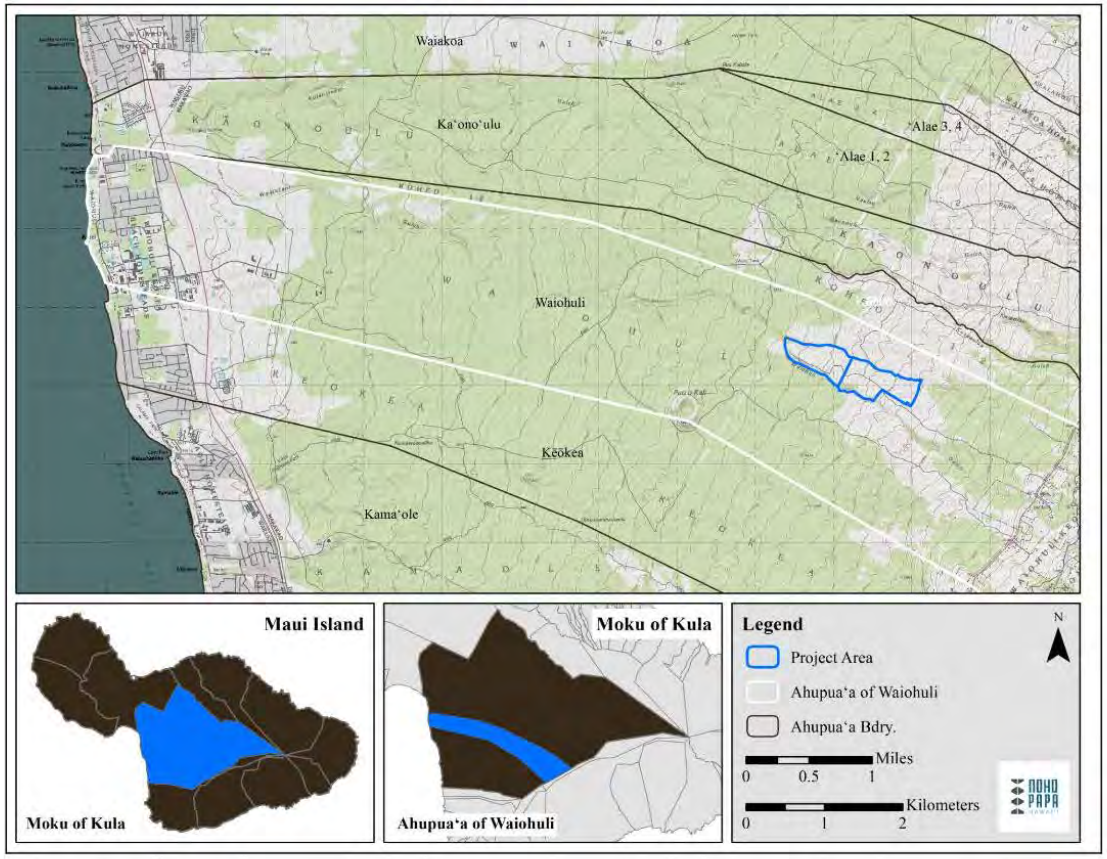

Figure 1. Aerial overview of the study area outlined in blue. Located in Waiohuli Ahupua'a, Kula Moku, Maui Mokupuni (TMKs: (2) 2-2-028:181 and (2) 2-2-002:014) (Google Earth)

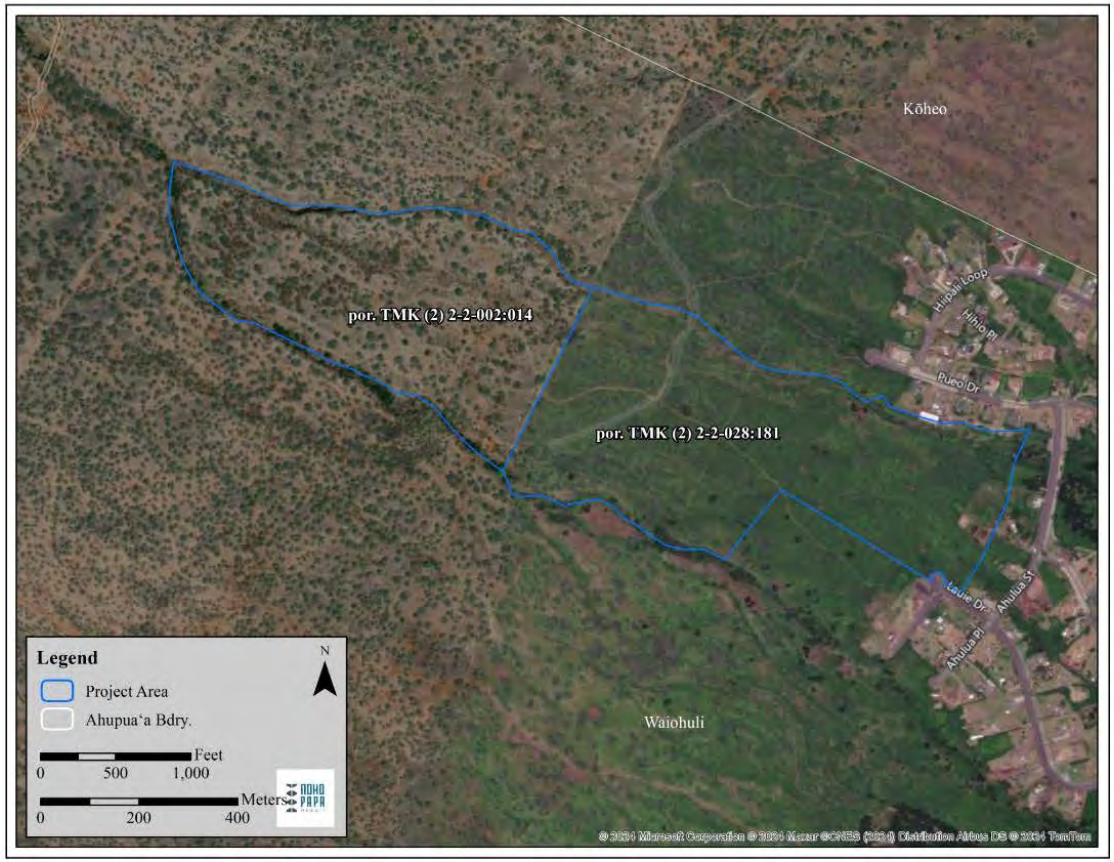

Figure 2. Aerial photo of the project area in Waiohuli Ahupua'a, Kula Moku, Maui Mokupuni (TMKs: (2) 2-2-028:181 and (2) 2-2-002:014) (Google Earth)

APPENDIX B: CONSULTATION QUESTIONNAIRE

NOHOPAPA HAWAI'I

Waiohuli Economic Development Opportunities ("WE DO")
Cultural Impact Assessment Questionnaire

Interviewer: _____ **Date:** _____ **Location:** _____

**Note, answering the following questions is optional*

Moʻokūʻauhau

Name:	
Where did you grow up? Where do you live today?	
How are you pili to this place? o Is Waiohuli significant to you/your ʻohana? If so, how? o Do you have a specific relationship or history with Waiohuli? o What do you value about Waiohuli?	
Do you/your ʻohana mālama this place or any locations nearby? If so, how?	
Is your ʻohana from the Waiohuli area and/or surrounding ahupuaʻa? o Do you/your ʻohana have any stories about the area? *(Share any connections to this wahi)*	

Biocultural Landscapes, Resources, Uses, and Practices

Are there any culturally important places you know, around, or connected to Waiohuli? o Any prominent geographical features, boundary markers, habitation, trails, burial sites, or religious sites? o What's the cultural significance of these sites/areas? o Do you know of any historical maps or photos that depict changing land use and/or settlement patterns?	
What native and/or introduced plants and animals are associated with Waiohuli? o In the surrounding area(s)? o Traditionally and historically? *Such as growing, cultivation, moʻolelo* o Cultural significance and/or uses of these resources?	

1

Do you know of any freshwater resources, springs, and streams connected to Waiohuli? o Cultural significance and/or uses of these resources?	
Are you aware of any seasonal changes to the natural landscape?	
Do you know of any iwi kūpuna previously revealed in the project area or vicinity?	

Moʻolelo, Inoa ʻĀina, Mele, Oli, ʻŌlelo Noʻeau

Any mele, ʻōlelo noʻeau, oli, or other oral or cultural traditions that reflect a sense of place and cultural identity for this place and its people?	

Cultural Practices

Do you know of any "old" ways or traditions associated with Waiohuli? Are any of these traditions still practiced in the area?	
Do you gather or use resources from this place? If so, what kind?	
Do you or your ʻohana engage in activities or cultural practices associated with this place? If so, what kind?	
Do you know of any cultural practices associated with the Waiohuli Ahupuaʻa, and/or the surrounding area?	
Can these cultural practices be integrated into resource management and stewardship of this place today? If so, how?	
Are there inappropriate practices/protocols/uses for the Waiohuli area?	

Concerns and Recommendations

Any concerns regarding how this project might impact any wahi kūpuna, cultural resources, or cultural practices within or around the project area?	
Specifically, do you foresee any adverse impacts to cultural resources, practices, or features resulting from the proposed project?	

Do you have any iwi kūpuna-related concerns or recommendations to share?	
Do you have any preferred alternatives to the proposed project?	
Do you wish to share any preferred or desired mitigation* measures relative to the impacts proposed by the proposed project? **Mitigation = actions that avoid, minimize, rectify, or reduce the impacts of a project*	
Do you have any short or long-term concerns regarding the project? Please explain.	
Do you have any recommendations regarding site management or protection and development in the area?	
Any other mana'o you'd like to share? *(i.e., recommendations, concerns, questions)*	

Contact Information & Referrals

You'll have the opportunity to review your written transcript/survey summary and make any additions, deletions, or corrections as you wish. What is the best way to send you the interview to review & approve? *(Email or Mail)*	
Can you refer us to other individuals or organizations we should talk to?	
Are there any parts of this questionnaire you do not want publicly disclosed?	
Please provide your mailing address so we can send you a makana as a Mahalo for sharing your valued mana'o and 'ike.	

APPENDIX C: INFORMED CONSENT FORM

NOHOPAPA HAWAI'I

INFORMED CONSENT FORM

Aloha mai, Nohopapa Hawai'i appreciates your generosity and willingness to share your knowledge of the wahi pana of Waiohuli and its surrounding areas. This mana'o will be included in the Cultural Impact Assessment (CIA) for the proposed new development of infrastructure, agricultural cultivation, renewable energy, and water source development for the long-term economic sustainability of the Waiohuli community proposed by the Waiohuli Hawaiian Homestead Association, Inc. (WHHA) in the Waiohuli Ahupua'a, Kula Moku, Maui Mokupuni.

Nohopapa Hawai'i understands our responsibility to respect the wishes and concerns of the interviewees participating in this study. Here are the procedures we promise to follow:

1. The interview will not be recorded without your knowledge and explicit permission.
2. You will have the opportunity to review the written transcript and summary of your interview. At that time, you may make any additions, deletions, or corrections you wish.
3. You will be given a copy of the interview transcript and/or summary for your records.
4. You will be given a copy of this release form for your records.
5. You will be given a copy of any photographs taken of you during the interview.

For your protection, we need your written confirmation that (check yes or no):

1. You consent to use the complete transcript and/or interview quotes for this study.
   Yes No
2. If a photograph is taken during the interview, you consent to the photograph being included in this study. Yes No

I, _____, agree to the procedures outlined above and,
(Please print your name here)
by my signature, give my consent and release of this interview and/or photograph to be used as specified.

_____
(Signature)

_____
(Date)

Nohopapa Hawai'i, LLC * nohopapa.hawaii@gmail.com

APPENDIX D: THE ENVIRONMENTAL COUNCIL'S 1997 GUIDELINES FOR ASSESSING CULTURAL IMPACTS

INTRODUCTION

It is the policy of the State of Hawai'i under Chapter 343, HRS, to alert decision makers, through the environmental assessment process, about significant environmental effects which may result from the implementation of certain actions. An environmental assessment of cultural impacts gathers information about cultural practices and cultural features that may be affected by actions subject to Chapter 343, and promotes responsible decision making.

Articles IX and XII of the State Constitution, other state laws, and the courts of the state require government agencies to promote and preserve cultural beliefs, practices, and resources of native Hawaiians and other ethnic groups. Chapter 343 also requires environmental assessment of cultural resources, in determining the significance of a proposed project.

The Environmental Council encourages preparers of environmental assessments and environmental impact statements to analyze the impact of a proposed action on cultural practices and features associated with the project area. The Council provides the following methodology and content protocol as guidance for any assessment of a project that may significantly affect cultural resources.

BACKGROUND

Prior to the arrival of westerners and the ideas of private land ownership, Hawaiians freely accessed and gathered resources of the land and seas to fulfill their community responsibilities. During the Māhele of 1848, large tracts of land were divided and control was given to private individuals. When King Kamehameha the III was forced to set up this new system of land ownership, he reserved the right of access to privately owned lands for Native Hawaiian ahupua'a tenants. However, with the later emergence of the western concept of land ownership, many Hawaiians were denied access to previously available traditional resources.

In 1978, the Hawaii constitution was amended to protect and preserve traditional and customary rights of Native Hawaiians. Then in 1995 the Hawaii Supreme Court confirmed that Native Hawaiians have rights to access undeveloped and under- developed private lands. Recently, state lawmakers clarified that government agencies and private developers must assess the impacts of their development on the traditional practices of Native Hawaiians as well as the cultural resources of all people of Hawaii. These Hawaii laws, and the National Historic Preservation Act, clearly mandate federal agencies in Hawaii, including the military, to evaluate the impacts of their actions on traditional practices and cultural resources.

If you own or control undeveloped or under-developed lands in Hawaii, here are some hints as to whether traditional practices are occurring or may have occurred on your lands. If there is a trail on your property, that may be an indication of traditional practices or customary usage. Other clues include streams, caves and native plants. Another important point to remember is that, although traditional practices may have been interrupted for many years, these customary practices cannot be denied in the future.

These traditional practices of Native Hawaiians were primarily for subsistence, medicinal, religious, and cultural purposes. Examples of traditional subsistence practices include fishing, picking ʻopihi and collecting limu or seaweed. The collection of herbs to cure the sick is an example of a traditional medicinal practice. The underlying purpose for conducting these traditional practices is to fulfill one's community responsibilities, such as feeding people or healing the sick.

As it is the responsibility of Native Hawaiians to conduct these traditional practices, government agencies and private developers also have a responsibility to follow the law and assess the impacts of their actions on traditional and cultural resources.

The State Environmental Council has prepared guidelines for assessing cultural resources and has compiled a directory of cultural consultants who can conduct such studies. The State Historic Preservation Division has drafted guidelines on how to conduct ethnographic inventory surveys. And the Office of Planning has recently completed a case study on traditional gathering rights on Kauaʻi.

The most important element of preparing Cultural Impact Assessments is consulting with community groups, especially with expert and responsible cultural practitioners within the ahupuaʻa of the project site. Conducting the appropriate documentary research should then follow the interviews with the experts. Documentary research should include analysis of Māhele and land records and review of transcripts of previous community consultation. Once all the information has been collected, and verified by the community experts, the assessment can then be used to protect and preserve these valuable traditional practices.

Native Hawaiians performed these traditional and customary practices out of a sense of responsibility: to feed their families, cure the sick, nurture the land, and honor their ancestors. As stewards of this sacred land, we too have a responsibility to preserve, protect and restore these cultural resources for future generations.

CULTURAL IMPACT ASSESSMENT METHODOLOGY

Cultural impacts differ from other types of impacts assessed in environmental assessments or environmental impact statements. A cultural impact assessment includes information relating to the practices and beliefs of a particular cultural or ethnic group or groups.

Such information may be obtained through scoping, community meetings, community consultation and oral histories. Information provided by knowledgeable informants, including traditional cultural practitioners, can be applied to the analysis of cultural impacts in conjunction with information concerning cultural practices and features obtained through consultation and from documentary research.

In scoping the cultural portion of an environmental assessment, the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment. Thus, for example, a proposed action that may not physically alter gathering practices, but may affect access to gathering areas would be included in the assessment. An ahupuaʻa is usually the appropriate geographical unit to begin an assessment of cultural impacts of a proposed action, particularly if it includes all of the types of cultural practices associated with the project area. In some cases, cultural practices are likely to extend beyond the ahupuaʻa and the geographical extent of the study area should take into account those cultural practices.

The historical period studied in a cultural impact assessment should commence with the initial presence in the area of the particular group whose cultural practices and features are being assessed. The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs.

The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man-made and natural, including submerged cultural resources, which support such cultural practices and beliefs.

The Environmental Council recommends that preparers of assessments analyzing cultural impacts adopt the following protocol:

1. Identify and consult with individuals and organizations with expertise concerning the types of cultural resources, practices and beliefs found within the broad geographical area, e.g., district or ahupuaʻa;
2. Identify and consult with individuals and organizations with knowledge of the area potentially affected by the proposed action;
3. Receive information from or conduct community consultation and oral histories with persons having knowledge of the potentially affected area;
4. Conduct ethnographic, historical, anthropological, sociological, and other culturally related documentary research;
5. Identify and describe the cultural resources, practices and beliefs located within the potentially affected area; and
6. Assess the impact of the proposed action, alternatives to the proposed action, and mitigation measures, on the cultural resources, practices and beliefs identified.

Interviews and oral histories with knowledgeable individuals may be recorded, if consent is given, and field visits by preparers accompanied by informants are encouraged. Persons interviewed should be afforded an opportunity to review the record of the interview, and consent to publish the record should be obtained whenever possible. For example, the precise location of human burials are likely to be withheld from a cultural impact assessment, but it is important that the document identify the impact a project would have on the burials. At times an informant may provide information only on the condition that it remain in confidence. The wishes of the informant should be respected.

Primary source materials reviewed and analyzed may include, as appropriate: Māhele, land court, census and tax records, including testimonies; vital statistics records; family histories and genealogies; previously published or recorded community consultation and oral histories; community studies, old maps and photographs; and other archival documents, including correspondence, newspaper or almanac articles, and visitor journals. Secondary source materials such as historical, sociological, and anthropological texts, manuscripts, and similar materials, published and unpublished, should also be consulted. Other materials which should be examined include prior land use proposals, decisions, and rulings which pertain to the study area.

CULTURAL IMPACT ASSESSMENT CONTENTS

In addition to the content requirements for environmental assessments and environmental impact statements, which are set out in HAR §§ 11-200-10 and 16 through 18, the portion of the assessment concerning cultural impacts should address, but not necessarily be limited to, the following matters:

1. A discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints or limitations which might have affected the quality of the information obtained.
2. A description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken.
3. Ethnographic and oral history interview procedures, including the circumstances, under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained.
4. Biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area.
5. A discussion concerning historical and cultural source materials consulted, the institutions and repositories searched, and the level of effort undertaken. This discussion should include, if appropriate, the particular perspective of the authors, any opposing views, and any other relevant constraints, limitations or biases.
6. A discussion concerning the cultural resources, practices and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site.
7. A discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project.
8. An explanation of confidential information that has been withheld from public disclosure in the assessment.
9. A discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs.
10. An analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place.
11. A bibliography of references, and attached records of interviews which were allowed to be disclosed.

The inclusion of this information will help make environmental assessments and environmental impact statements complete and meet the requirements of Chapter 343, HRS. If you have any questions, please call 586-4185.

APPENDIX E: ACT 50: A BILL FOR AN ACT RELATING TO EIS

Act 50 [State of Hawai‘i 2000]. H.B. NO. 2895 H.D.1 was passed by the 20th Legislature and approved by the Governor on April 26, 2000 as Act 50.

A Bill for an Act Relating to Environmental Impact Statements.

SECTION 1. The legislature finds 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.

The legislature also finds that native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the “aloha spirit” in Hawai‘i. 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, practices, and resources of native Hawaiians as well as other ethnic groups.

Moreover, the past failure to require native Hawaiian cultural impact assessments has resulted in the loss and destruction of many important cultural resources and has interfered with the exercise of native Hawaiian culture. The legislature further finds that due consideration of the effects of human activities on native Hawaiian culture and the exercise thereof is necessary to ensure the continued existence, development, and exercise of native Hawaiian culture.

The purpose of this Act is to: (1) Require that environmental impact statements include the disclosure of the effects of a proposed action on the cultural practices of the community and State; and (2) Amend the definition of “significant effect” to include adverse effects on cultural practices.

SECTION 2. Section 343-2, Hawai‘i Revised Statutes, is amended by amending the definitions of “environmental impact statement” or “statement” and “significant effect”, to read as follows:

“Environmental impact statement” or “statement” means an informational document prepared in compliance with the rules adopted under section 343-6 and which discloses the environmental effects of a proposed action, effects of a proposed action on the economic [and] welfare, social welfare, and cultural practices of the community and State, effects of the economic activities arising out of the proposed action, measures proposed to minimize adverse effects, and alternatives to the action and their environmental effects.

The initial statement filed for public review shall be referred to as the draft statement and shall be distinguished from the final statement which is the document that has incorporated the public's comments and the responses to those comments. The final statement is the document that shall be evaluated for acceptability by the respective accepting authority.

“Significant effect” means the sum of effects on the quality of the environment, including actions that irrevocably commit a natural resource, curtail the range of beneficial uses of the environment, are contrary to the State's environmental policies or long-term environmental goals as established by law, or adversely affect the economic [or] welfare, social welfare[.], or cultural practices of the community and State.”

SECTION 3. Statutory material to be repealed is bracketed. New statutory material is underscored.

SECTION 4. This Act shall take effect upon its approval.

(Approved April 26, 2000.)


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APPENDIX E

Transportation Impact Assessment Report

TRAFFIC IMPACT ANALYSIS REPORT
WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO) PROJECT
KULA, MAUI, HAWAII

FINAL

January 2, 2025

Prepared for:

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TRAFFIC IMPACT ANALYSIS REPORT

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO) PROJECT

Kula, Maui, Hawaii

FINAL

Prepared for

PBR Hawaii

Prepared by

Austin, Tsutsumi & Associates, Inc.

Civil Engineers • Surveyors
Honolulu • Wailuku, Hawaii

January 2, 2025

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APPENDICES

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

TERRANCE S. ARASHIRO, P.E.
ADRIENNE W.L.H. WONG, P.E., LEED AP
DEANNA M.R. HAYASHI, P.E.
PAUL K. ARITA, P.E.
ERIK S. KANESHIRO, L.P.L.S, LEED AP
MATT K. NAKAMOTO, P.E.
GARRETT K. TOKUOKA, P.E.

ADRIENNE W.L.H. WONG, P.E., LEED AP
Maui Branch Manager

TRAFFIC IMPACT ANALYSIS REPORT

Waiohuli Economic Development Opportunities (WE DO) Project

Kula, Maui, Hawaii

1. INTRODUCTION

This report documents the findings of a traffic study conducted by Austin, Tsutsumi, and Associates, Inc. (ATA) to evaluate the traffic impacts resulting from the proposed Waiohuli Economic Development Opportunities (WE DO) project (hereinafter referred to as the "Project") located in Kula, Maui, Hawaii.

1.1 Project Location

The Project is located on currently undeveloped lands to the west of the existing Waiohuli Community Center more specifically identified as TMKs (2) 2-2-002-014 and (2) 2-2-028-181. Figure 1.1 shows the location of the proposed Project site.

1.2 Project Description

The Project, a collaboration between the Waiohuli Hawaiian Homesteaders Association (WHHA) and Pueo Development LLC, aims to boost upcountry Maui's economy through a master plan that blends construction with jobs in infrastructure, agriculture, and renewable energy. It seeks to improve self-sufficiency and economic stability by creating local employment opportunities and fostering community growth.

The Project is currently in the master planning stages, and implementation of the various elements in the plan are subject to the availability of funding (public and private). For the purposes of preparing this TIAR, the following land uses are proposed:

- Community Support Training Facilities (6 acres): Recreational spaces, educational and workforce training facilities, multi-purpose functional spaces, and health and wellness facilities that feature both Hawaiian healing practices and western medical services.

- Infrastructure Training Sites (31 acres): Job training facilities, water source development, wastewater treatment package plant, 100-105 single-family units, 50-80 multi-family units, and approximately 100-165 kupuna housing units.
- Agriculture Development Training Sites (42 acres): Agriculture, educational and job training facilities.
- Renewable Energy Development/Training Sites (26 acres): Training sites for renewable energy development.
- Natural Drainage Gulch Areas (45 acres): Contiguous natural green corridor around the perimeter and between proposed development areas.

Access to the Project is planned to be provided via Lauie Drive, with the existing cul-de-sac near the Waiohuli Community Center being converted to a through road providing access to the Project. In the future, development may be continued north and provide connection to Pueo Drive through internal roadways; however this development is an ideation and beyond the scope of this study.

Since the Project is in the master planning stage, the exact phasing and build-out timeline is not yet known; however for planning purposes, a 20-year horizon to Year 2044 is conservatively used for this TIAR. The site plan can be found in Figure 1.2.

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES PROJECT

AustinTsutsumi & ASSOCIATES, INC.
Engineers & Surveyors

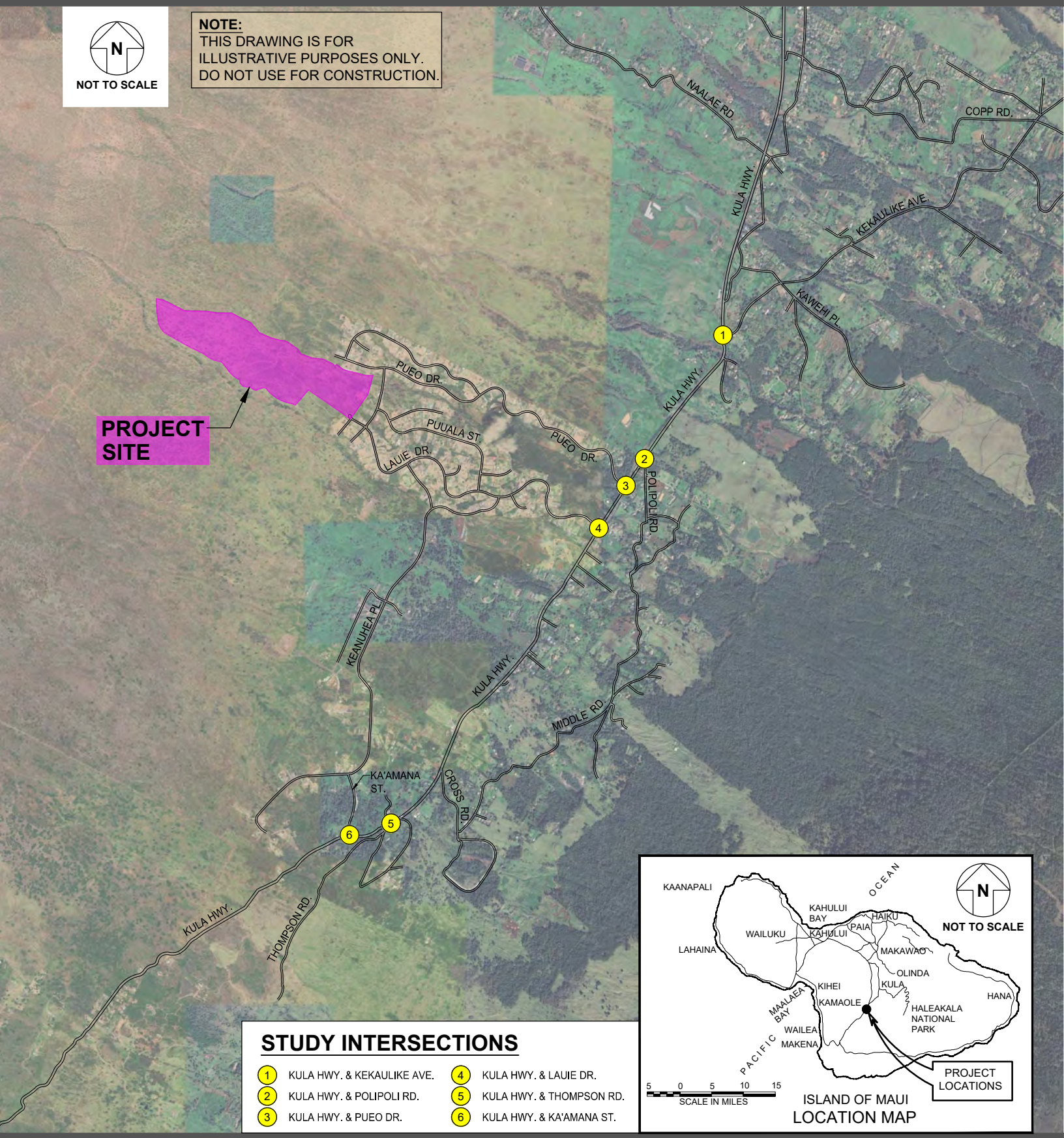

FIGURE 1.1

LOCATION MAP

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES PROJECT

AustinTsutsumi & ASSOCIATES, INC.
Engineers & Surveyors

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NOT TO SCALE

NOTE:
THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

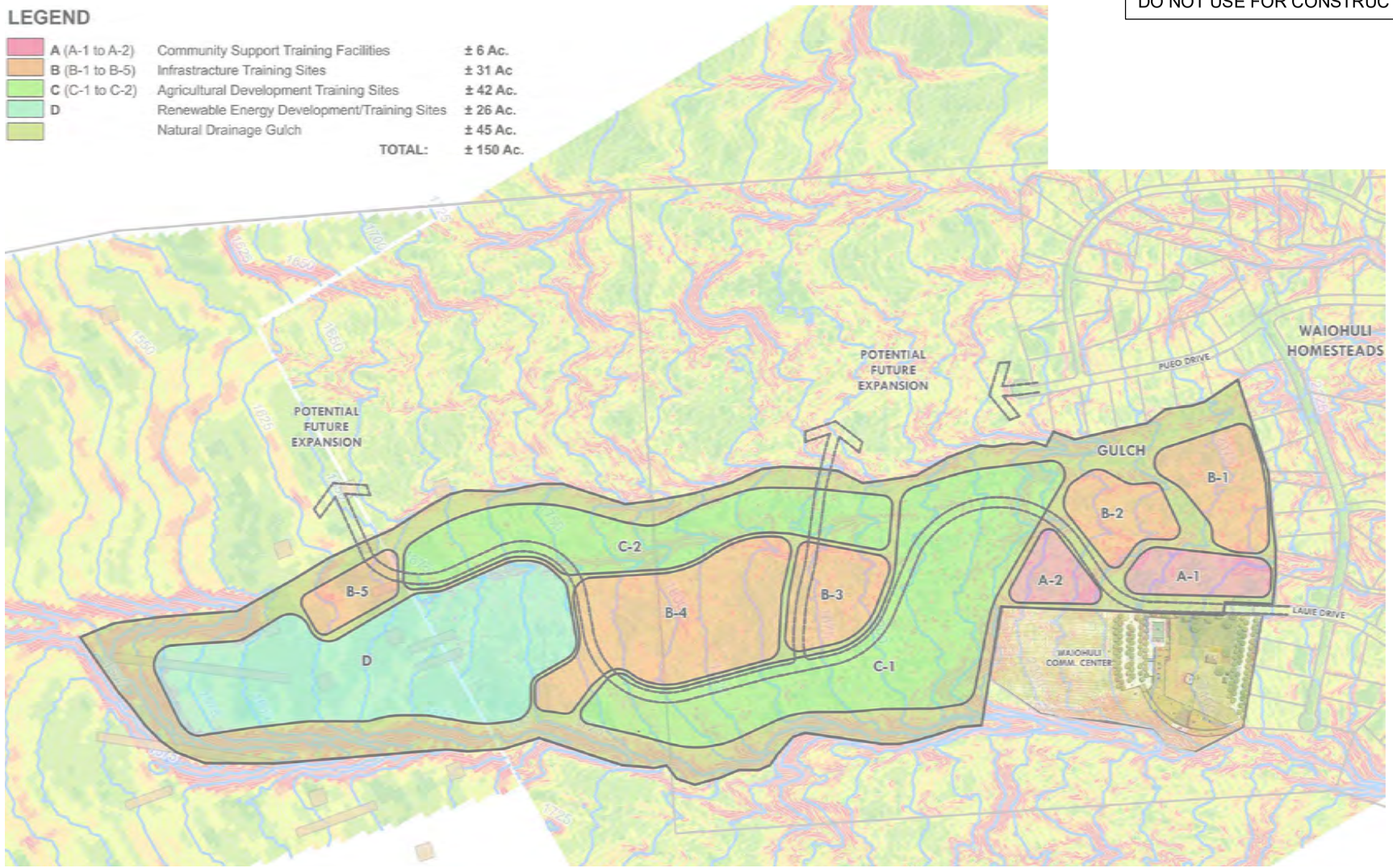

FIGURE 1.2

SITE PLAN

2. METHODOLOGY

2.1 Study Methodology

This study will address the following:

- Assess existing traffic operating conditions at key intersections during the weekday morning (AM) and afternoon (PM) peak hours of traffic within the study area.
- Traffic projections for Base Year 2044 (without the Project) including traffic generated by other known developments in the vicinity of the Project in addition to an ambient growth rate. These other known developments are projects that are currently under construction or known new/future developments that are anticipated to affect traffic demand and operations within the study area.
- Trip generation and traffic assignment characteristics for the proposed Project.
- Traffic projections for Future Year 2044 (with the Project), which includes Base Year traffic volumes in addition to traffic volumes generated by the Project.
- Recommendations for Base Year and Future Year roadway improvements or other mitigative measures, as appropriate, to reduce or eliminate the adverse impacts resulting from traffic generated by known developments in the region or the Project.

2.2 Intersection Analysis

Level of Service (LOS) is a qualitative measure used to describe the conditions of traffic flow at intersections, with values ranging from free-flow conditions at LOS A to congested conditions at LOS F. The Highway Capacity Manual (HCM), 7th Edition, includes methods for calculating volume-to-capacity ratios, delays, and corresponding Levels of Service that were utilized in this study. LOS definitions for signalized and unsignalized intersections are provided in Appendix B.

Analyses for the study intersections were performed using the traffic analysis software Synchro, which is able to prepare reports based on the methodologies described in the HCM. These reports contain control delay results as based on intersection lane geometry, signal timing, and hourly traffic volumes. Based on the vehicular delay at each intersection, a LOS is assigned to each approach and intersection movement as a qualitative measure of performance. These results, as confirmed or refined by field observations, constitute the technical analysis that will form the basis of the recommendations outlined in this report.

2.3 Study Area Intersection Analysis

Analysis within the Project's study area was performed at the following intersections:

- Kula Highway/Kekaulike Avenue (unsignalized)
- Kula Highway/Polipoli Road (unsignalized)
- Kula Highway/Pueo Drive (unsignalized)
- Kula Highway/Lauie Drive (unsignalized)
- Kula Highway/Thompson Road (unsignalized)
- Kula Highway/Kaamana Street (unsignalized)

3. EXISTING TRAFFIC CONDITIONS

3.1 Multimodal Facilities

3.1.1 Bicycle and Pedestrian Facilities

In the vicinity of the Project, there are no sidewalks currently available along Kula Highway or Lauie Drive.

According to State of Hawaii Department of Transportation Bicycle Planning Bikeway Map, there is an existing signed shared roadway along Kekaulike Avenue between Haleakala Crater Road and Kula Highway. There is also a signed shared roadway proposed along Kula Highway between Kekaulike Avenue/Haleakala Highway and Piilani Highway; though there is no exact timeline for this improvement.

3.1.2 Transit Facilities

The Maui Bus system offers several routes that connect the major areas in Maui. As of February 2024, a one-way fare costs $2.00, and a monthly pass costs $45.00. The Project area is served by the Kula Islander (Route 39), which provides service between Kula Hospital and the transit hub at Queen Kaahumanu Shopping Center in Kahului. The nearest existing stop to the Project is the Lauie Drive/Ahulua Street stop.

3.2 Roadway System

The following are brief descriptions of the existing roadways studied within the vicinity of the Project:

Kaamana Street is a two-way, two-lane roadway that provides connection to residences in the study area. This roadway begins to the west with its intersection with Keanuhea Street and continues eastward until its intersection with Kula Highway.

Kekaulike Avenue is a two-way, two-lane roadway that begins to the southwest at its intersection with Kula Highway and extends northeast until at its intersection with Haleakala Highway, where the roadway continues northward as Haleakala Highway.

Kula Highway is generally a north-south, two-way, two-lane roadway. This roadway begins to the south near Ulupalakua School & Ranch (where it transitions from Piilani Highway) and extends northward until it transitions to Haleakala Highway north of its intersection with Makaena Place.

Lauie Drive is a two-way, two-lane roadway that begins to the east at its intersection with Kula Highway and extends westward until it ends in a cul-de-sac near the Waiohuli Community Center.

Polipoli Road is a two-way, two-lane unstriped roadway that begins to the west at its intersection with Polipoli Road and extends to the southeast until it ends in a cul-de-sac to the southeast of its intersection with Middle Road.

Pueo Drive is a two-way, two-lane roadway that begins to the east at its intersection with Kula Highway and extends westward until it ends in a cul-de-sac to the west of its intersection with Hiipali Loop.

Thompson Road is generally a two-way, two-lane roadway that begins to the north at its intersection with Kula Highway and extends southward until it transitions to Keokea Place, which ultimately provides access to Kula Hospital & Clinic and loops around to connect back to Kula Highway. The posted speed limit is 15 in the vicinity of the Project.

3.3 Existing Traffic Volumes

The hourly traffic volume data utilized in this report was collected on Tuesday, February 13, 2024. See the traffic count data provided in Appendix A for the existing intersections studied and their corresponding traffic count data. Based on the traffic count data, the weekday AM and PM peak hours of traffic were determined to occur between 6:45 AM – 7:45 AM and 3:30 PM – 4:30 PM, respectively.

3.4 Existing Observations and Intersection Analysis

Traffic volumes along Kula Highway were observed to be generally very low throughout the AM and PM peak hours. As a result, turning movements from the stop-controlled minor streets at the study intersections experienced little difficulty finding adequate gaps in Kula Highway traffic.

During both peak hours, all movements at both study intersections operate acceptably at LOS B or better.

Existing laneage, volumes, and LOS can be found in Figure 3.1 and a LOS summary can be found in Table 3.1.

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES PROJECT

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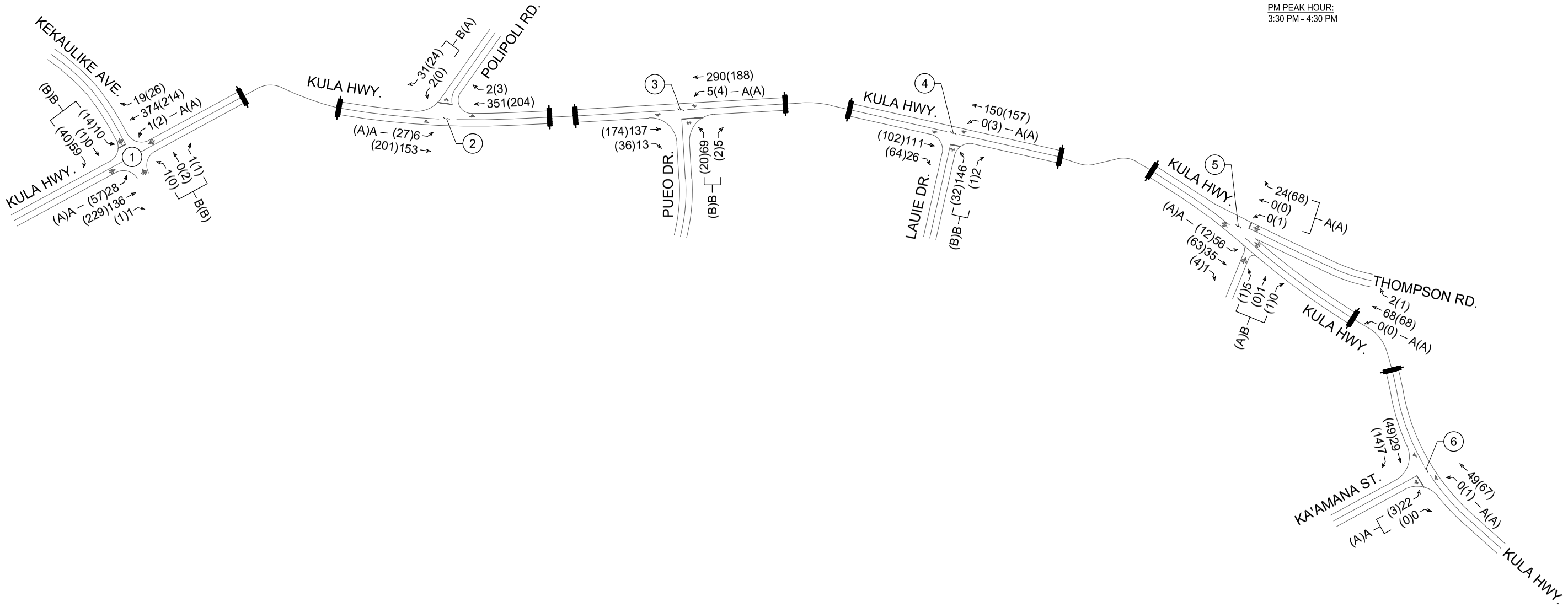
DATE OF COUNTS:
TUESDAY, FEBRUARY 23, 2024

AM PEAK HOUR:
6:45 AM - 7:45 AM

PM PEAK HOUR:
3:30 PM - 4:30 PM



LEGEND

##(##)	- AM(PM) VEHICLE VOLUMES
(X)	- UNSIGNALIZED INTERSECTION X
X(X)	- AM(PM) LOS

FIGURE 3.1

EXISTING CONDITIONS LANEAGE, VOLUMES, AND LOS

TABLE 3.1: LOS SUMMARY TABLE
EXISTING CONDITIONS

Intersection	Existing Conditions					
	AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1: Kula Highway & Kekaulike Avenue						
NB LT	7.5	0.00	A	7.7	0.00	A
EB LT/TH/RT	12.2	0.00	B	13.0	0.01	B
WB LT/TH/RT	12.1	0.13	B	11.6	0.10	B
SB LT	8.3	0.03	A	7.9	0.05	A
OVERALL	1.7	-	-	1.9	-	-
2: Kula Highway & Polipoli Road						
WB LT/RT	10.9	0.06	B	9.6	0.03	A
SB LT	8.1	0.01	A	7.7	0.02	A
OVERALL	0.7	-	-	1.0	-	-
3: Kula Highway & Pueo Drive						
NB LT	7.6	0.00	A	7.7	0.00	A
EB LT/RT	12.6	0.15	B	11.2	0.04	B
OVERALL	1.9	-	-	0.7	-	-
4: Kula Highway & Lauie Drive						
NB LT	0.0	-	A	7.6	0.00	A
EB LT/RT	11.7	0.23	B	10.6	0.05	B
OVERALL	4.0	-	-	1.0	-	-
5: Kula Highway & Thompson Road						
NB LT	0.0	-	A	0.0	-	A
EB LT/TH/RT	10.5	0.01	B	9.3	0.00	A
WB LT/TH/RT	8.7	0.03	A	9.0	0.08	A
SB LT	7.5	0.04	A	7.4	0.01	A
OVERALL	3.6	-	-	3.3	-	-
6: Kula Highway & Kamana Street						
NB LT	0.0	-	A	7.4	0.00	A
EB LT/RT	9.1	0.03	A	9.2	0.00	A
OVERALL	1.9	-	-	0.3	-	-

4. BASE YEAR TRAFFIC CONDITIONS

For planning purposes, a 20-year horizon, to Year 2044, was selected to reflect the Project completion year. The Base Year 2044 scenario represents the traffic conditions within the study area without the Project. Traffic projections were formulated by applying a defacto growth rate to the traffic count volumes as well as trips generated by known future developments in the vicinity of the Project.

4.1 Defacto Growth Rate

Projections for Base Year 2044 traffic were based upon the Maui Regional Travel Demand Model (MRTDM) growth and nearby developments in the immediate vicinity of the Project. The annual growth rate used along Kula Highway was 0.64% per year.

4.2 Traffic Forecasts for Known Developments

There are a number of planned developments in the area that are in various stages of progression. Because of the long 20-year horizon, it was conservatively assumed that some projects that are currently stalled will be completed by 2044. Therefore, these projections are generally conservative, and the growth may not materialize if background projects are not constructed. The known developments that were assumed to be complete by Year 2044 are listed below based on the available information.

- Kauhale Lani Residential – Proposed to construct approximately 170 single-family units plus 170 ohana units with access via Old Haleakala Highway. This development still requires entitlements before construction but was conservatively included in Base Year conditions.
- Kualono Subdivision – Partially completed 49 single-family residential subdivision with access via Old Haleakala Highway.
- Kulamalu Town Center (TC) – The majority of parcels within this development is currently occupied by a mix of retail/office space and residential subdivisions. Approximately 99,250 SF of vacant lot space remains undeveloped. The existing occupied lot area for retail/office space is approximately 175,900 SF with a building SF GFA of 74,400 SF, or 42% Floor Area Ratio (FAR). By applying the 42% FAR to the remaining 99,250 SF of vacant lot space, it was determined that approximately 42,000 SF of future retail/office space is assumed to be constructed by Year 2044. A church is also planned within this development. Access will occur via Aapueo Parkway.
- Pulelehuakea Subdivision – Proposed to construct approximately 13 single-family homes with access via Aina Lani Drive. A total of 26 single-family units were assumed for the purpose of this analysis to account for the construction of any ohana units.
- DHHL Keokea-Waiohuli (also known as Waiohuli Homestead Community) – Proposed to construct a total of 334 residential lots at full build-out, including Phase 1 which includes 55 units, Phase 1A which consists of 46 units, Phase 2 which consists of 76 units, Phase 3 which consists of 77 units, Phase 4A which consists of 27 units, and Phase 4B which consists of 53 units. For the purpose of this report, it was assumed that Phases 1 and 1A was partially complete and occupied at the time of the traffic count, and the remainder of Phase 1A, 2, 3, 4A, and 4B was incorporated into Base Year conditions.

- Hokuula – Proposes to develop 196 single-family dwelling units and a maximum of 53 ohana units in addition to a 10-acre park upon 62.994 acres of land off of Haliimaile Road. The project will be accessed via two driveways from Haliimaile Road.
- Boschetti-Makawao 201H Development – Proposes to develop approximately 57.616 acres of land to provide 160 multi-family residential units and 77 single-family units with the potential for one ohana dwelling unit on each single-family lot. Vehicular access to the Project will be provided via four (4) new Project accesses along Apana Road.
- DHHL Farm Lots Master Plan – Proposes to develop approximately 69 acres of land to provide a 10,000 SF healing center, 2.9 acres of garden planting areas and walking paths, a commercial area/food truck space for 20 food trucks, 5,000 SF multipurpose hale with certified kitchen and courtyard, approximately 200-seat amphitheater, a preschool and K-6 immersion school, and senior daycare. This project is currently in the master planning stage and the exact phasing timeline for the build-out of the project is not yet known; however this project was incorporated into Base Year conditions.

The forecast trip generation for each of these developments was based on information obtained from submitted TIARs and the Trip Generation Manual published by the Institute of Transportation Engineers (ITE).

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES PROJECT

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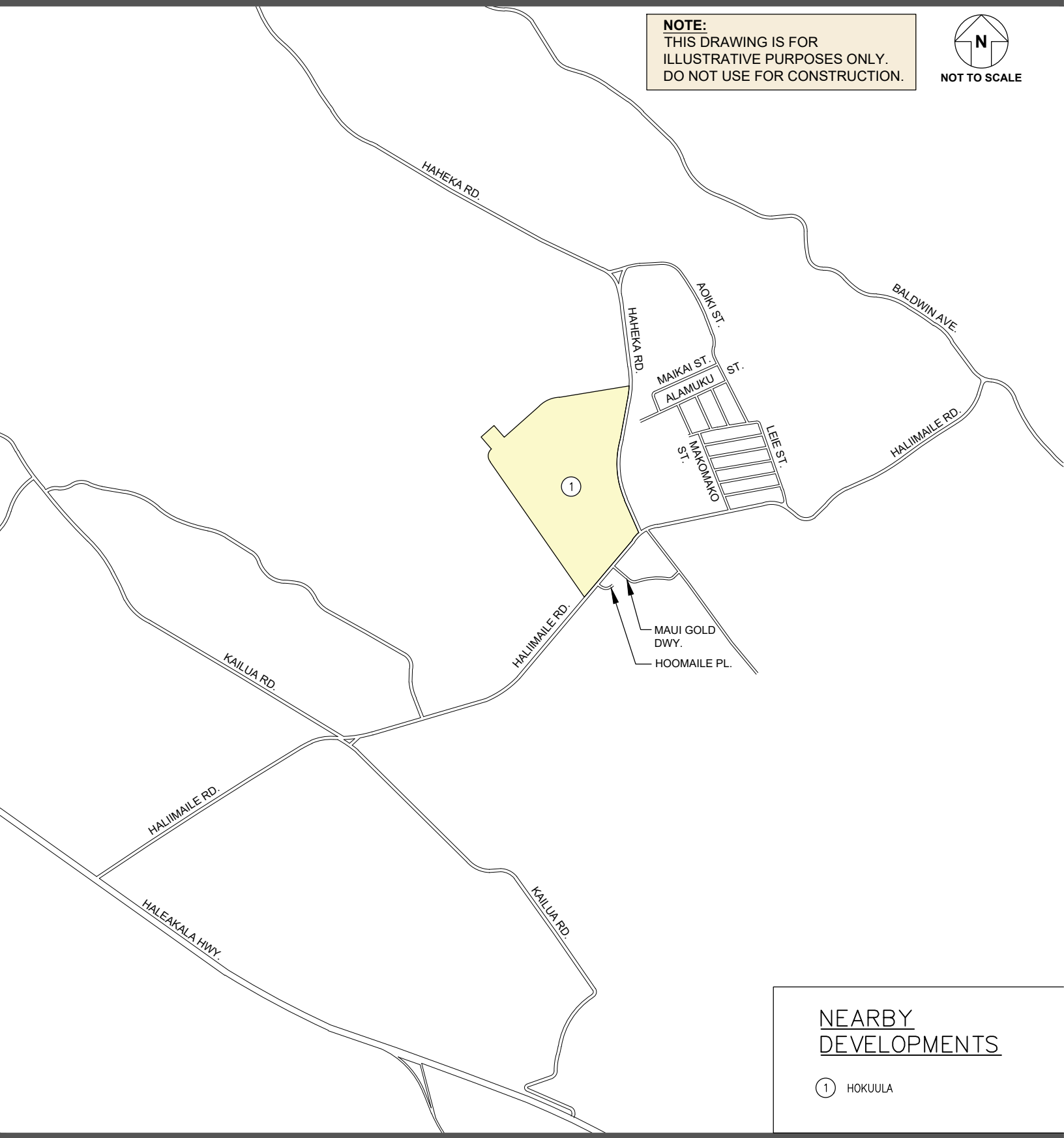

FIGURE 4.1

HALIIMAILE DEVELOPMENT

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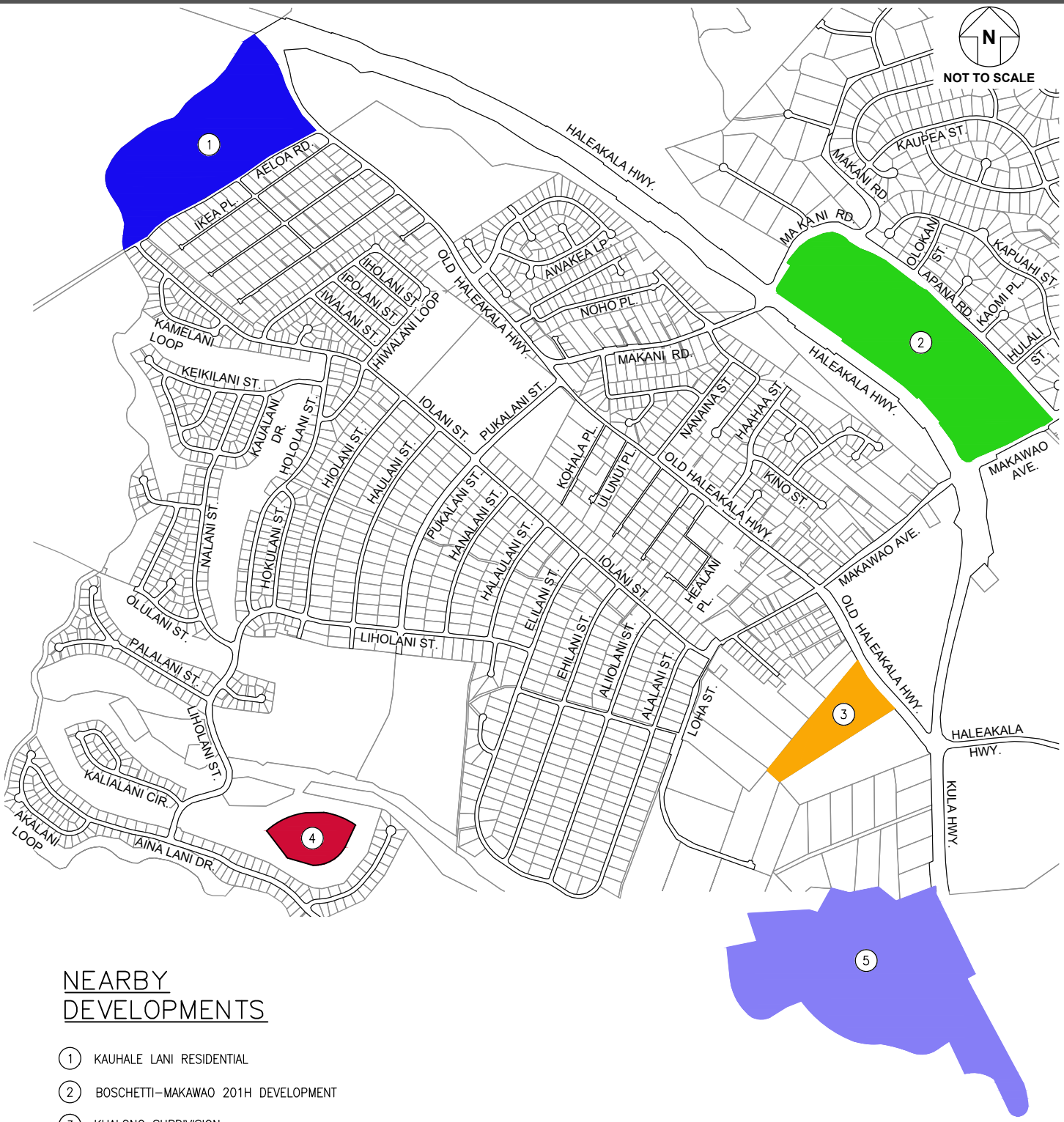

NEARBY DEVELOPMENTS

1. KAUHALE LANI RESIDENTIAL
2. BOSCHETTI–MAKAWAO 201H DEVELOPMENT
3. KUALONO SUBDIVISION
4. PULELEHUAKEA SUBDIVISION
5. KULAMALU TOWN CENTER

FIGURE 4.2

PUKALANI-MAKAWAO DEVELOPMENTS

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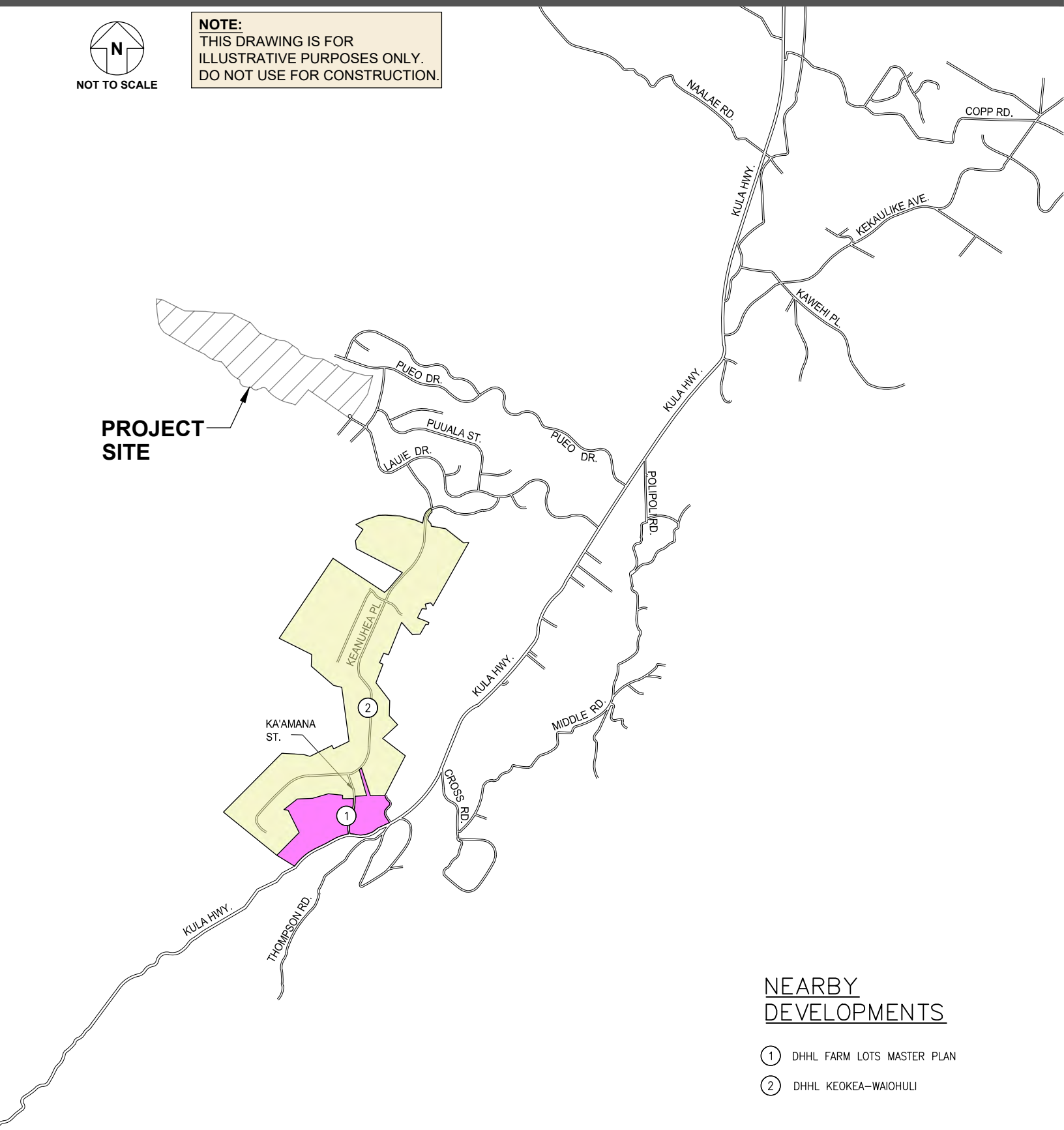

NEARBY DEVELOPMENTS

1. DHHL FARM LOTS MASTER PLAN
2. DHHL KEOKEA–WAIOHULI

FIGURE 4.3

KEOKEA BACKGROUND PROJECTS

4.3 Planned Roadway Improvements

The following roadway improvements have been considered in the study area:

- Kihei-Upcountry Highway: A Final Environmental Impact Statement (FEIS) for the project was accepted in May 2002 which studied eight (8) alignment alternatives and a No Build alternative that was intended to improve connectivity between Kihei and Upcountry areas. The preferred alternative is an approximately 9.8-mile, two-lane arterial roadway that spans between the Haleakala Highway/Haliimaile Road intersection to the Piilani Highway/Kaonoulu Street intersection. There has been no movement on this project in over a decade, and as a result, this project was not included in Base Year projections.
- Kula Highway/Lauie Drive Improvements: In the Traffic Impact Analysis Report (TIAR) for the Waiohuli Homestead Community, revised on May 23, 2005, it was recommended that the Kula Highway/Lauie Drive intersection be improved to provide a northbound left-turn lane from Kula Highway onto Lauie Drive and a median refuge lane for left-turns from Lauie Drive onto Kula Highway. The TIAR states that "this improvement will not be regarded until the project is in later stages of full build-out" and that it is recommended that "this intersection be monitored to determine when the improvements should be initiated". As discussed in Section 4.2, Phase 1 and Phase 1A are partially occupied with construction ongoing; however the timeline for the development of subsequent phases is not known, and therefore, it is uncertain if or when this improvement will be constructed. This improvement was considered as a possible improvement in Base Year and Future Year conditions.

4.4 Base Year 2044 Analysis

As a result of development in the area, it is anticipated that Kula Highway will experience a significant increase in traffic of about 215-415 trips in each direction. As described in Section 4.2, due to the long 20-year horizon, it was assumed that some projects that are currently stalled will proceed and be completed by Year 2044; however the growth that is projected may not materialize if background projects are not constructed. Therefore, the projections and analysis for Base Year conditions are considered to be conservative.

With Base Year conditions, all movements at all intersections in the study area are anticipated to operate at LOS D or better across both peak hours with the exception of the eastbound approach at the Kula Highway/Lauie Drive intersection during the AM peak hour, which is anticipated to operate at LOS E due to high eastbound left-turn volumes and increased traffic along Kula Highway from defacto growth and traffic generated by background projects.

Signal analysis shows that a signal is warranted with the projected Base Year conditions with shared lanes on all approaches (existing laneage configuration) at the Kula Highway/Lauie Drive intersection. The signal warrant is also met if Kula Highway was widened to provide an additional southbound right-turn lane or northbound left-turn lane. The installation of a traffic signal at this intersection would provide the benefit of a protected phase for the eastbound left-turn movement to turn onto Kula Highway. With the signal installed, all movements are anticipated to operate at LOS B or better across both peak hours. All movements at all study intersections are anticipated to operate below capacity.

However, if a median refuge lane is installed, as described in Section 4.3 with the Waiohuli Homestead Community project, the 100% signal warrant is not met and the eastbound movement is anticipated to operate at LOS C across both peak hours.

When considering a traffic signal or median refuge lane at the Kula Highway/Lauie Drive intersection, design parameters such as laneage, right-of-way (ROW) constraints and topography should be considered. Due to the anticipated increase in southbound right-turn volumes at Lauie Drive, it may be beneficial to provide a right-turn auxiliary lane to separate through traffic from turning traffic and provide space for speed changes as southbound right-turn vehicles slow to execute the turn; however, the widening of Kula Highway to accommodate a median refuge lane may eliminate the possibility of the installation of a southbound right-turn auxiliary lane due to right-of-way constraints. Additionally, the total length of the median refuge lane is restricted to approximately 150 feet including storage and taper due to the downstream drainage canal. Ultimately, the benefits that each of the improvements are able to provide within the physical limitations of the improvements alternatives should be considered when selecting the improvement to be installed.

Base Year laneage, volumes, and LOS can be found in Figure 4.3. Table 4.1 shows a LOS Summary for Existing and Base Year conditions with and without improvements.

WAIOHULI ECONOMIC
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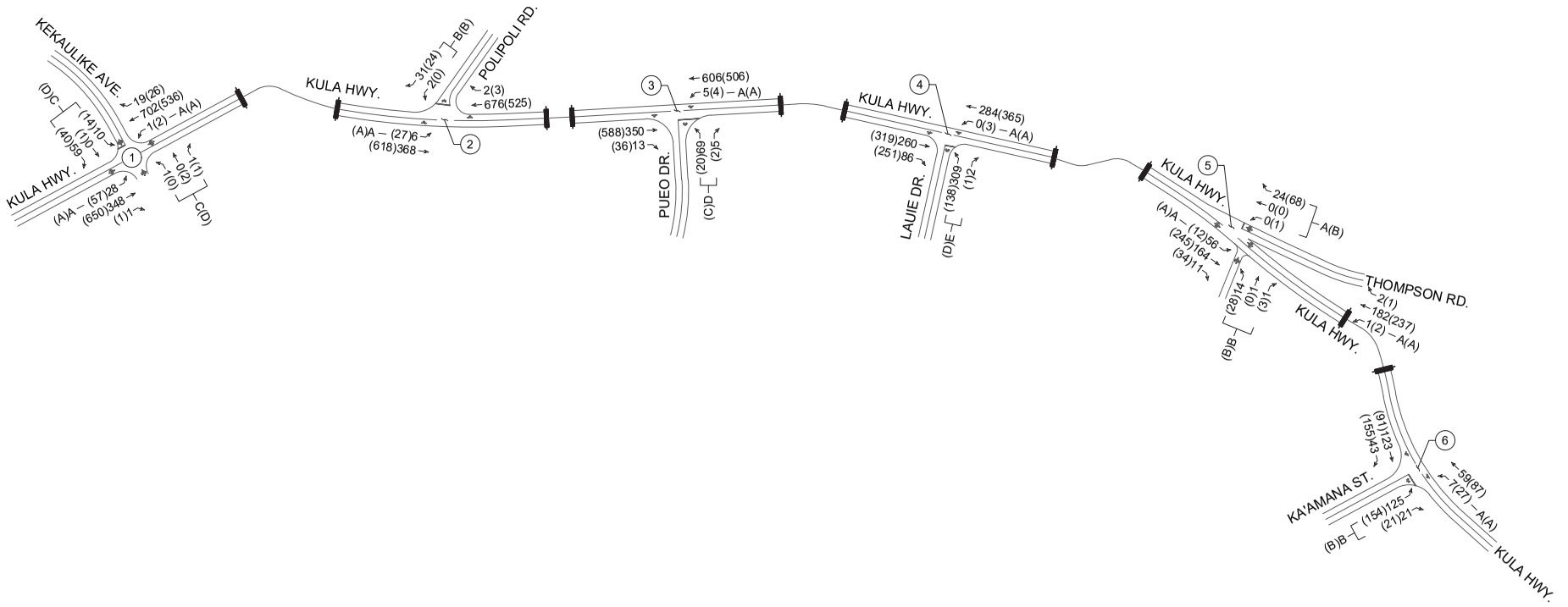

LEGEND

##(##)	- AM(PM) VEHICLE VOLUMES
(X)	- UNSIGNALIZED INTERSECTION X
X(X)	- AM(PM) LOS

FIGURE 4.4

BASE YEAR 2044 CONDITIONS
LANEAGE, VOLUMES, AND LOS

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TABLE 4.1: LOS SUMMARY TABLE
EXISTING AND BASE YEAR CONDITIONS

Intersection	Existing Conditions						Base Year No Mitigation Conditions						Base Year With Median Refuge Lane						Base Year With Signal					
	AM			PM			AM			PM			AM			PM			AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1: Kula Highway & Kekaulike Avenue																								
NB LT	7.5	0.00	A	7.7	0.00	A	8.1	0.00	A	9.1	0.00	A	Same as Base Year No Mitigation Conditions						Same as Base Year No Mitigation Conditions					
EB LT/TH/RT	12.2	0.00	B	13.0	0.01	B	21.9	0.01	C	28.7	0.02	D												
WB LT/TH/RT	12.1	0.13	B	11.6	0.10	B	19.6	0.23	C	25.1	0.25	D												
SB LT	8.3	0.03	A	7.9	0.05	A	9.5	0.04	A	9.0	0.06	A												
OVERALL	1.7	-	-	1.9	-	-	1.4	-	-	1.5	-	-												
2: Kula Highway & Polipoli Road																								
WB LT/RT	10.9	0.06	B	9.6	0.03	A	15.0	0.09	B	12.3	0.05	B	Same as Base Year No Mitigation Conditions						Same as Base Year No Mitigation Conditions					
SB LT	8.1	0.01	A	7.7	0.02	A	9.2	0.01	A	8.7	0.03	A												
OVERALL	0.7	-	-	1.0	-	-	0.5	-	-	0.4	-	-												
3: Kula Highway & Pueo Drive																								
EB LT/RT	12.6	0.15	B	11.2	0.04	B	25.1	0.31	D	24.4	0.11	C	Same as Base Year No Mitigation Conditions						Same as Base Year No Mitigation Conditions					
OVERALL	1.9	-	-	0.7	-	-	1.8	-	-	0.5	-	-												
4: Kula Highway & Lauie Drive																								
NB LT	0.0	-	A	7.6	0.00	A	0.0	-	A	8.8	0.00	A	0.0	-	A	8.8	0.00	A	-	-	-	-	-	-
NB LT/TH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.8	0.46	A	3.3	0.35	A
EB LT/RT	11.7	0.23	B	10.6	0.05	B	35.1	0.77	E	26.6	0.48	D	22.3	0.63	C	17.5	0.35	C	9.1	0.71	A	14.8	0.74	B
SB TH/RT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.4	0.58	A	4.7	0.67	A
OVERALL	4.0	-	-	1.0	-	-	11.6	-	-	3.5	-	-	7.4	-	-	2.3	-	-	7.1	-	A	5.6	-	A
5: Kula Highway & Thompson Road																								
NB LT	0.0	-	A	0.0	-	A	7.6	0.00	A	7.9	0.00	A	Same as Base Year No Mitigation Conditions						Same as Base Year No Mitigation Conditions					
EB LT/TH/RT	10.5	0.01	B	9.3	0.00	A	13.3	0.04	B	14.7	0.08	B												
WB LT/TH/RT	8.7	0.03	A	9.0	0.08	A	9.4	0.03	A	10.2	0.10	B												
SB LT	7.5	0.04	A	7.4	0.01	A	7.7	0.04	A	7.8	0.01	A												
OVERALL	3.6	-	-	3.3	-	-	1.9	-	-	2.0	-	-												
6: Kula Highway & Kamana Street																								
NB LT	0.0	-	A	7.4	0.00	A	7.6	0.01	A	7.8	0.02	A	Same as Base Year No Mitigation Conditions						Same as Base Year No Mitigation Conditions					
EB LT/RT	9.1	0.03	A	9.2	0.00	A	10.9	0.21	B	12.6	0.29	B												
OVERALL	1.9	-	-	0.3	-	-	4.4	-	-	4.5	-	-												

5. FUTURE YEAR TRAFFIC CONDITIONS

The Future Year 2044 scenario represents the traffic conditions within the Project study area with the full build-out and occupancy of the Project.

5.1 Project Land Uses

The Project is currently in the master planning stages, and implementation of the various elements in the plan are subject to the availability of funding (public and private). For the purposes of preparing this TIAR, the following land uses are proposed:

- Community Support Training Facilities (6 acres): Recreational spaces, educational and workforce training facilities, multi-purpose functional spaces, and health and wellness facilities that feature both Hawaiian healing practices and western medical services.
- Infrastructure Training Sites (31 acres): Job training facilities, water source development, wastewater treatment package plant, 100-105 single family units, 50-80 multi-family units, and approximately 100-165 kupuna housing units.
- Agriculture Development Training Sites (42 acres): Agriculture, educational and job training facilities.
- Renewable Energy Development/Training Sites (26 acres): Training sites for renewable energy development.
- Natural Drainage Gulch Areas (45 acres): Contiguous natural green corridor around the perimeter and between proposed development areas.

Access to the Project is planned to be provided via Lauie Drive, with the existing cul-de-sac near the Waiohuli Community Center being converted to a through road providing access to the Project. In the future, development may be continued north and provide connection to Pueo Drive through internal roadways; however this development is an ideation and beyond the scope of this study.

Since the Project is in the master planning stage, the exact phasing and build-out timeline is not yet known; however for planning purposes, a 20-year horizon to Year 2044 is conservatively used for this TIAR.

5.2 Travel Demand Estimations

5.2.1 Trip Generation

The Institute of Transportation Engineers (ITE) publishes a book based on empirical data compiled from a body of more than 4,250 trip generation studies submitted by public agencies, developers, consulting firms, and associations. This publication, titled Trip Generation Manual, 11th Edition, provides trip rates and/or formulae based on graphs that correlate vehicular trips with independent variables. The independent variables can range from Dwelling Units (DU) for single and multi-family attached homes to Square-Foot Gross Leasable Area (SF GLA) for commercial development. These trip rates/formulae and their associated directional distributions were used to estimate increases in vehicular trips generated by the proposed Project.

Since the Project is in the master planning phase, the exact activities for each of the component areas are not currently clear, and the sizes of the buildings are also not definitive. Where land use information or quantities for the Project were not available, conservative estimates were made based upon data from similar land uses on Maui island.

Table 5.1 shows trip generation formulae for Project land uses which had trip generation data available in the ITE Trip Generation Manual and Table 5.2 shows the estimated trip generation for the entire Project.

5.2.2 Trip Distribution & Assignment

Trips generated by the Project were assigned throughout the study area generally based upon existing and projected Base Year 2044 travel patterns. The traffic generated by the Project was added to the forecast Base Year 2044 traffic volumes within the vicinity of the Project to constitute the traffic volumes for the Future Year 2044 traffic conditions. Figure 5.1 illustrates the Project-generated trip distribution.

Table 5.1: Master Plan Land Use and ITE Land Use Trip Generation Rates

Master Plan Land Use	Land Use (ITE Code)	Independent Variable	AM		PM	
			% Enter	Trip Rate	% Enter	Trip Rate
Single Family Residential	Single-Family Detached Housing (ITE 210)	DU	25%	[a]	63%	[b]
Multi-Family (MF) Residential	Multifamily Housing Low-Rise (ITE 220)	DU	24%	[c]	63%	[d]
Kupuna Housing	Senior Adult Housing (ITE 252)	DU	34%	[e]	56%	[f]
Community Based Health Center	Health & Fitness Club (ITE 492)	kSF	51%	1.31	57%	[g]
Cultural Center	Recreational Community Center (ITE 495)	kSF	66%	1.91	47%	[h]
Community Development Team Headquarters	Small Office Building (ITE 712)	kSF	82%	1.67	34%	2.16
Agriculture Development Center	Junior/Community College (ITE 540)	Students	81%	[i]	56%	[j]
Trail Head Park	Public Park (ITE 411)	Acres	59%	0.02	55%	[k]
Greenway Trail (40')						

[a] T = EXP(0.91 * LN(X) + 0.12)
[b] T = EXP(0.94* LN(X) + 0.27)
[c] T = 0.31*(X) + 22.85
[d] T = 0.43*(X) + 20.55
[e] T = 0.19*(X) + 0.90
[f] T = 0.25*(X) + 0.07
[g] T= EXP(0.67* LN(X) + 2.44)
[h] T = EXP(0.71* LN(X) + 2.31)
[i] T = EXP(0.63* LN(X) + 1.30)
[j] T = EXP(0.68* LN(X) + 0.81)
[k] T = 0.06(X) + 22.60

Table 5.2: Project Trip Generation

Master Plan Land Use	ITE Land Use (ITE Code)	Qty	IV	AM			PM		
				Enter	Exit	Total	Enter	Exit	Total
Single Family Residential	Single-Family Detached Housing (ITE 210)	105	DU	20	58	78	66	38	104
Multi-Family (MF) Residential	Multifamily Housing Low-Rise (ITE 220)	80	DU	12	36	48	35	20	55
Kupuna Housing	Senior Adult Housing (ITE 252)	165	DU	11	21	32	23	18	41
Community Based Health Center	Health & Fitness Club (ITE 492)[1]	13.9	kSF	9	9	18	38	29	67
Cultural Center	Recreational Community Center (ITE 495)[2]	8.9	kSF	11	6	17	23	25	48
Community Development Team Headquarters	Small Office Building (ITE 712)[2]	4.7	kSF	7	1	8	3	7	10
Agriculture Development Center	Junior/Community College (ITE 540)[3]	24	Students	22	5	27	11	9	20
Trail Head Park	Public Park (ITE 411)	7.3	Acres	0	0	0	13	10	23
Greenway Trail (40')									
Utility Management Center (with well site)	*Non-ITE Trip Generation*[4]	0.7	Acres	6	0	6	6	0	6
Native Dryland Forest Restoration	*Non-ITE Trip Generation*[5]	7.3	Acres	2	2	4	2	2	4
Solar Farm	*Non-ITE Trip Generation*[4]	26.4	Acres	4	0	4	0	4	4
Wastewater Treatment Facility (WWTF)	*Non-ITE Trip Generation*[4]	1.6	Acres	10	0	10	0	10	10
				114	**138**	**252**	**220**	**172**	**392**

[1]Estimated based upon Floor Area Ratio (FAR) of Maui Medical Kahului campus (0.20 FAR)

[2]Estimated based upon Floor Area Ratios (FAR) of Waliuku Community Center (0.12 FAR)

[3]Conservatively based upon 2022 enrollment of UH Maui College Agriculture Program

[4]Estimated using staffing information for similar projects on Maui, including other wastewater facilities and the Kuihelani Solar project

[5]Based upon man-hour volunteer information for Auwahi Forest Restoration Project (local Maui forest restoration nonprofit)

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES PROJECT

AustinTsutsumi & ASSOCIATES, INC.
Engineers & Surveyors

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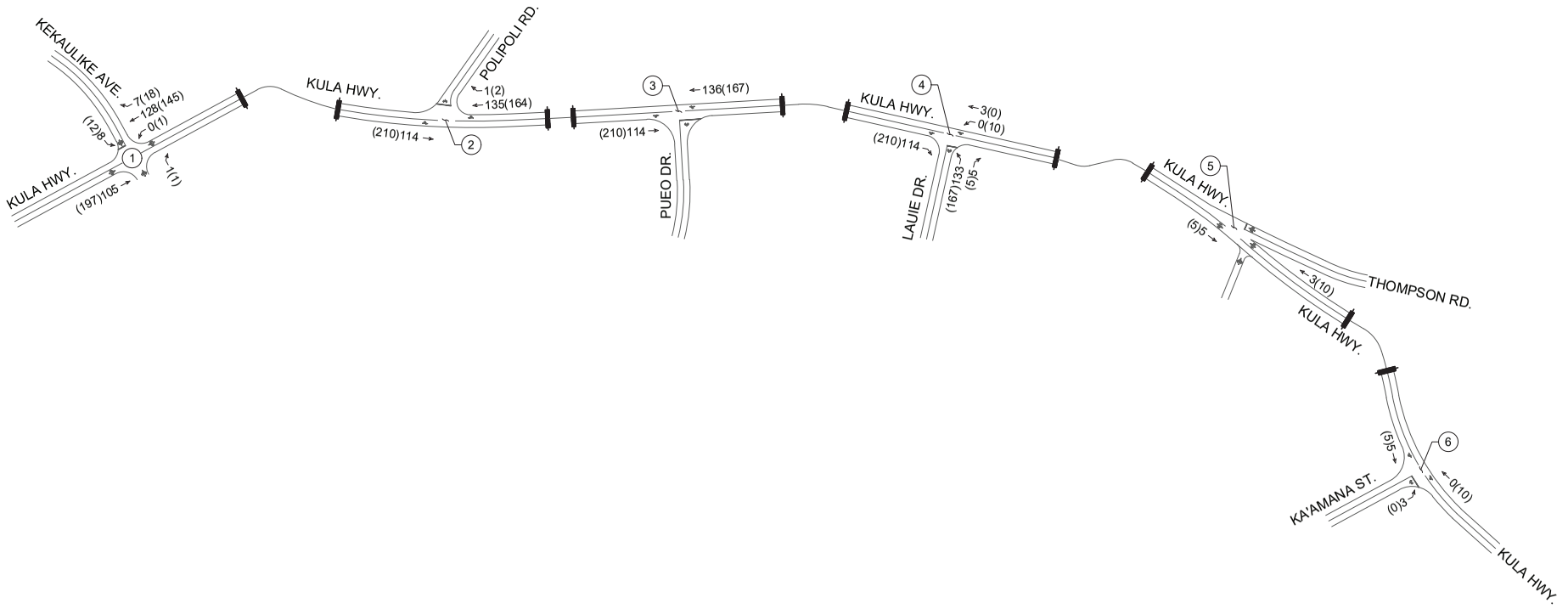

LEGEND

##(##) - AM(PM) VEHICLE VOLUMES

(X) - UNSIGNALIZED INTERSECTION X

FIGURE 5.1

PROJECT TRIPS

5.3 Future Year 2044 Analysis

The Project is forecast to generate approximately 252(392) trips in the AM(PM) peak hours at full build-out, with all of the trips being added to Kula Highway, the only regional route through the area.

As a result of the increase in traffic along Kula Highway, it is anticipated that the minor stop-controlled approaches at the Kula Highway/Kekaulike Avenue intersection will operate at LOS E/F during the PM peak hour; however these movements are anticipated to remain under capacity. A signal warrant is not anticipated to be met at this intersection with the 100% warrant and right-turn volume adjustments. All other movements are anticipated to operate at LOS D or better across both peak hours.

The minor stop-controlled eastbound approach at the Kula Highway/Pueo Drive intersection is anticipated to lower from LOS D(C) to LOS E during both peak hours; however the movement is anticipated to remain significantly under capacity. A signal warrant is not anticipated to be met at this intersection with Future Year conditions.

With the existing laneage at the Kula Highway/Lauie Drive intersection, the eastbound approach is anticipated to operate at LOS F and overcapacity during both peak hours and the 100% signal warrant is anticipated to be met with this laneage. The 100% 4-hour signal warrant is also anticipated to be met with the installation of a median refuge lane is installed, as described in Section 4.3 with the Waiohuli Homestead Community Project. Since the build-out of the Project is anticipated to be phased (though the phases are not yet known), it is recommended that the Kula Highway/Lauie Drive intersection be monitored and a signal installed when appropriate. With a signal installed, it is anticipated that all movements at the intersection will operate at LOS B or better across both peak hours.

Future Year laneage, volumes, and LOS can be found in Figure 5.2. Table 5.3 shows a LOS Summary for Existing, Base Year with no mitigation, and Future Year with no mitigation. Table 5.4 shows a LOS table for Future Year conditions with and without mitigation at the Kula Highway/Lauie Drive intersection.

WAIOHULI ECONOMIC
DEVELOPMENT OPPORTUNITIES
PROJECT

AustinTsutsumi & ASSOCIATES, INC.
Engineers & Surveyors

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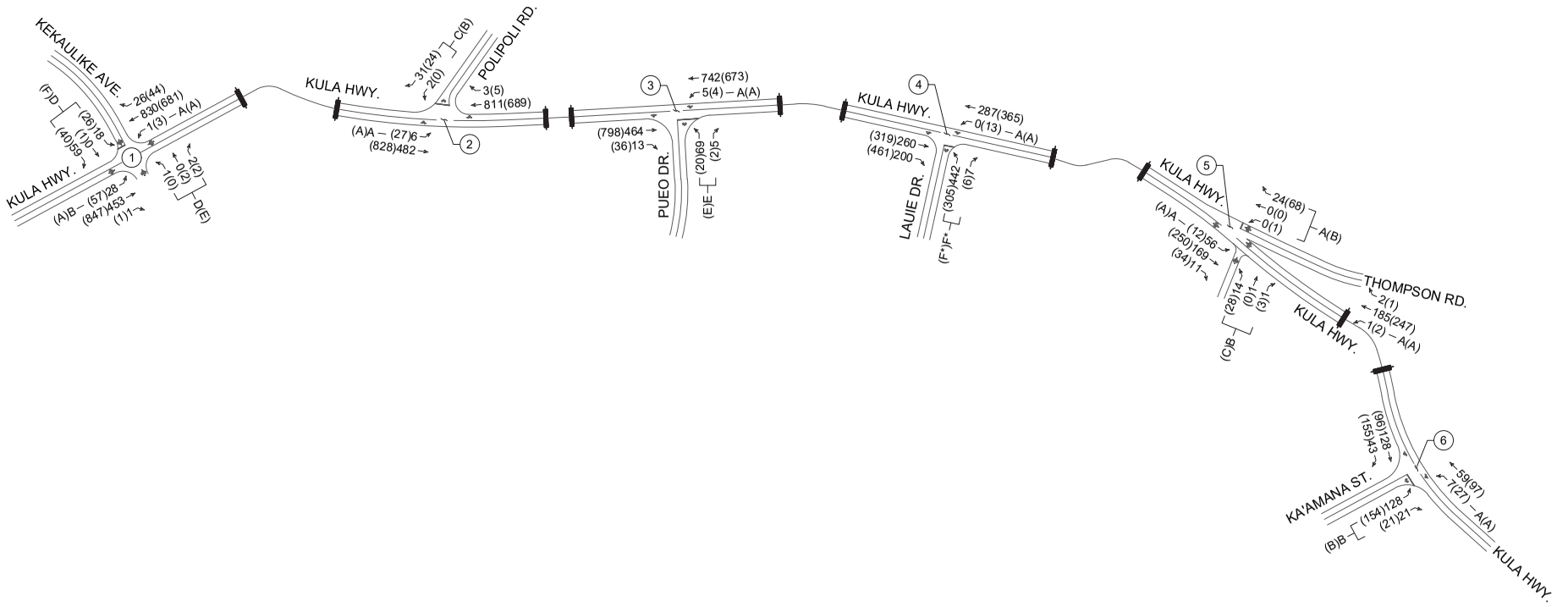

LEGEND

##(##)	- AM(PM) VEHICLE VOLUMES
(X)	- UNSIGNALIZED INTERSECTION X
X(X)	- AM(PM) LOS

FIGURE 5.2

FUTURE YEAR 2044 CONDITIONS
LANEAGE, VOLUMES, AND LOS

TABLE 5.3: LOS SUMMARY TABLE
EXISTING , BASE YEAR, AND FUTURE YEAR CONDITIONS

Intersection	Existing Conditions						Base Year No Mitigation Conditions						Future Year No Mitigation Conditions					
	AM			PM			AM			PM			AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1: Kula Highway & Kekaulike Avenue																		
NB LT	7.5	0.00	A	7.7	0.00	A	8.1	0.00	A	9.1	0.00	A	8.4	0.00	A	9.9	0.00	A
EB LT/TH/RT	12.2	0.00	B	13.0	0.01	B	21.9	0.01	C	28.7	0.02	D	31.4	0.02	D	49.2	0.04	E
WB LT/TH/RT	12.1	0.13	B	11.6	0.10	B	19.6	0.23	C	25.1	0.25	D	26.3	0.31	D	52.9	0.45	F
SB LT	8.3	0.03	A	7.9	0.05	A	9.5	0.04	A	9.0	0.06	A	10.1	0.04	B	9.7	0.08	A
OVERALL	1.7	-	-	1.9	-	-	1.4	-	-	1.5	-	-	1.5	-	-	2.1	-	-
2: Kula Highway & Polipoli Road																		
WB LT/RT	10.9	0.06	B	9.6	0.03	A	15.0	0.09	B	12.3	0.05	B	17.7	0.11	C	14.4	0.06	B
SB LT	8.1	0.01	A	7.7	0.02	A	9.2	0.01	A	8.7	0.03	A	9.7	0.01	A	9.4	0.03	A
OVERALL	0.7	-	-	1.0	-	-	0.5	-	-	0.4	-	-	0.5	-	-	0.4	-	-
3: Kula Highway & Pueo Drive																		
NB LT	7.6	0.00	A	7.7	0.00	A	8.1	0.01	A	9.0	0.01	A	8.5	0.01	A	9.8	0.01	A
EB LT/RT	12.6	0.15	B	11.2	0.04	B	25.1	0.31	D	24.4	0.11	C	41.0	0.45	E	42.9	0.20	E
OVERALL	1.9	-	-	0.7	-	-	1.8	-	-	0.5	-	-	2.4	-	-	0.6	-	-
4: Kula Highway & Lauie Drive																		
NB LT	0.0	-	A	7.6	0.00	A	0.0	-	A	8.8	0.00	A	0.0	-	A	9.6	0.02	A
EB LT/RT	11.7	0.23	B	10.6	0.05	B	35.1	0.77	E	26.6	0.48	D	142.0	1.20	F*	203.6	1.31	F*
OVERALL	4.0	-	-	1.0	-	-	11.6	-	-	3.5	-	-	53.3	-	-	43.2	-	-
5: Kula Highway & Thompson Road																		
NB LT	0.0	-	A	0.0	-	A	7.6	0.00	A	7.9	0.00	A	7.6	0.00	A	7.9	0.00	A
EB LT/TH/RT	10.5	0.01	B	9.3	0.00	A	13.3	0.04	B	14.7	0.08	B	13.4	0.04	B	15.0	0.09	C
WB LT/TH/RT	8.7	0.03	A	9.0	0.08	A	9.4	0.03	A	10.2	0.10	B	9.4	0.03	A	10.2	0.10	B
SB LT	7.5	0.04	A	7.4	0.01	A	7.7	0.04	A	7.8	0.01	A	7.8	0.04	A	7.8	0.01	A
OVERALL	3.6	-	-	3.3	-	-	1.9	-	-	2.0	-	-	1.9	-	-	2.0	-	-
6: Kula Highway & Kamana Street																		
NB LT	0.0	-	A	7.4	0.00	A	7.6	0.01	A	7.8	0.02	A	7.6	0.01	A	7.9	0.02	A
EB LT/RT	9.1	0.03	A	9.2	0.00	A	10.9	0.21	B	12.6	0.29	B	11.0	0.21	B	12.8	0.29	B
OVERALL	1.9	-	-	0.3	-	-	4.4	-	-	4.5	-	-	4.4	-	-	4.5	-	-

* Indicates overcapacity conditions, v/c ≥ 1.

TABLE 5.4: LOS SUMMARY TABLE
FUTURE YEAR CONDITIONS AT KULA HIGHWAY/LAUIE DRIVE
WITH AND WITHOUT MITIGATION

Intersection	Future Year Conditions No Mitigation						Future Year With Median Refuge Lane						Future Year With Signal					
	AM			PM			AM			PM			AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
4: Kula Highway & Lauie Drive																		
NB LT	0.0	-	A	9.6	0.02	A	0.0	-	A	9.6	0.02	A	-	-	-	-	-	-
NB LT/TH	-	-	-	-	-	-	-	-	-	-	-	-	7.3	0.42	A	5.5	0.41	A
EB LT/RT	142.0	1.20	F*	203.6	1.31	F*	58.3	0.96	F	53.0	0.88	F	11.6	0.79	B	17.7	0.78	B
SB TH/RT	-	-	-	-	-	-	-	-	-	-	-	-	9.5	0.72	A	17.0	0.89	B
OVERALL	53.3	-	-	43.2	-	-	21.9	-	-	11.3	-	-	9.8	-	A	14.2	-	B

* Indicates overcapacity conditions, v/c ≥ 1.

6. CONCLUSION

The Project, a collaboration between the Waiohuli Hawaiian Homesteaders Association (WHHA) and Pueo Development LLC, aims to boost upcountry Maui's economy through a master plan that blends construction with jobs in infrastructure, agriculture, and renewable energy. It seeks to improve self-sufficiency and economic stability by creating local employment opportunities and fostering community growth.

The Project is currently in the master planning stages, and implementation of the various elements in the plan are subject to the availability of funding (public and private). For the purposes of preparing this TIAR, the following land uses are proposed:

- Community Support Training Facilities (6 acres): Recreational spaces, educational and workforce training facilities, multi-purpose functional spaces, and health and wellness facilities that feature both Hawaiian healing practices and western medical services.
- Infrastructure Training Sites (31 acres): Job training facilities, water source development, wastewater treatment package plant, 100-105 single family units, 50-80 multi-family units, and approximately 100-165 kupuna housing units.
- Agriculture Development Training Sites (42 acres): Agriculture, educational and job training facilities.
- Renewable Energy Development/Training Sites (26 acres): Training sites for renewable energy development.
- Natural Drainage Gulch Areas (45 acres): Contiguous natural green corridor around the perimeter and between proposed development areas.

Access to the Project is planned to be provided via Lauie Drive, with the existing cul-de-sac near the Waiohuli Community Center being converted to a through road providing access to the Project. In the future, development may be continued north and provide connection to Pueo Drive through internal roadways; however this development is an ideation and beyond the scope of this study.

Since the Project is in the master planning stage, the exact phasing and build-out timeline is not yet known; however for planning purposes, a 20-year horizon to Year 2044 is conservatively used for this TIAR.

6.1 Existing Conditions

There are no sidewalks or bicycle facilities currently available along Kula Highway or Lauie Drive. There is an existing signed shared roadway along Kekaulike Avenue between Haleakala Crater Road and Kula Highway. There is also a signed shared roadway proposed along Kula Highway between Kekaulike Avenue/Haleakala Highway and Piilani Highway; though there is no exact timeline for this improvement. The Project area is served by the Maui Bus Kula Islander Route, with the nearest existing stop at Lauie Drive/Ahula Street.

The hourly traffic volume data utilized in this report was collected on Tuesday, February 13, 2024. Based on the traffic count data, the weekday AM and PM peak hours of traffic were determined to occur between 6:45 AM – 7:45 AM and 3:30 PM – 4:30 PM, respectively.

Traffic volumes along Kula Highway were observed to be generally very low throughout the AM and PM peak hours. As a result, turning movements from the stop-controlled minor streets at the study intersections experienced little difficulty finding adequate gaps in Kula Highway traffic.

During both peak hours, all movements at both study intersections operate acceptably at LOS B or better.

6.2 Base Year 2044

The Year 2044 was selected to reflect the Project completion year. Projections for Base Year 2044 traffic were based upon the Maui Regional Travel Demand Model (MRTDM) growth for forecast years between 2007 and 2035, and nearby developments in the immediate vicinity of the Project. The annual growth rate used along Kula Highway was 0.64% per year.

A number of background developments were conservatively anticipated to be completed by Year 2044 and their corresponding trips added to the network, including Kauhale Lani Residential, Kualono Subdivision, Kulamalu Town Center, Pulelehuakea Subdivision, DHHL Keokea-Waiohuli (also known as the Waiohuli Homestead Community), Hokuula, the Boschetti-Makawao 201H Development, and the DHHL Farm Lots Master Plan project. As described in Section 4.2, due to the long 20-year horizon, it was assumed that some projects that are currently stalled will be completed by Year 2044; however the growth that is projected may not materialize if background projects are not constructed. Therefore, the projections and analysis for Base Year conditions are considered to be conservative.

The Kihei-Upcountry Highway was not included in Base Year projections as there has been no movement on this project in over a decade.

The TIAR for the Waiohuli Homestead Community, revised on May 23, 2005, recommended that the Kula Highway/Lauie Drive intersection be improved to provide a northbound left-turn lane from Kula Highway onto Lauie Drive and a median refuge lane for left-turns from Lauie Drive onto Kula Highway. The TIAR recommended that the intersection be monitored to determine when the improvements should be constructed. Currently, Phase 1 and Phase 1A of the project are partially occupied; however the development timeline for subsequent phases is not yet known, and it is uncertain if or when this improvement was constructed.

As a result of development in the area, it is anticipated that Kula Highway will experience a significant increase in traffic of about 215-415 trips in each direction.

With Base Year conditions, all movements at all intersections in the study area are anticipated to operate at LOS D or better across both peak hours with the exception of the eastbound approach at the Kula Highway/Lauie Drive intersection during the AM peak hour, which is anticipated to operate at LOS E due to high eastbound left-turn volumes and increased traffic along Kula Highway from defacto growth and traffic generated by background projects.

At the Kula Highway/Lauie Drive intersection, a signal warrant is met with the existing laneage configuration and is also met if Kula Highway was widened to provide an additional southbound right-turn lane or northbound left-turn lane. With a signal installed, all movements are anticipated to operate at LOS B or better across both peak hours.

However, if a median refuge lane is installed, as described in Section 4.3 with the Waiohuli Homestead Community project, the 100% signal warrant is not met and the eastbound movement is anticipated to operate at LOS C across both peak hours.

When considering a traffic signal or median refuge lane at the Kula Highway/Lauie Drive intersection, design parameters such as laneage, right-of-way (ROW) constraints and topography should be considered.

6.3 Future Year 2044

The Project is forecast to generate approximately 252(392) trips in the AM(PM) peak hours at full build-out, with all of the trips being added to Kula Highway, the only regional route through the area.

With Future Year conditions, it is anticipated that some of the minor stop-controlled approaches at the Kula Highway intersections with Kekaulike Avenue and Pueo Drive are anticipated to operate at LOS E/F; however all movements are anticipated to operate under capacity. The 100% signal warrant was not met at either intersection with right-turn volume adjustments.

With the existing laneage at the Kula Highway/Lauie Drive intersection, the eastbound approach is anticipated to operate at LOS F and overcapacity during both peak hours and the 100% signal warrant is anticipated to be met with this laneage. The 100% 4-hour signal warrant is also anticipated to be met with the installation of a median refuge lane is installed, as described in Section 4.3 with the Waiohuli Homestead Community Project. Since the build-out of the Project is anticipated to be phased (though the phases are not yet known), it is recommended that the Kula Highway/Lauie Drive intersection be monitored and a signal installed when appropriate. With a signal installed, it is anticipated that all movements at the intersection will operate at LOS B or better across both peak hours.

7. RECOMMENDATIONS

The following improvements are recommended with Base Year conditions (without the Project):

- Monitor the Kula Highway/Lauie Drive intersection and install a signal or northbound left-turn and median refuge lane when appropriate.
    - When considering a traffic signal or median refuge lane at the Kula Highway/Lauie Drive intersection, design parameters such as laneage, right-of-way (ROW) constraints and topography should be considered.

The following improvements are recommended with Future Year conditions (with the Project)

- If not already signalized, monitor the Kula Highway/Lauie Drive intersection and install a signal when appropriate.

8. REFERENCES

1. Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2009.
2. Institute of Transportation Engineers, Trip Generation, 11th Edition, 2021.
3. Julian Ng Incorporated, Traffic Assessment of Hale Mahaolu Ewalu Senior Housing Project, July 2013.
4. Kittelson & Associates, Inc., Transportation Impact Analysis for the Kula Lodge and Restaurant, September 1994.
5. Phillip Rowell and Associates, Traffic Impact Analysis Report for the Kauhale Lani Community, February 2008.
6. Phillip Rowell and Associates, Traffic Impact Assessment Report for the Pulelehuakea Residential Subdivision, April 2010.
7. Phillip Rowell and Associates, Traffic Impact Assessment Report for the Waiohuli Homestead Community, May 2005.
8. Transportation Research Board, Highway Capacity Manual, 7th Edition, 2016.
9. Wilson Okamoto Corporation, Traffic Impact Report for Kula Ridge, July 2006.
10. Wilson Okamoto Corporation, Traffic Impact Report for the Kula Senior Community Housing, December 2005.

APPENDICES

APPENDIX A

TRAFFIC COUNT DATA

APPENDIX B

LEVEL OF SERVICE CRITERIA

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File Name : Kula Hwy - Kaamana St
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				From East				KULA HWYt. From South				KAAMANA ST From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	0	13	0	0	0	0	0	0	0	3	0	0	4	0	0	0	20
06:45 AM	0	10	0	0	0	0	0	0	0	14	0	0	2	0	0	0	26
Total	0	23	0	0	0	0	0	0	0	17	0	0	6	0	0	0	46
07:00 AM	0	6	1	0	0	0	0	0	0	16	0	0	7	0	0	0	30
07:15 AM	0	4	1	0	0	0	0	0	0	9	0	0	8	0	0	0	22
07:30 AM	0	9	5	0	0	0	0	0	0	10	0	0	5	0	0	0	29
07:45 AM	0	7	3	0	0	0	0	0	0	8	0	0	3	0	0	0	21
Total	0	26	10	0	0	0	0	0	0	43	0	0	23	0	0	0	102
08:00 AM	0	19	1	0	0	0	0	0	0	15	0	0	2	0	0	0	37
08:15 AM	0	10	4	0	0	0	0	0	0	14	0	0	8	0	1	0	37
Grand Total	0	78	15	0	0	0	0	0	0	89	0	0	39	0	1	0	222
Apprch %	0	83.9	16.1	0	0	0	0	0	0	100	0	0	97.5	0	2.5	0	
Total %	0	35.1	6.8	0	0	0	0	0	0	40.1	0	0	17.6	0	0.5	0	
Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
% Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	2.6	0	0	0	0.5
Cars & Light Goods	0	75	15	0	0	0	0	0	0	84	0	0	38	0	1	0	213
% Cars & Light Goods	0	96.2	100	0	0	0	0	0	0	94.4	0	0	97.4	0	100	0	95.9
Buses	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
% Buses	0	0	0	0	0	0	0	0	0	3.4	0	0	0	0	0	0	1.4
Single-Unit Trucks	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
% Single-Unit Trucks	0	2.6	0	0	0	0	0	0	0	1.1	0	0	0	0	0	0	1.4
Articulated Trucks	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0	0	0	1.1	0	0	0	0	0	0	0.5
Bicycles on Road	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Bicycles on Road	0	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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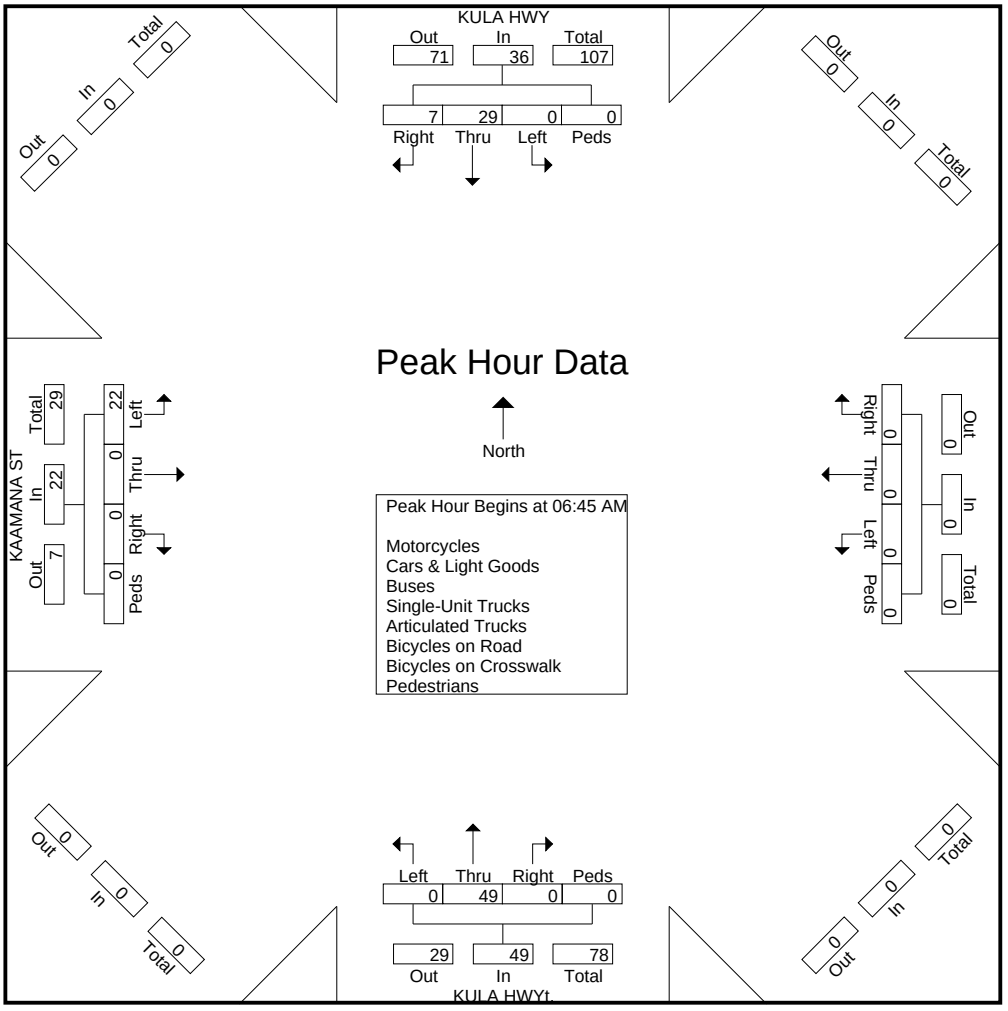
File Name : Kula Hwy - Kaamana St
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024
Page No : 2

	KULA HWY From North					From East					KULA HWYt. From South					KAAMANA ST From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:45 AM to 07:30 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	0	**10**	0	0	10	0	0	0	0	0	0	14	0	0	14	2	0	0	0	2	26
07:00 AM	0	6	1	0	7	0	0	0	0	0	0	**16**	0	0	**16**	7	0	0	0	7	**30**
07:15 AM	0	4	1	0	5	0	0	0	0	0	0	9	0	0	9	**8**	0	0	0	**8**	22
07:30 AM	0	9	**5**	0	**14**	0	0	0	0	0	0	10	0	0	10	5	0	0	0	5	29
Total Volume	0	29	7	0	36	0	0	0	0	0	0	49	0	0	49	22	0	0	0	22	107
% App. Total	0	80.6	19.4	0		0	0	0	0		0	100	0	0		100	0	0	0		
PHF	.000	.725	.350	.000	.643	.000	.000	.000	.000	.000	.000	.766	.000	.000	.766	.688	.000	.000	.000	.688	.892



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File Name : Kula Hwy - Kaamana St
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				From East				KULA HWYt. From South				KAAMANA ST From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:30 PM	0	16	3	0	0	0	0	0	0	28	0	0	0	0	0	0	47
03:45 PM	0	13	2	0	0	0	0	0	0	14	0	0	1	0	0	0	30
Total	0	29	5	0	0	0	0	0	0	42	0	0	1	0	0	0	77
04:00 PM	0	8	4	0	0	0	0	0	1	16	0	0	2	0	0	1	32
04:15 PM	0	12	5	0	0	0	0	0	0	9	0	0	0	0	0	0	26
04:30 PM	0	10	4	0	0	0	0	0	0	10	0	0	2	0	2	0	28
04:45 PM	0	7	4	0	0	0	0	0	0	17	0	0	1	0	0	0	29
Total	0	37	17	0	0	0	0	0	1	52	0	0	5	0	2	1	115
05:00 PM	0	11	6	0	0	0	0	0	0	15	0	0	0	0	1	0	33
05:15 PM	0	8	3	0	0	0	0	0	1	14	0	0	1	0	0	0	27
Grand Total	0	85	31	0	0	0	0	0	2	123	0	0	7	0	3	1	252
Apprch %	0	73.3	26.7	0	0	0	0	0	1.6	98.4	0	0	63.6	0	27.3	9.1	
Total %	0	33.7	12.3	0	0	0	0	0	0.8	48.8	0	0	2.8	0	1.2	0.4	
Motorcycles	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3
% Motorcycles	0	1.2	0	0	0	0	0	0	0	1.6	0	0	0	0	0	0	1.2
Cars & Light Goods	0	83	31	0	0	0	0	0	2	120	0	0	6	0	3	0	245
% Cars & Light Goods	0	97.6	100	0	0	0	0	0	100	97.6	0	0	85.7	0	100	0	97.2
Buses	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Buses	0	0	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	0.4
Single-Unit Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Single-Unit Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
% Bicycles on Road	0	1.2	0	0	0	0	0	0	0	0	0	0	14.3	0	0	0	0.8
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0.4
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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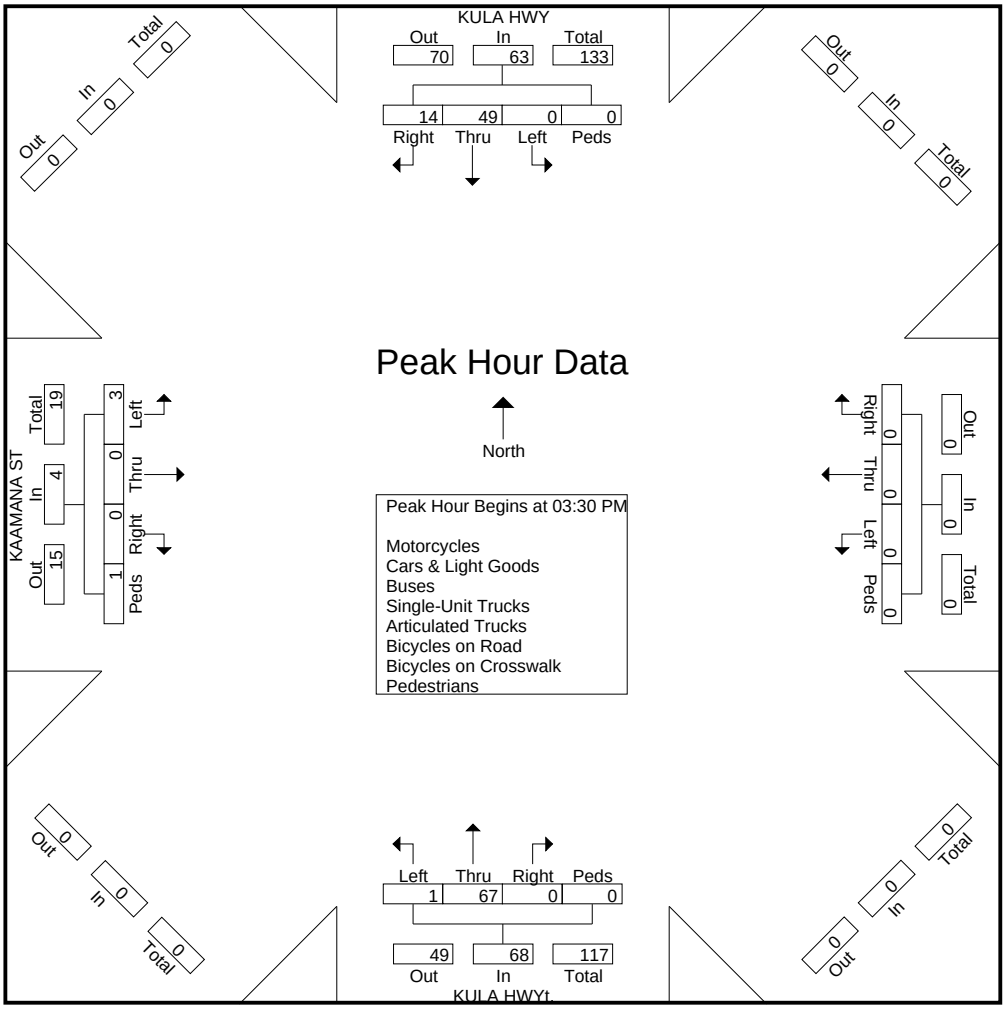
File Name : Kula Hwy - Kaamana St
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024
Page No : 2

	KULA HWY From North					From East					KULA HWYt. From South					KAAMANA ST From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	**16**	3	0	**19**	0	0	0	0	0	0	**28**	0	0	**28**	0	0	0	0	0	**47**
03:45 PM	0	13	2	0	15	0	0	0	0	0	0	14	0	0	14	1	0	0	0	1	30
04:00 PM	0	8	4	0	12	0	0	0	0	0	**1**	16	0	0	17	**2**	0	0	**1**	**3**	32
04:15 PM	0	12	**5**	0	17	0	0	0	0	0	0	9	0	0	9	0	0	0	0	0	26
Total Volume	0	49	14	0	63	0	0	0	0	0	1	67	0	0	68	3	0	0	1	4	135
% App. Total	0	77.8	22.2	0		0	0	0	0		1.5	98.5	0	0		75	0	0	25		
PHF	.000	.766	.700	.000	.829	.000	.000	.000	.000	.000	.250	.598	.000	.000	.607	.375	.000	.000	.250	.333	.718



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File Name : Kula Hwy - Kekaulike Ave
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				KEKAULIKE AVE From East				KULA HWY From South				Eastbound Approach From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:00 AM	0	7	0	0	0	0	8	0	0	49	2	0	0	0	0	0	66
06:15 AM	5	9	0	0	2	0	6	0	0	51	0	0	0	0	0	0	73
06:30 AM	1	38	0	0	4	0	10	0	0	63	0	0	0	1	0	0	117
06:45 AM	3	37	0	0	1	0	19	0	0	77	4	0	0	0	0	0	141
Total	9	91	0	0	7	0	43	0	0	240	6	0	0	1	0	0	397
07:00 AM	8	19	1	0	3	0	10	0	0	97	7	0	0	0	1	0	146
07:15 AM	10	36	0	1	2	0	18	1	1	121	4	0	1	0	0	0	195
07:30 AM	7	44	0	0	4	0	12	0	0	79	4	0	0	0	0	0	150
07:45 AM	7	54	2	0	6	0	8	0	0	57	4	0	1	0	0	0	139
Total	32	153	3	1	15	0	48	1	1	354	19	0	2	0	1	0	630
08:00 AM	13	39	0	0	9	0	7	0	0	49	2	0	0	1	0	0	120
08:15 AM	4	36	1	0	15	2	11	0	0	63	5	0	0	2	0	0	139
08:30 AM	9	42	0	0	4	1	11	0	0	52	2	0	1	1	0	0	123
08:45 AM	13	56	0	0	3	0	13	0	1	52	2	0	1	0	0	0	141
Total	39	173	1	0	31	3	42	0	1	216	11	0	2	4	0	0	523
09:00 AM	5	34	0	0	0	0	11	0	0	35	2	0	0	0	0	0	87
09:15 AM	7	36	0	0	4	0	6	0	0	46	6	0	0	1	0	0	106
09:30 AM	10	33	0	0	5	0	11	0	0	41	2	0	0	0	0	0	102
09:45 AM	5	34	0	0	3	0	8	0	0	41	5	0	1	0	0	0	97
Total	27	137	0	0	12	0	36	0	0	163	15	0	1	1	0	0	392
10:00 AM	12	24	1	4	3	2	11	0	0	50	2	0	0	0	1	5	115
10:15 AM	8	46	0	0	1	0	15	0	1	36	5	0	0	1	0	0	113
10:30 AM	7	30	0	0	4	2	15	0	0	51	3	0	1	0	0	2	115
10:45 AM	13	37	1	0	0	0	7	0	0	48	3	0	1	0	0	4	114
Total	40	137	2	4	8	4	48	0	1	185	13	0	2	1	1	11	457
11:00 AM	10	37	1	0	4	0	15	0	0	49	2	0	1	0	0	0	119
11:15 AM	11	33	0	0	2	0	10	0	0	37	6	0	0	0	0	0	99
11:30 AM	9	40	0	0	6	0	10	0	0	43	2	0	0	0	0	0	110
11:45 AM	12	31	0	0	3	0	10	0	0	37	2	0	0	0	0	0	95
Total	42	141	1	0	15	0	45	0	0	166	12	0	1	0	0	0	423
12:00 PM	4	38	0	0	3	1	9	0	0	37	4	0	1	0	0	0	97
12:15 PM	6	32	0	0	4	0	12	0	0	30	5	0	0	0	0	0	89
12:30 PM	9	45	1	0	3	0	13	0	0	49	3	0	0	0	1	0	124
12:45 PM	10	35	0	0	4	0	8	0	0	28	2	0	0	0	0	0	87
Total	29	150	1	0	14	1	42	0	0	144	14	0	1	0	1	0	397
01:00 PM	6	44	0	0	3	0	11	0	0	38	3	0	0	0	0	0	105
01:15 PM	7	38	0	0	5	0	10	0	1	49	4	0	1	0	0	0	115
01:30 PM	12	24	0	0	7	0	13	0	0	53	2	0	0	0	0	0	111
01:45 PM	10	46	0	0	5	0	17	0	0	45	2	0	0	0	0	0	125
Total	35	152	0	0	20	0	51	0	1	185	11	0	1	0	0	0	456
02:00 PM	9	51	1	0	1	0	8	0	0	45	4	0	0	0	0	0	119
02:15 PM	7	50	0	0	5	0	6	0	0	54	4	0	0	0	2	0	128
02:30 PM	10	67	0	0	2	0	10	0	0	48	5	0	0	0	0	0	142
02:45 PM	15	58	1	0	6	0	9	0	0	46	3	0	0	0	1	0	139
Total	41	226	2	0	14	0	33	0	0	193	16	0	0	0	3	0	528
03:00 PM	10	62	0	0	3	0	11	0	0	41	5	0	0	0	0	0	132
03:15 PM	12	54	0	0	1	0	13	0	0	58	4	0	0	0	0	0	142

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File Name : Kula Hwy - Kekaulike Ave
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				KEKAULIKE AVE From East				KULA HWY From South				Eastbound Approach From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:30 PM	10	63	0	0	4	0	14	0	0	71	7	0	0	0	0	0	169
03:45 PM	10	52	0	0	2	0	4	0	1	51	5	0	0	1	1	0	127
Total	42	231	0	0	10	0	42	0	1	221	21	0	0	1	1	0	570
04:00 PM	22	53	1	0	4	0	10	0	1	54	5	0	0	0	0	0	150
04:15 PM	15	61	0	0	4	1	12	0	0	38	9	0	0	1	0	0	141
04:30 PM	17	53	1	0	5	1	8	0	0	34	4	0	1	0	0	0	124
04:45 PM	15	77	0	0	3	0	9	0	0	44	5	0	0	0	0	0	153
Total	69	244	2	0	16	2	39	0	1	170	23	0	1	1	0	0	568
05:00 PM	22	66	0	0	5	0	6	0	0	36	2	0	0	0	0	0	137
05:15 PM	14	63	0	0	6	0	11	0	0	42	3	0	0	0	0	0	139
05:30 PM	24	64	0	0	4	0	8	0	0	39	5	0	0	0	0	0	144
05:45 PM	16	65	0	0	4	0	6	0	0	48	2	0	0	0	0	0	141
Total	76	258	0	0	19	0	31	0	0	165	12	0	0	0	0	0	561
Grand Total	481	2093	12	5	181	10	500	1	6	2402	173	0	11	9	7	11	5902
Apprch %	18.6	80.8	0.5	0.2	26.2	1.4	72.3	0.1	0.2	93.1	6.7	0	28.9	23.7	18.4	28.9	
Total %	8.1	35.5	0.2	0.1	3.1	0.2	8.5	0	0.1	40.7	2.9	0	0.2	0.2	0.1	0.2	
Motorcycles	2	3	0	0	1	0	2	0	0	5	1	0	0	0	0	0	14
% Motorcycles	0.4	0.1	0	0	0.6	0	0.4	0	0	0.2	0.6	0	0	0	0	0	0.2
Cars & Light Goods	465	2032	12	0	170	8	483	0	6	2332	168	0	10	9	7	0	5702
% Cars & Light Goods	96.7	97.1	100	0	93.9	80	96.6	0	100	97.1	97.1	0	90.9	100	100	0	96.6
Buses	5	20	0	0	2	0	3	0	0	22	1	0	0	0	0	0	53
% Buses	1	1	0	0	1.1	0	0.6	0	0	0.9	0.6	0	0	0	0	0	0.9
Single-Unit Trucks	7	27	0	0	4	0	10	0	0	29	3	0	1	0	0	0	81
% Single-Unit Trucks	1.5	1.3	0	0	2.2	0	2	0	0	1.2	1.7	0	9.1	0	0	0	1.4
Articulated Trucks	0	4	0	0	0	0	1	0	0	2	0	0	0	0	0	0	7
% Articulated Trucks	0	0.2	0	0	0	0	0.2	0	0	0.1	0	0	0	0	0	0	0.1
Bicycles on Road	2	7	0	0	4	2	1	0	0	12	0	0	0	0	0	0	28
% Bicycles on Road	0.4	0.3	0	0	2.2	20	0.2	0	0	0.5	0	0	0	0	0	0	0.5
Bicycles on Crosswalk	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	11	15
% Bicycles on Crosswalk	0	0	0	80	0	0	0	0	0	0	0	0	0	0	0	100	0.3
Pedestrians	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	2
% Pedestrians	0	0	0	20	0	0	0	100	0	0	0	0	0	0	0	0	0

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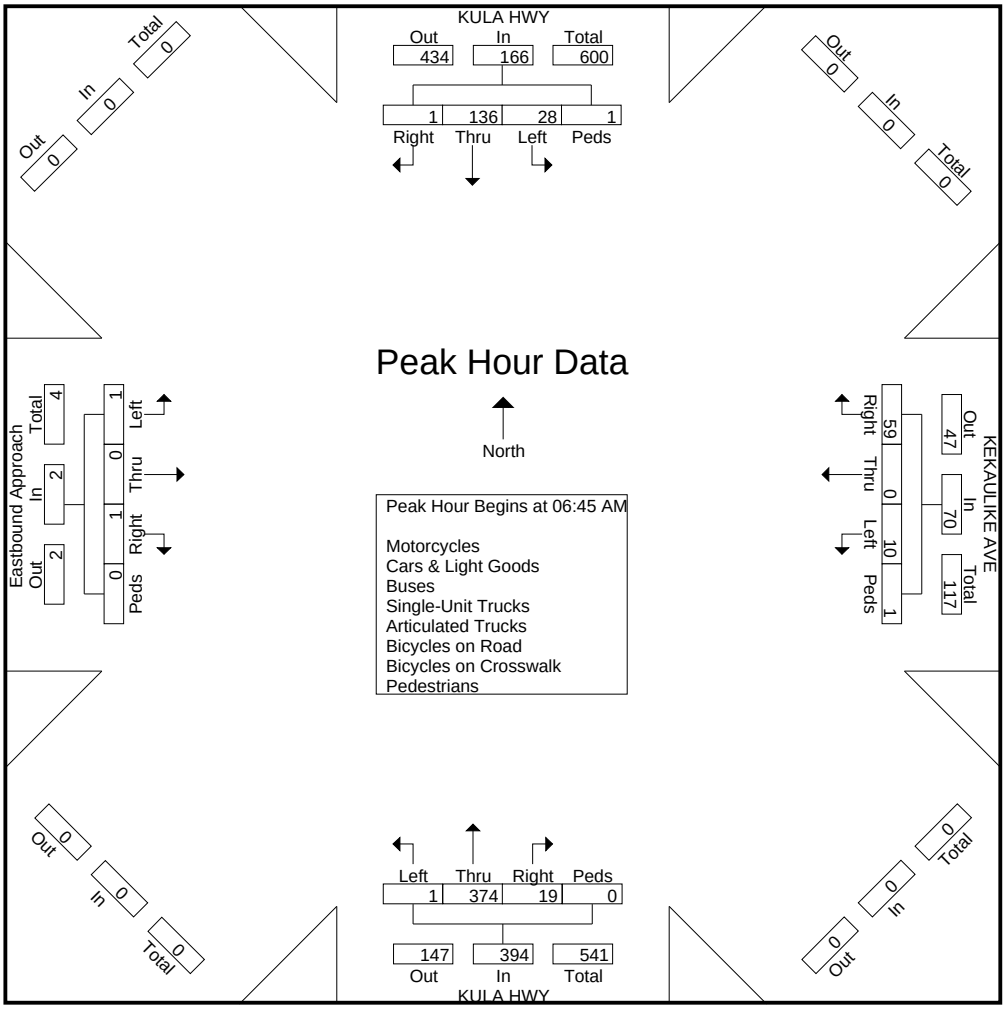
File Name : Kula Hwy - Kekaulike Ave
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024
Page No : 3

	KULA HWY From North					KEKAULIKE AVE From East					KULA HWY From South					Eastbound Approach From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	3	37	0	0	40	1	0	**19**	0	20	0	77	4	0	81	0	0	0	0	0	141
07:00 AM	8	19	**1**	0	28	3	0	10	0	13	0	97	**7**	0	104	0	0	**1**	0	**1**	146
07:15 AM	**10**	36	0	**1**	47	2	0	18	**1**	**21**	**1**	**121**	4	0	**126**	**1**	0	0	0	1	**195**
07:30 AM	7	**44**	0	0	**51**	**4**	0	12	0	16	0	79	4	0	83	0	0	0	0	0	150
Total Volume	28	136	1	1	166	10	0	59	1	70	1	374	19	0	394	1	0	1	0	2	632
% App. Total	16.9	81.9	0.6	0.6		14.3	0	84.3	1.4		0.3	94.9	4.8	0		50	0	50	0		
PHF	.700	.773	.250	.250	.814	.625	.000	.776	.250	.833	.250	.773	.679	.000	.782	.250	.000	.250	.000	.500	.810



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File Name : Kula Hwy - Kekaulike Ave
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Start Date : 2/13/2024
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				KEKAULIKE AVE From East				KULA HWY From South				Eastbound Approach From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	1	38	0	0	4	0	10	0	0	63	0	0	0	1	0	0	117
06:45 AM	3	37	0	0	1	0	19	0	0	77	4	0	0	0	0	0	141
Total	4	75	0	0	5	0	29	0	0	140	4	0	0	1	0	0	258
07:00 AM	8	19	1	0	3	0	10	0	0	97	7	0	0	0	1	0	146
07:15 AM	10	36	0	1	2	0	18	1	1	121	4	0	1	0	0	0	195
07:30 AM	7	44	0	0	4	0	12	0	0	79	4	0	0	0	0	0	150
07:45 AM	7	54	2	0	6	0	8	0	0	57	4	0	1	0	0	0	139
Total	32	153	3	1	15	0	48	1	1	354	19	0	2	0	1	0	630
08:00 AM	13	39	0	0	9	0	7	0	0	49	2	0	0	1	0	0	120
08:15 AM	4	36	1	0	15	2	11	0	0	63	5	0	0	2	0	0	139
Grand Total	53	303	4	1	44	2	95	1	1	606	30	0	2	4	1	0	1147
Apprch %	14.7	83.9	1.1	0.3	31	1.4	66.9	0.7	0.2	95.1	4.7	0	28.6	57.1	14.3	0	
Total %	4.6	26.4	0.3	0.1	3.8	0.2	8.3	0.1	0.1	52.8	2.6	0	0.2	0.3	0.1	0	
Motorcycles	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
% Motorcycles	0	0	0	0	0	0	1.1	0	0	0	0	0	0	0	0	0	0.1
Cars & Light Goods	53	297	4	0	43	2	92	0	1	594	28	0	2	4	1	0	1121
% Cars & Light Goods	100	98	100	0	97.7	100	96.8	0	100	98	93.3	0	100	100	100	0	97.7
Buses	0	2	0	0	1	0	1	0	0	7	1	0	0	0	0	0	12
% Buses	0	0.7	0	0	2.3	0	1.1	0	0	1.2	3.3	0	0	0	0	0	1
Single-Unit Trucks	0	4	0	0	0	0	1	0	0	3	1	0	0	0	0	0	9
% Single-Unit Trucks	0	1.3	0	0	0	0	1.1	0	0	0.5	3.3	0	0	0	0	0	0.8
Articulated Trucks	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.1
Bicycles on Road	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	2
% Pedestrians	0	0	0	100	0	0	0	100	0	0	0	0	0	0	0	0	0.2

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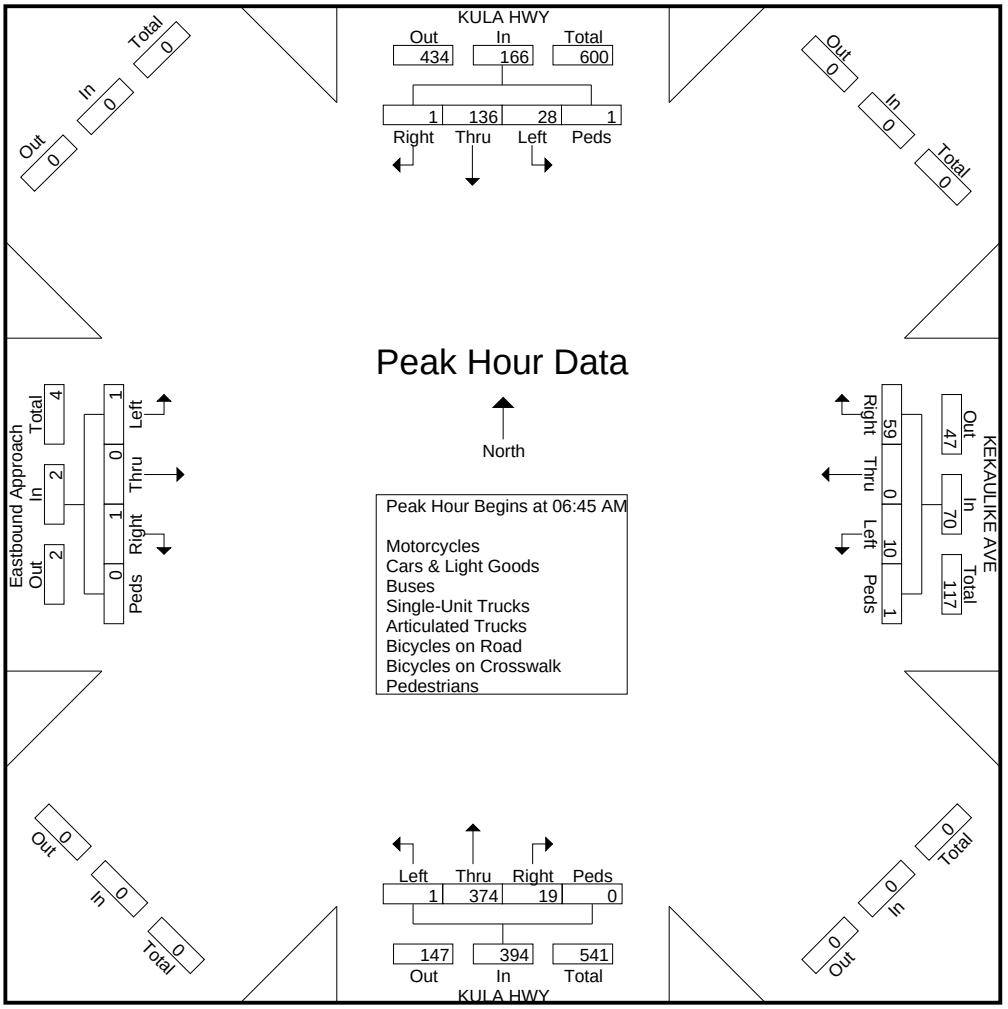
Start Date : 2/13/2024
Page No : 2

	KULA HWY From North					KEKAULIKE AVE From East					KULA HWY From South					Eastbound Approach From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	3	37	0	0	40	1	0	**19**	0	20	0	77	4	0	81	0	0	0	0	0	141
07:00 AM	8	19	**1**	0	28	3	0	10	0	13	0	97	**7**	0	104	0	0	**1**	0	**1**	146
07:15 AM	**10**	36	0	**1**	47	2	0	18	**1**	**21**	**1**	**121**	4	0	**126**	**1**	0	0	0	1	**195**
07:30 AM	7	**44**	0	0	**51**	**4**	0	12	0	16	0	79	4	0	83	0	0	0	0	0	150
Total Volume	28	136	1	1	166	10	0	59	1	70	1	374	19	0	394	1	0	1	0	2	632
% App. Total	16.9	81.9	0.6	0.6		14.3	0	84.3	1.4		0.3	94.9	4.8	0		50	0	50	0		
PHF	.700	.773	.250	.250	.814	.625	.000	.776	.250	.833	.250	.773	.679	.000	.782	.250	.000	.250	.000	.500	.810



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File Name : Kula Hwy - Kekaulike Ave
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024
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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				KEKAULIKE AVE From East				KULA HWY From South				Eastbound Approach From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:30 PM	10	63	0	0	4	0	14	0	0	71	7	0	0	0	0	0	169
03:45 PM	10	52	0	0	2	0	4	0	1	51	5	0	0	1	1	0	127
Total	20	115	0	0	6	0	18	0	1	122	12	0	0	1	1	0	296
04:00 PM	22	53	1	0	4	0	10	0	1	54	5	0	0	0	0	0	150
04:15 PM	15	61	0	0	4	1	12	0	0	38	9	0	0	1	0	0	141
04:30 PM	17	53	1	0	5	1	8	0	0	34	4	0	1	0	0	0	124
04:45 PM	15	77	0	0	3	0	9	0	0	44	5	0	0	0	0	0	153
Total	69	244	2	0	16	2	39	0	1	170	23	0	1	1	0	0	568
05:00 PM	22	66	0	0	5	0	6	0	0	36	2	0	0	0	0	0	137
05:15 PM	14	63	0	0	6	0	11	0	0	42	3	0	0	0	0	0	139
Grand Total	125	488	2	0	33	2	74	0	2	370	40	0	1	2	1	0	1140
Apprch %	20.3	79.3	0.3	0	30.3	1.8	67.9	0	0.5	89.8	9.7	0	25	50	25	0	
Total %	11	42.8	0.2	0	2.9	0.2	6.5	0	0.2	32.5	3.5	0	0.1	0.2	0.1	0	
Motorcycles	1	1	0	0	0	0	1	0	0	2	0	0	0	0	0	0	5
% Motorcycles	0.8	0.2	0	0	0	0	1.4	0	0	0.5	0	0	0	0	0	0	0.4
Cars & Light Goods	122	484	2	0	33	2	73	0	2	367	40	0	1	2	1	0	1129
% Cars & Light Goods	97.6	99.2	100	0	100	100	98.6	0	100	99.2	100	0	100	100	100	0	99
Buses	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Buses	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Single-Unit Trucks	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
% Single-Unit Trucks	0	0.4	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.3
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
% Bicycles on Road	0.8	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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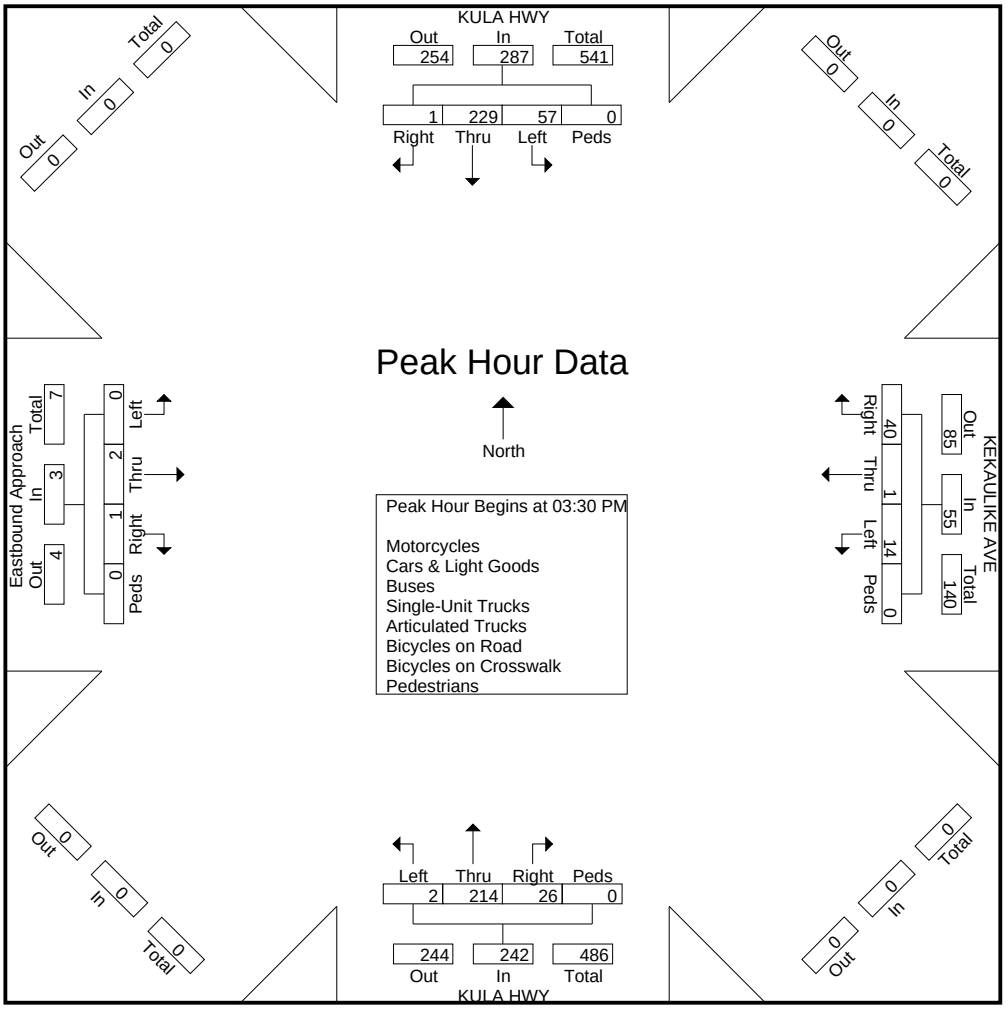
File Name : Kula Hwy - Kekaulike Ave
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024
Page No : 2

	KULA HWY From North					KEKAULIKE AVE From East					KULA HWY From South					Eastbound Approach From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	10	**63**	0	0	73	**4**	0	**14**	0	**18**	0	**71**	7	0	**78**	0	0	0	0	0	**169**
03:45 PM	10	52	0	0	62	2	0	4	0	6	**1**	51	5	0	57	0	**1**	**1**	0	**2**	127
04:00 PM	**22**	53	**1**	0	**76**	4	0	10	0	14	1	54	5	0	60	0	0	0	0	0	150
04:15 PM	15	61	0	0	76	4	**1**	12	0	17	0	38	**9**	0	47	0	1	0	0	1	141
Total Volume	57	229	1	0	287	14	1	40	0	55	2	214	26	0	242	0	2	1	0	3	587
% App. Total	19.9	79.8	0.3	0		25.5	1.8	72.7	0		0.8	88.4	10.7	0		0	66.7	33.3	0		
PHF	.648	.909	.250	.000	.944	.875	.250	.714	.000	.764	.500	.754	.722	.000	.776	.000	.500	.250	.000	.375	.868



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File Name : Kula Hwy - Lauie Dr
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				From East				KULA HWY From South				LAUIE DR From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:00 AM	0	1	1	0	0	0	0	0	0	16	0	0	17	0	1	0	36
06:15 AM	0	9	0	0	0	0	0	0	0	17	0	0	20	0	0	0	46
06:30 AM	0	34	0	0	0	0	0	0	0	18	0	0	20	0	0	0	72
06:45 AM	0	40	3	0	0	0	0	0	0	34	0	0	33	0	1	0	111
Total	0	84	4	0	0	0	0	0	0	85	0	0	90	0	2	0	265
07:00 AM	0	20	3	0	0	0	0	0	0	44	0	0	33	0	0	0	100
07:15 AM	0	20	7	0	0	0	0	0	0	36	0	0	51	0	0	0	114
07:30 AM	0	31	13	0	0	0	0	0	0	36	0	0	29	0	1	0	110
07:45 AM	0	40	5	0	0	0	0	0	0	29	0	0	13	0	0	0	87
Total	0	111	28	0	0	0	0	0	0	145	0	0	126	0	1	0	411
08:00 AM	0	38	13	0	0	0	0	0	0	17	0	0	16	0	2	0	86
08:15 AM	0	30	7	0	0	0	0	0	1	39	0	0	16	0	0	0	93
08:30 AM	0	21	12	0	0	0	0	0	0	35	0	0	14	0	0	0	82
08:45 AM	0	39	9	0	0	0	0	0	0	33	0	0	4	0	0	0	85
Total	0	128	41	0	0	0	0	0	1	124	0	0	50	0	2	0	346
09:00 AM	0	28	7	0	0	0	0	0	0	22	0	0	9	0	0	0	66
09:15 AM	0	37	0	0	0	0	0	0	1	38	0	0	8	0	1	0	85
09:30 AM	0	30	6	0	0	0	0	0	0	24	0	0	10	0	1	0	71
09:45 AM	0	26	4	0	0	0	0	0	1	31	0	0	8	0	0	0	70
Total	0	121	17	0	0	0	0	0	2	115	0	0	35	0	2	0	292
10:00 AM	0	18	4	0	0	0	0	0	0	33	0	0	9	0	0	0	64
10:15 AM	0	33	8	0	0	0	0	0	0	27	0	0	4	0	0	0	72
10:30 AM	0	25	7	0	0	0	0	0	0	31	0	0	11	0	0	0	74
10:45 AM	0	26	7	0	0	0	0	0	0	34	0	0	10	0	0	0	77
Total	0	102	26	0	0	0	0	0	0	125	0	0	34	0	0	0	287
11:00 AM	0	24	6	0	0	0	0	0	0	33	0	0	11	0	0	0	74
11:15 AM	0	17	7	0	0	0	0	0	1	28	0	0	8	0	1	0	62
11:30 AM	0	30	5	0	0	0	0	0	2	28	0	0	4	0	2	0	71
11:45 AM	0	21	5	0	0	0	0	0	0	22	0	0	8	0	1	0	57
Total	0	92	23	0	0	0	0	0	3	111	0	0	31	0	4	0	264
12:00 PM	0	25	9	0	0	0	0	0	0	28	0	0	4	0	1	0	67
12:15 PM	0	25	4	0	0	0	0	0	0	15	0	0	10	0	1	0	55
12:30 PM	0	24	7	0	0	0	0	0	0	23	0	0	12	0	2	0	68
12:45 PM	0	26	10	0	0	0	0	0	0	14	0	0	10	0	2	0	62
Total	0	100	30	0	0	0	0	0	0	80	0	0	36	0	6	0	252
01:00 PM	0	21	10	0	0	0	0	0	0	24	0	0	6	0	1	0	62
01:15 PM	0	22	8	0	0	0	0	0	1	28	0	0	10	0	1	0	70
01:30 PM	0	23	4	0	0	0	0	0	0	27	0	0	9	0	0	0	63
01:45 PM	0	24	11	0	0	0	0	0	0	29	0	0	10	0	0	0	74
Total	0	90	33	0	0	0	0	0	1	108	0	0	35	0	2	0	269
02:00 PM	0	25	15	0	0	0	0	0	1	34	0	0	12	0	0	0	87
02:15 PM	0	28	15	0	0	0	0	0	2	34	0	0	9	0	1	0	89
02:30 PM	0	35	10	0	0	0	0	0	0	38	0	0	11	0	0	0	94
02:45 PM	0	28	9	0	0	0	0	0	1	32	0	0	6	0	0	0	76
Total	0	116	49	0	0	0	0	0	4	138	0	0	38	0	1	0	346
03:00 PM	0	37	17	0	0	0	0	0	1	27	0	0	9	0	0	0	91
03:15 PM	0	34	14	0	0	0	0	0	0	39	0	0	9	0	0	0	96

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File Name : Kula Hwy - Lauie Dr
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				From East				KULA HWY From South				LAUIE DR From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:30 PM	0	23	24	0	0	0	0	0	1	52	0	0	8	0	0	0	108
03:45 PM	0	22	10	0	0	0	0	0	1	35	0	0	9	0	0	0	77
Total	0	116	65	0	0	0	0	0	3	153	0	0	35	0	0	0	372
04:00 PM	0	30	12	0	0	0	0	0	0	45	0	0	8	0	0	0	95
04:15 PM	0	27	18	0	0	0	0	0	1	25	0	1	7	0	1	0	80
04:30 PM	0	28	9	0	0	0	0	0	0	24	0	0	5	0	0	0	66
04:45 PM	0	32	20	0	0	0	0	0	1	34	0	0	10	0	0	0	97
Total	0	117	59	0	0	0	0	0	2	128	0	1	30	0	1	0	338
05:00 PM	0	37	20	0	0	0	0	0	0	23	0	0	8	0	1	0	89
05:15 PM	0	33	21	0	0	0	0	0	0	27	0	0	15	0	0	0	96
05:30 PM	0	19	18	0	0	0	0	0	0	26	0	0	6	0	0	0	69
05:45 PM	0	25	19	0	0	0	0	0	1	29	0	0	8	0	0	0	82
Total	0	114	78	0	0	0	0	0	1	105	0	0	37	0	1	0	336
Grand Total	0	1291	453	0	0	0	0	0	17	1417	0	1	577	0	22	0	3778
Apprch %	0	74	26	0	0	0	0	0	1.2	98.7	0	0.1	96.3	0	3.7	0	
Total %	0	34.2	12	0	0	0	0	0	0.4	37.5	0	0	15.3	0	0.6	0	
Motorcycles	0	6	1	0	0	0	0	0	0	7	0	0	0	0	0	0	14
% Motorcycles	0	0.5	0.2	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0.4
Cars & Light Goods	0	1242	441	0	0	0	0	0	16	1355	0	0	562	0	20	0	3636
% Cars & Light Goods	0	96.2	97.4	0	0	0	0	0	94.1	95.6	0	0	97.4	0	90.9	0	96.2
Buses	0	3	5	0	0	0	0	0	1	15	0	0	6	0	1	0	31
% Buses	0	0.2	1.1	0	0	0	0	0	5.9	1.1	0	0	1	0	4.5	0	0.8
Single-Unit Trucks	0	19	5	0	0	0	0	0	0	27	0	0	8	0	1	0	60
% Single-Unit Trucks	0	1.5	1.1	0	0	0	0	0	0	1.9	0	0	1.4	0	4.5	0	1.6
Articulated Trucks	0	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0	4
% Articulated Trucks	0	0.1	0.2	0	0	0	0	0	0	0.1	0	0	0.2	0	0	0	0.1
Bicycles on Road	0	20	0	0	0	0	0	0	0	12	0	0	0	0	0	0	32
% Bicycles on Road	0	1.5	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	0.8
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0

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Start Date : 2/13/2024
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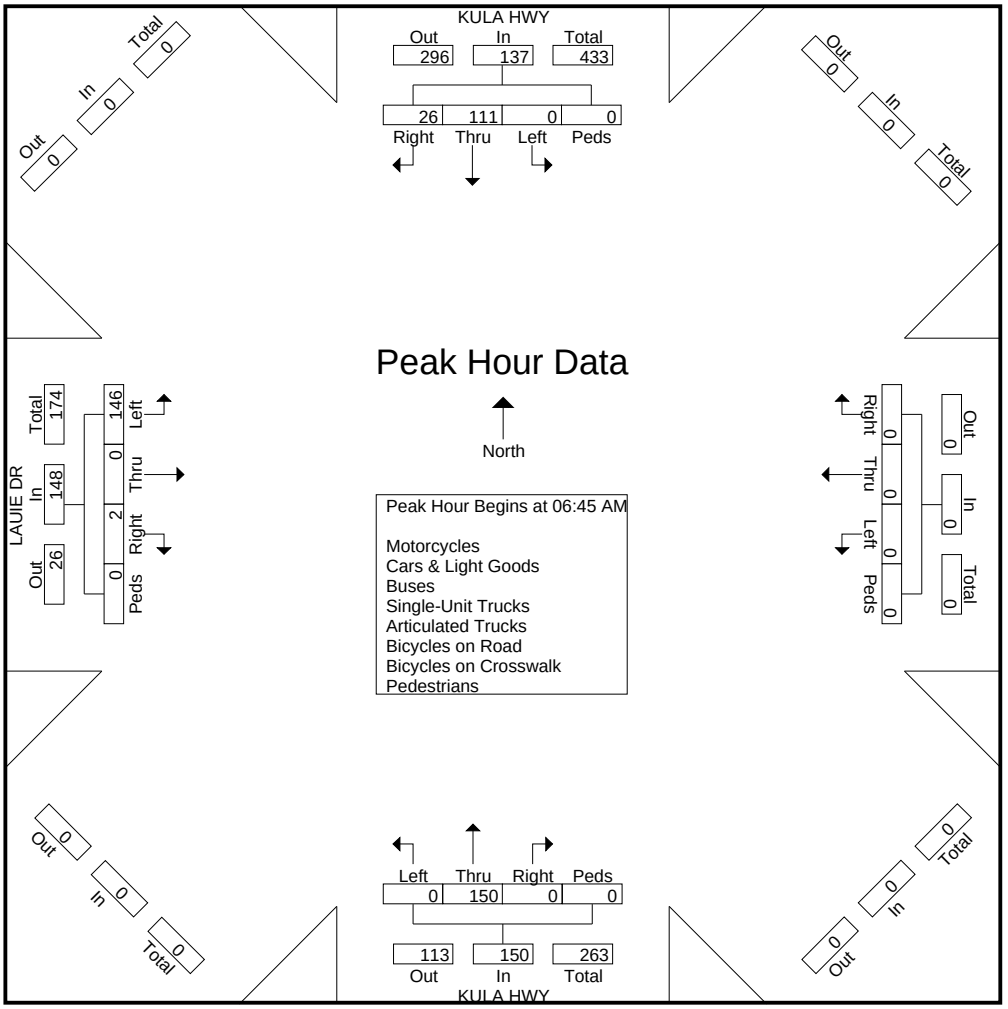
	KULA HWY From North					From East					KULA HWY From South					LAUIE DR From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	0	**40**	3	0	43	0	0	0	0	0	0	34	0	0	34	33	0	**1**	0	34	111
07:00 AM	0	20	3	0	23	0	0	0	0	0	0	**44**	0	0	**44**	33	0	0	0	33	100
07:15 AM	0	20	7	0	27	0	0	0	0	0	0	36	0	0	36	**51**	0	0	0	**51**	**114**
07:30 AM	0	31	**13**	0	**44**	0	0	0	0	0	0	36	0	0	36	29	0	1	0	30	110
Total Volume	0	111	26	0	137	0	0	0	0	0	0	150	0	0	150	146	0	2	0	148	435
% App. Total	0	81	19	0		0	0	0	0		0	100	0	0		98.6	0	1.4	0		
PHF	.000	.694	.500	.000	.778	.000	.000	.000	.000	.000	.000	.852	.000	.000	.852	.716	.000	.500	.000	.725	.954



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Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				From East				KULA HWY From South				LAUIE DR From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	0	34	0	0	0	0	0	0	0	18	0	0	20	0	0	0	72
06:45 AM	0	40	3	0	0	0	0	0	0	34	0	0	33	0	1	0	111
Total	0	74	3	0	0	0	0	0	0	52	0	0	53	0	1	0	183
07:00 AM	0	20	3	0	0	0	0	0	0	44	0	0	33	0	0	0	100
07:15 AM	0	20	7	0	0	0	0	0	0	36	0	0	51	0	0	0	114
07:30 AM	0	31	13	0	0	0	0	0	0	36	0	0	29	0	1	0	110
07:45 AM	0	40	5	0	0	0	0	0	0	29	0	0	13	0	0	0	87
Total	0	111	28	0	0	0	0	0	0	145	0	0	126	0	1	0	411
08:00 AM	0	38	13	0	0	0	0	0	0	17	0	0	16	0	2	0	86
08:15 AM	0	30	7	0	0	0	0	0	1	39	0	0	16	0	0	0	93
Grand Total	0	253	51	0	0	0	0	0	1	253	0	0	211	0	4	0	773
Apprch %	0	83.2	16.8	0	0	0	0	0	0.4	99.6	0	0	98.1	0	1.9	0	
Total %	0	32.7	6.6	0	0	0	0	0	0.1	32.7	0	0	27.3	0	0.5	0	
Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cars & Light Goods	0	250	48	0	0	0	0	0	1	245	0	0	208	0	4	0	756
% Cars & Light Goods	0	98.8	94.1	0	0	0	0	0	100	96.8	0	0	98.6	0	100	0	97.8
Buses	0	1	2	0	0	0	0	0	0	6	0	0	2	0	0	0	11
% Buses	0	0.4	3.9	0	0	0	0	0	0	2.4	0	0	0.9	0	0	0	1.4
Single-Unit Trucks	0	2	1	0	0	0	0	0	0	1	0	0	1	0	0	0	5
% Single-Unit Trucks	0	0.8	2	0	0	0	0	0	0	0.4	0	0	0.5	0	0	0	0.6
Articulated Trucks	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0.1
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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File Name : Kula Hwy - Lauie Dr
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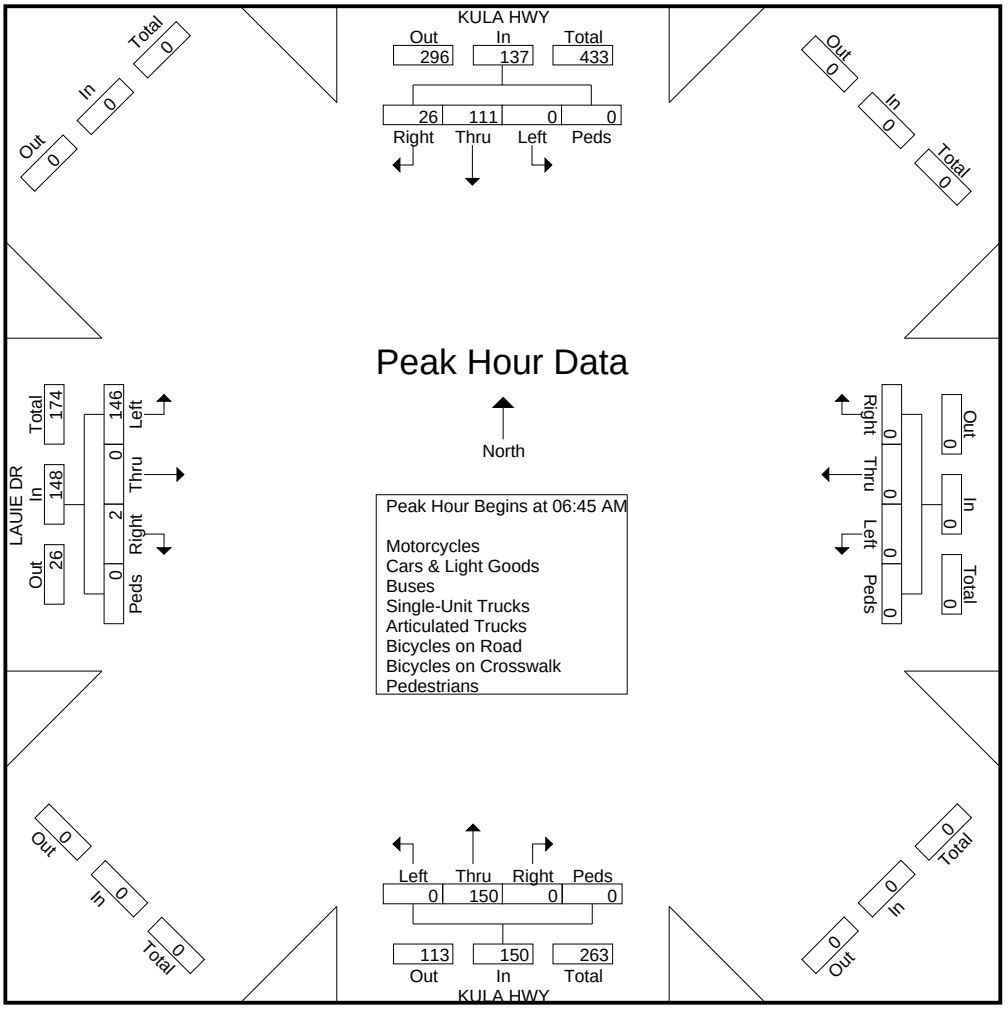
	KULA HWY From North					From East					KULA HWY From South					LAUIE DR From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	0	**40**	3	0	43	0	0	0	0	0	0	34	0	0	34	33	0	**1**	0	34	111
07:00 AM	0	20	3	0	23	0	0	0	0	0	0	**44**	0	0	**44**	33	0	0	0	33	100
07:15 AM	0	20	7	0	27	0	0	0	0	0	0	36	0	0	36	**51**	0	0	0	**51**	**114**
07:30 AM	0	31	**13**	0	**44**	0	0	0	0	0	0	36	0	0	36	29	0	1	0	30	110
Total Volume	0	111	26	0	137	0	0	0	0	0	0	150	0	0	150	146	0	2	0	148	435
% App. Total	0	81	19	0		0	0	0	0		0	100	0	0		98.6	0	1.4	0		
PHF	.000	.694	.500	.000	.778	.000	.000	.000	.000	.000	.000	.852	.000	.000	.852	.716	.000	.500	.000	.725	.954



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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				From East				KULA HWY From South				LAUIE DR From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:30 PM	0	23	24	0	0	0	0	0	1	52	0	0	8	0	0	0	108
03:45 PM	0	22	10	0	0	0	0	0	1	35	0	0	9	0	0	0	77
Total	0	45	34	0	0	0	0	0	2	87	0	0	17	0	0	0	185
04:00 PM	0	30	12	0	0	0	0	0	0	45	0	0	8	0	0	0	95
04:15 PM	0	27	18	0	0	0	0	0	1	25	0	1	7	0	1	0	80
04:30 PM	0	28	9	0	0	0	0	0	0	24	0	0	5	0	0	0	66
04:45 PM	0	32	20	0	0	0	0	0	1	34	0	0	10	0	0	0	97
Total	0	117	59	0	0	0	0	0	2	128	0	1	30	0	1	0	338
05:00 PM	0	37	20	0	0	0	0	0	0	23	0	0	8	0	1	0	89
05:15 PM	0	33	21	0	0	0	0	0	0	27	0	0	15	0	0	0	96
Grand Total	0	232	134	0	0	0	0	0	4	265	0	1	70	0	2	0	708
Apprch %	0	63.4	36.6	0	0	0	0	0	1.5	98.1	0	0.4	97.2	0	2.8	0	
Total %	0	32.8	18.9	0	0	0	0	0	0.6	37.4	0	0.1	9.9	0	0.3	0	
Motorcycles	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	4
% Motorcycles	0	0.9	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	0.6
Cars & Light Goods	0	230	133	0	0	0	0	0	3	261	0	0	70	0	2	0	699
% Cars & Light Goods	0	99.1	99.3	0	0	0	0	0	75	98.5	0	0	100	0	100	0	98.7
Buses	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2
% Buses	0	0	0.7	0	0	0	0	0	25	0	0	0	0	0	0	0	0.3
Single-Unit Trucks	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
% Single-Unit Trucks	0	0	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	0.3
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0.1

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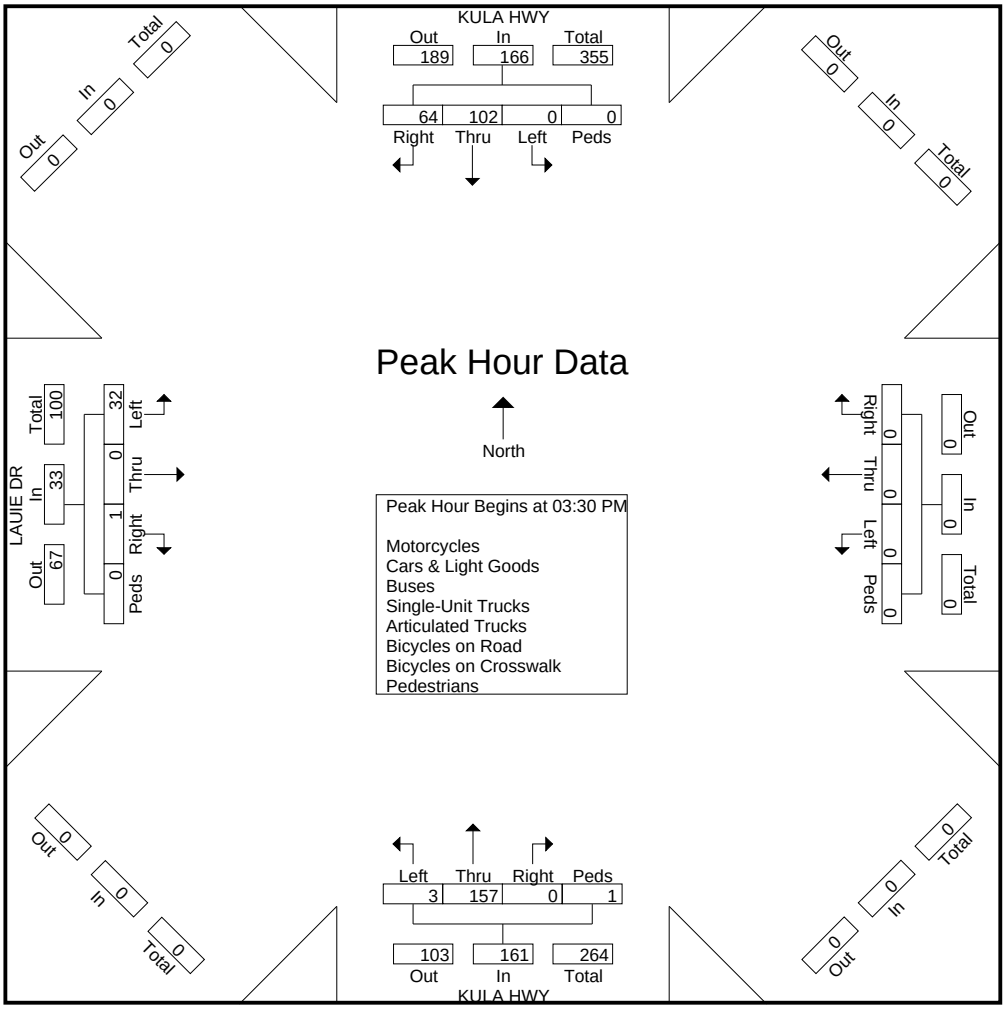
	KULA HWY From North					From East					KULA HWY From South					LAUIE DR From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	23	**24**	0	**47**	0	0	0	0	0	**1**	**52**	0	0	**53**	8	0	0	0	8	**108**
03:45 PM	0	22	10	0	32	0	0	0	0	0	1	35	0	0	36	**9**	0	0	0	**9**	77
04:00 PM	0	**30**	12	0	42	0	0	0	0	0	0	45	0	0	45	8	0	0	0	8	95
04:15 PM	0	27	18	0	45	0	0	0	0	0	1	25	0	**1**	27	7	0	**1**	0	8	80
Total Volume	0	102	64	0	166	0	0	0	0	0	3	157	0	1	161	32	0	1	0	33	360
% App. Total	0	61.4	38.6	0		0	0	0	0		1.9	97.5	0	0.6		97	0	3	0		
PHF	.000	.850	.667	.000	.883	.000	.000	.000	.000	.000	.750	.755	.000	.250	.759	.889	.000	.250	.000	.917	.833



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File Name : Kula Hwy - Polipoli Rd
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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				POLIPOLI RD From East				KULA HWY From South				From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:00 AM	1	10	0	0	0	0	4	0	0	44	0	0	0	0	0	0	59
06:15 AM	2	9	0	0	0	0	3	0	0	53	0	0	0	0	0	0	67
06:30 AM	1	33	0	0	1	0	7	0	0	50	0	0	0	0	0	0	92
06:45 AM	1	48	0	0	1	0	13	0	0	69	0	0	0	0	0	0	132
Total	5	100	0	0	2	0	27	0	0	216	0	0	0	0	0	0	350
07:00 AM	2	21	0	0	1	0	8	0	0	95	1	0	0	0	0	0	128
07:15 AM	3	35	0	0	0	0	6	0	0	112	0	0	0	0	0	0	156
07:30 AM	0	49	0	0	0	0	4	0	0	75	1	0	0	0	0	0	129
07:45 AM	3	51	0	0	2	0	6	0	0	55	0	0	0	0	0	0	117
Total	8	156	0	0	3	0	24	0	0	337	2	0	0	0	0	0	530
08:00 AM	3	53	0	0	1	0	5	0	0	42	1	0	0	0	0	0	105
08:15 AM	5	43	0	0	0	0	4	0	0	63	1	0	0	0	0	0	116
08:30 AM	5	41	0	0	0	0	5	0	0	53	1	0	0	0	0	0	105
08:45 AM	5	55	0	0	0	0	7	0	0	46	0	0	0	0	0	0	113
Total	18	192	0	0	1	0	21	0	0	204	3	0	0	0	0	0	439
09:00 AM	0	35	0	0	0	0	3	0	0	39	1	0	0	0	0	0	78
09:15 AM	4	39	0	0	1	0	5	0	0	47	0	0	0	0	0	0	96
09:30 AM	0	39	0	0	0	0	6	0	0	39	1	0	0	0	0	0	85
09:45 AM	1	35	0	0	0	0	7	2	0	39	2	0	0	0	0	0	86
Total	5	148	0	0	1	0	21	2	0	164	4	0	0	0	0	0	345
10:00 AM	5	31	0	0	0	0	3	1	0	47	0	0	0	0	0	0	87
10:15 AM	5	42	0	0	0	0	4	0	0	36	0	0	0	0	0	0	87
10:30 AM	2	31	0	0	1	0	4	0	0	50	0	0	0	0	0	0	88
10:45 AM	3	39	0	0	0	0	4	2	0	45	0	0	0	0	0	0	93
Total	15	143	0	0	1	0	15	3	0	178	0	0	0	0	0	0	355
11:00 AM	3	34	0	0	0	0	4	3	0	45	2	0	0	0	0	0	91
11:15 AM	8	29	0	0	0	0	4	0	0	39	0	0	0	0	0	0	80
11:30 AM	1	43	0	0	0	0	5	0	0	39	0	0	0	0	0	0	88
11:45 AM	3	34	0	0	0	0	4	0	0	37	0	0	0	0	0	0	78
Total	15	140	0	0	0	0	17	3	0	160	2	0	0	0	0	0	337
12:00 PM	2	37	0	0	1	0	5	4	0	29	1	0	0	0	0	0	79
12:15 PM	3	31	0	0	0	0	4	0	0	28	1	0	0	0	0	0	67
12:30 PM	4	39	0	0	0	0	6	0	0	44	0	0	0	0	0	0	93
12:45 PM	3	39	0	0	0	0	4	0	0	24	1	0	0	0	0	0	71
Total	12	146	0	0	1	0	19	4	0	125	3	0	0	0	0	0	310
01:00 PM	9	34	0	0	0	0	8	0	0	29	4	0	0	0	0	0	84
01:15 PM	3	48	0	0	0	0	3	0	0	49	0	0	0	0	0	0	103
01:30 PM	4	30	0	0	2	0	3	0	0	49	0	0	0	0	0	0	88
01:45 PM	6	41	0	0	0	0	2	0	0	44	0	0	0	0	0	0	93
Total	22	153	0	0	2	0	16	0	0	171	4	0	0	0	0	0	368
02:00 PM	2	49	0	0	0	0	5	0	0	49	1	0	0	0	0	0	106
02:15 PM	4	51	0	0	0	0	2	0	0	45	1	0	0	0	0	0	103
02:30 PM	6	59	0	0	0	0	3	0	0	54	0	0	0	0	0	0	122
02:45 PM	8	51	0	0	0	0	3	0	0	44	1	0	0	0	0	0	107
Total	20	210	0	0	0	0	13	0	0	192	3	0	0	0	0	0	438
03:00 PM	2	64	0	0	0	0	7	0	0	40	1	0	0	0	0	0	114
03:15 PM	2	54	0	0	0	0	3	0	0	62	0	0	0	0	0	0	121

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Start Date : 2/13/2024

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				POLIPOLI RD From East				KULA HWY From South				From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:30 PM	8	53	0	0	0	0	7	0	0	67	3	0	0	0	0	0	138
03:45 PM	5	47	0	0	0	0	9	0	0	46	0	0	0	0	0	0	107
Total	17	218	0	0	0	0	26	0	0	215	4	0	0	0	0	0	480
04:00 PM	9	46	0	0	0	0	4	0	0	55	0	0	0	0	0	0	114
04:15 PM	5	55	0	0	0	0	4	0	0	36	0	0	0	0	0	0	100
04:30 PM	7	53	0	0	0	0	3	0	0	36	0	0	0	0	0	0	99
04:45 PM	8	74	0	0	0	0	3	0	0	47	1	0	0	0	0	0	133
Total	29	228	0	0	0	0	14	0	0	174	1	0	0	0	0	0	446
05:00 PM	3	67	0	0	0	0	2	0	0	37	0	0	0	0	0	0	109
05:15 PM	8	61	0	0	0	0	1	0	0	47	0	0	0	0	0	0	117
05:30 PM	7	47	0	0	0	0	4	0	0	39	2	0	0	0	0	0	99
05:45 PM	8	59	0	0	0	0	4	0	0	42	0	0	0	0	0	0	113
Total	26	234	0	0	0	0	11	0	0	165	2	0	0	0	0	0	438
Grand Total	192	2068	0	0	11	0	224	12	0	2301	28	0	0	0	0	0	4836
Apprch %	8.5	91.5	0	0	4.5	0	90.7	4.9	0	98.8	1.2	0	0	0	0	0	
Total %	4	42.8	0	0	0.2	0	4.6	0.2	0	47.6	0.6	0	0	0	0	0	
Motorcycles	0	6	0	0	0	0	0	0	0	7	0	0	0	0	0	0	13
% Motorcycles	0	0.3	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.3
Cars & Light Goods	179	2001	0	0	11	0	216	0	0	2236	24	0	0	0	0	0	4667
% Cars & Light Goods	93.2	96.8	0	0	100	0	96.4	0	0	97.2	85.7	0	0	0	0	0	96.5
Buses	4	16	0	0	0	0	0	0	0	25	0	0	0	0	0	0	45
% Buses	2.1	0.8	0	0	0	0	0	0	0	1.1	0	0	0	0	0	0	0.9
Single-Unit Trucks	6	25	0	0	0	0	2	0	0	29	0	0	0	0	0	0	62
% Single-Unit Trucks	3.1	1.2	0	0	0	0	0.9	0	0	1.3	0	0	0	0	0	0	1.3
Articulated Trucks	0	3	0	0	0	0	1	0	0	2	0	0	0	0	0	0	6
% Articulated Trucks	0	0.1	0	0	0	0	0.4	0	0	0.1	0	0	0	0	0	0	0.1
Bicycles on Road	3	17	0	0	0	0	5	0	0	2	4	0	0	0	0	0	31
% Bicycles on Road	1.6	0.8	0	0	0	0	2.2	0	0	0.1	14.3	0	0	0	0	0	0.6
Bicycles on Crosswalk	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	12
% Bicycles on Crosswalk	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0.2
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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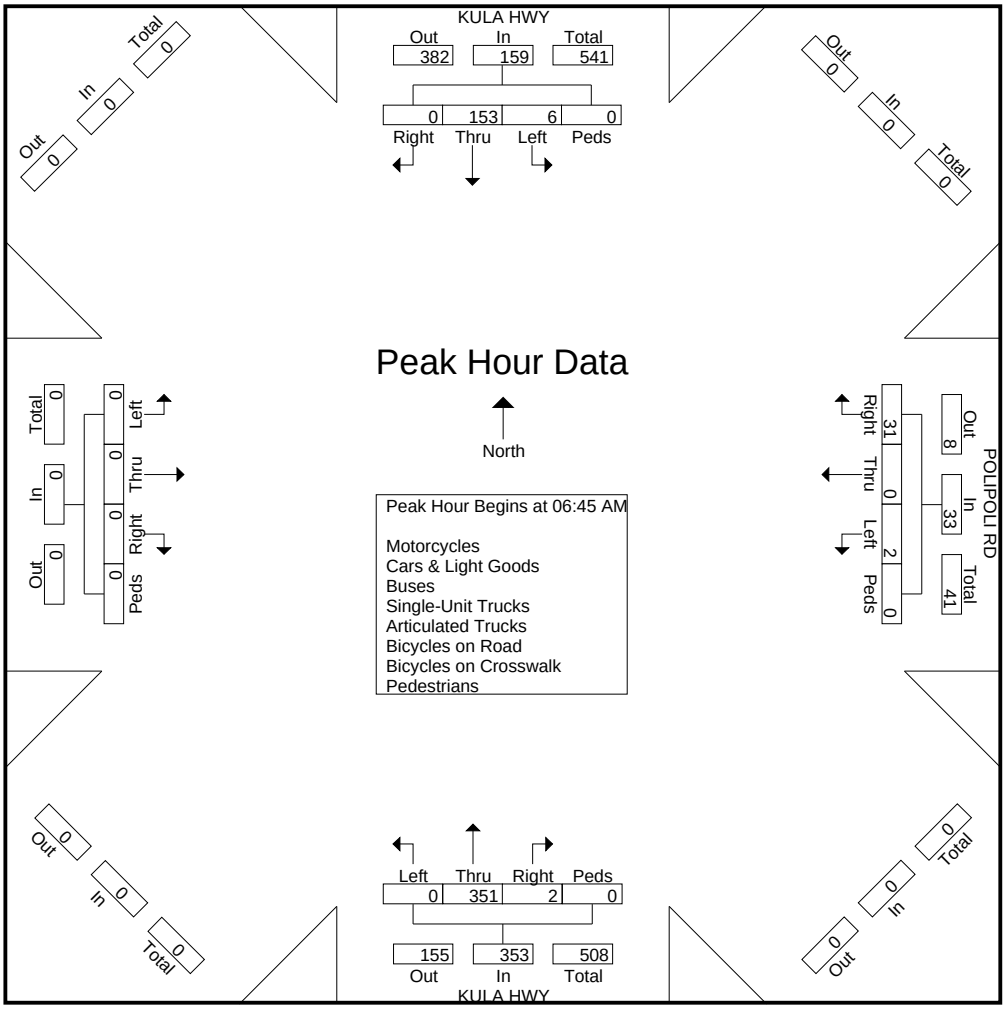
	KULA HWY From North					POLIPOLI RD From East					KULA HWY From South					From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	1	48	0	0	**49**	**1**	0	**13**	0	**14**	0	69	0	0	69	0	0	0	0	0	132
07:00 AM	2	21	0	0	23	1	0	8	0	9	0	95	**1**	0	96	0	0	0	0	0	128
07:15 AM	**3**	35	0	0	38	0	0	6	0	6	0	**112**	0	0	**112**	0	0	0	0	0	**156**
07:30 AM	0	**49**	0	0	49	0	0	4	0	4	0	75	1	0	76	0	0	0	0	0	129
Total Volume	6	153	0	0	159	2	0	31	0	33	0	351	2	0	353	0	0	0	0	0	545
% App. Total	3.8	96.2	0	0		6.1	0	93.9	0		0	99.4	0.6	0		0	0	0	0		
PHF	.500	.781	.000	.000	.811	.500	.000	.596	.000	.589	.000	.783	.500	.000	.788	.000	.000	.000	.000	.000	.873



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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				POLIPOLI RD From East				KULA HWY From South				From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	1	33	0	0	1	0	7	0	0	50	0	0	0	0	0	0	92
06:45 AM	1	48	0	0	1	0	13	0	0	69	0	0	0	0	0	0	132
Total	2	81	0	0	2	0	20	0	0	119	0	0	0	0	0	0	224
07:00 AM	2	21	0	0	1	0	8	0	0	95	1	0	0	0	0	0	128
07:15 AM	3	35	0	0	0	0	6	0	0	112	0	0	0	0	0	0	156
07:30 AM	0	49	0	0	0	0	4	0	0	75	1	0	0	0	0	0	129
07:45 AM	3	51	0	0	2	0	6	0	0	55	0	0	0	0	0	0	117
Total	8	156	0	0	3	0	24	0	0	337	2	0	0	0	0	0	530
08:00 AM	3	53	0	0	1	0	5	0	0	42	1	0	0	0	0	0	105
08:15 AM	5	43	0	0	0	0	4	0	0	63	1	0	0	0	0	0	116
Grand Total	18	333	0	0	6	0	53	0	0	561	4	0	0	0	0	0	975
Apprch %	5.1	94.9	0	0	10.2	0	89.8	0	0	99.3	0.7	0	0	0	0	0	
Total %	1.8	34.2	0	0	0.6	0	5.4	0	0	57.5	0.4	0	0	0	0	0	
Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cars & Light Goods	16	329	0	0	6	0	52	0	0	549	4	0	0	0	0	0	956
% Cars & Light Goods	88.9	98.8	0	0	100	0	98.1	0	0	97.9	100	0	0	0	0	0	98.1
Buses	0	1	0	0	0	0	0	0	0	9	0	0	0	0	0	0	10
% Buses	0	0.3	0	0	0	0	0	0	0	1.6	0	0	0	0	0	0	1
Single-Unit Trucks	2	3	0	0	0	0	0	0	0	2	0	0	0	0	0	0	7
% Single-Unit Trucks	11.1	0.9	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0.7
Articulated Trucks	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.1
Bicycles on Road	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
% Bicycles on Road	0	0	0	0	0	0	1.9	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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File Name : Kula Hwy - Polipoli Rd
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Start Date : 2/13/2024
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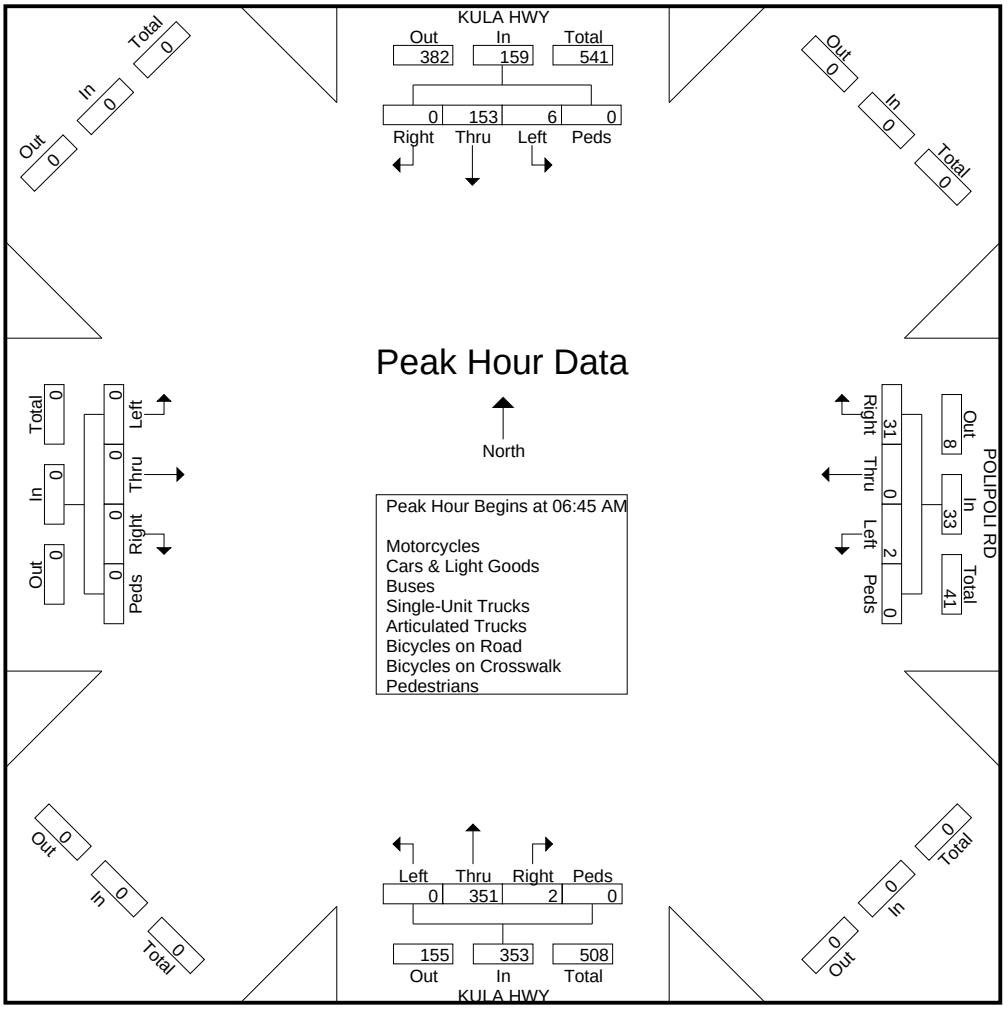
	KULA HWY From North					POLIPOLI RD From East					KULA HWY From South					From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	1	48	0	0	**49**	**1**	0	**13**	0	**14**	0	69	0	0	69	0	0	0	0	0	132
07:00 AM	2	21	0	0	23	1	0	8	0	9	0	95	**1**	0	96	0	0	0	0	0	128
07:15 AM	**3**	35	0	0	38	0	0	6	0	6	0	**112**	0	0	**112**	0	0	0	0	0	**156**
07:30 AM	0	**49**	0	0	49	0	0	4	0	4	0	75	1	0	76	0	0	0	0	0	129
Total Volume	6	153	0	0	159	2	0	31	0	33	0	351	2	0	353	0	0	0	0	0	545
% App. Total	3.8	96.2	0	0		6.1	0	93.9	0		0	99.4	0.6	0		0	0	0	0		
PHF	.500	.781	.000	.000	.811	.500	.000	.596	.000	.589	.000	.783	.500	.000	.788	.000	.000	.000	.000	.000	.873



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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				POLIPOLI RD From East				KULA HWY From South				From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:30 PM	8	53	0	0	0	0	7	0	0	67	3	0	0	0	0	0	138
03:45 PM	5	47	0	0	0	0	9	0	0	46	0	0	0	0	0	0	107
Total	13	100	0	0	0	0	16	0	0	113	3	0	0	0	0	0	245
04:00 PM	9	46	0	0	0	0	4	0	0	55	0	0	0	0	0	0	114
04:15 PM	5	55	0	0	0	0	4	0	0	36	0	0	0	0	0	0	100
04:30 PM	7	53	0	0	0	0	3	0	0	36	0	0	0	0	0	0	99
04:45 PM	8	74	0	0	0	0	3	0	0	47	1	0	0	0	0	0	133
Total	29	228	0	0	0	0	14	0	0	174	1	0	0	0	0	0	446
05:00 PM	3	67	0	0	0	0	2	0	0	37	0	0	0	0	0	0	109
05:15 PM	8	61	0	0	0	0	1	0	0	47	0	0	0	0	0	0	117
Grand Total	53	456	0	0	0	0	33	0	0	371	4	0	0	0	0	0	917
Apprch %	10.4	89.6	0	0	0	0	100	0	0	98.9	1.1	0	0	0	0	0	
Total %	5.8	49.7	0	0	0	0	3.6	0	0	40.5	0.4	0	0	0	0	0	
Motorcycles	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
% Motorcycles	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0.2
Cars & Light Goods	52	456	0	0	0	0	33	0	0	368	4	0	0	0	0	0	913
% Cars & Light Goods	98.1	100	0	0	0	0	100	0	0	99.2	100	0	0	0	0	0	99.6
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Single-Unit Trucks	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
% Single-Unit Trucks	1.9	0	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.2
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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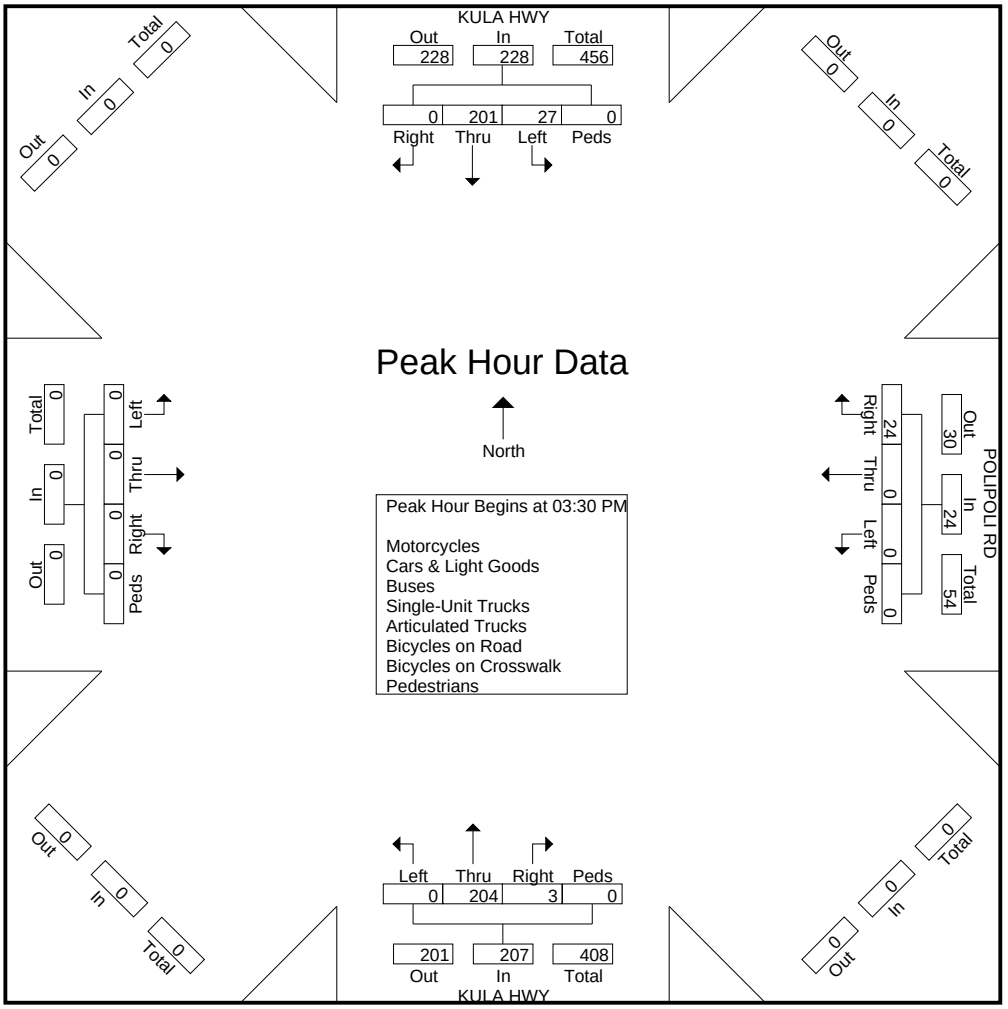
	KULA HWY From North					POLIPOLI RD From East					KULA HWY From South					From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	8	53	0	0	**61**	0	0	7	0	7	0	**67**	**3**	0	**70**	0	0	0	0	0	**138**
03:45 PM	5	47	0	0	52	0	0	**9**	0	**9**	0	46	0	0	46	0	0	0	0	0	107
04:00 PM	**9**	46	0	0	55	0	0	4	0	4	0	55	0	0	55	0	0	0	0	0	114
04:15 PM	5	**55**	0	0	60	0	0	4	0	4	0	36	0	0	36	0	0	0	0	0	100
Total Volume	27	201	0	0	228	0	0	24	0	24	0	204	3	0	207	0	0	0	0	0	459
% App. Total	11.8	88.2	0	0		0	0	100	0		0	98.6	1.4	0		0	0	0	0		
PHF	.750	.914	.000	.000	.934	.000	.000	.667	.000	.667	.000	.761	.250	.000	.739	.000	.000	.000	.000	.000	.832



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Start Date : 2/13/2024

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				From East				KULA HWY From South				PUEO DR From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:00 AM	0	3	2	0	0	0	0	0	0	37	0	0	9	0	0	0	51
06:15 AM	0	8	1	0	0	0	0	0	0	39	0	0	13	0	0	0	61
06:30 AM	0	33	0	0	0	0	0	0	0	43	0	0	8	0	1	0	85
06:45 AM	0	46	1	0	0	0	0	0	2	64	0	0	9	0	1	0	123
Total	0	90	4	0	0	0	0	0	2	183	0	0	39	0	2	0	320
07:00 AM	0	21	1	0	0	0	0	0	1	74	0	0	20	0	2	0	119
07:15 AM	0	24	5	0	0	0	0	0	2	88	0	0	25	0	2	0	146
07:30 AM	0	46	6	0	0	0	0	0	0	64	0	0	15	0	0	0	131
07:45 AM	0	46	7	0	0	0	0	0	0	44	0	0	9	0	1	0	107
Total	0	137	19	0	0	0	0	0	3	270	0	0	69	0	5	0	503
08:00 AM	0	48	5	0	0	0	0	0	1	34	0	0	9	0	2	0	99
08:15 AM	0	36	7	0	0	0	0	0	0	54	0	0	9	0	0	0	106
08:30 AM	0	38	4	0	0	0	0	0	0	49	0	0	5	0	0	0	96
08:45 AM	0	47	6	0	0	0	0	0	1	35	0	0	9	0	1	0	99
Total	0	169	22	0	0	0	0	0	2	172	0	0	32	0	3	0	400
09:00 AM	0	31	6	0	0	0	0	0	0	33	0	0	7	0	3	0	80
09:15 AM	0	38	3	0	0	0	0	0	1	48	0	0	1	0	1	0	92
09:30 AM	0	36	3	0	0	0	0	0	0	34	0	0	7	0	0	0	80
09:45 AM	0	31	4	0	0	0	0	0	1	38	0	0	3	0	1	0	78
Total	0	136	16	0	0	0	0	0	2	153	0	0	18	0	5	0	330
10:00 AM	0	28	6	0	0	0	0	0	1	41	0	0	9	0	0	0	85
10:15 AM	0	37	2	0	0	0	0	0	0	31	0	0	5	0	3	0	78
10:30 AM	0	30	6	0	0	0	0	0	0	42	0	0	6	0	1	0	85
10:45 AM	0	38	5	0	0	0	0	0	1	45	0	0	2	0	1	0	92
Total	0	133	19	0	0	0	0	0	2	159	0	0	22	0	5	0	340
11:00 AM	0	31	4	0	0	0	0	0	1	44	0	0	5	0	2	0	87
11:15 AM	0	23	5	0	0	0	0	0	0	35	0	0	3	0	0	0	66
11:30 AM	0	36	8	0	0	0	0	0	0	34	0	0	7	0	0	0	85
11:45 AM	0	28	5	0	0	0	0	0	1	26	0	0	6	0	1	0	67
Total	0	118	22	0	0	0	0	0	2	139	0	0	21	0	3	0	305
12:00 PM	0	33	4	0	0	0	0	0	2	31	0	0	4	0	0	0	74
12:15 PM	0	31	2	0	0	0	0	0	0	25	0	0	4	0	0	0	62
12:30 PM	0	31	6	0	0	0	0	0	0	38	0	0	6	0	1	0	82
12:45 PM	0	36	5	0	0	0	0	0	0	25	0	0	0	0	0	0	66
Total	0	131	17	0	0	0	0	0	2	119	0	0	14	0	1	0	284
01:00 PM	0	32	3	0	0	0	0	0	0	28	0	0	5	0	0	0	68
01:15 PM	0	30	10	0	0	0	0	0	0	39	0	0	8	0	1	0	88
01:30 PM	0	25	3	0	0	0	0	0	0	35	0	0	12	0	1	0	76
01:45 PM	0	36	7	0	0	0	0	0	1	39	0	0	5	0	0	0	88
Total	0	123	23	0	0	0	0	0	1	141	0	0	30	0	2	0	320
02:00 PM	0	38	9	0	0	0	0	0	0	44	0	0	6	0	0	0	97
02:15 PM	0	44	6	0	0	0	0	0	0	42	0	0	3	0	1	0	96
02:30 PM	0	47	13	0	0	0	0	0	1	50	0	0	4	0	1	0	116
02:45 PM	0	39	12	0	0	0	0	0	0	39	0	0	7	0	2	0	99
Total	0	168	40	0	0	0	0	0	1	175	0	0	20	0	4	0	408
03:00 PM	0	52	13	0	0	0	0	0	0	35	0	0	7	0	0	0	107
03:15 PM	0	50	6	0	0	0	0	0	0	49	0	0	11	0	1	0	117

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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				From East				KULA HWY From South				PUEO DR From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:30 PM	0	45	7	0	0	0	0	0	1	60	0	0	10	0	1	0	124
03:45 PM	0	37	10	0	0	0	0	0	2	42	0	0	4	0	0	0	95
Total	0	184	36	0	0	0	0	0	3	186	0	0	32	0	2	0	443
04:00 PM	0	42	10	0	0	0	0	0	1	53	0	0	2	0	0	0	108
04:15 PM	0	50	9	0	0	0	0	0	0	33	0	0	4	0	1	0	97
04:30 PM	0	37	12	0	0	0	0	0	0	28	0	0	8	0	2	0	87
04:45 PM	0	54	17	0	0	0	0	0	2	44	0	0	5	0	0	0	122
Total	0	183	48	0	0	0	0	0	3	158	0	0	19	0	3	0	414
05:00 PM	0	53	12	0	0	0	0	0	1	30	0	1	6	0	1	0	104
05:15 PM	0	55	11	0	0	0	0	0	1	40	0	0	6	0	0	0	113
05:30 PM	0	37	14	0	0	0	0	0	1	34	0	0	7	0	0	0	93
05:45 PM	0	44	13	0	0	0	0	0	0	37	0	0	6	0	0	0	100
Total	0	189	50	0	0	0	0	0	3	141	0	1	25	0	1	0	410
Grand Total	0	1761	316	0	0	0	0	0	26	1996	0	1	341	0	36	0	4477
Apprch %	0	84.8	15.2	0	0	0	0	0	1.3	98.7	0	0	90.5	0	9.5	0	
Total %	0	39.3	7.1	0	0	0	0	0	0.6	44.6	0	0	7.6	0	0.8	0	
Motorcycles	0	5	1	0	0	0	0	0	0	6	0	0	1	0	1	0	14
% Motorcycles	0	0.3	0.3	0	0	0	0	0	0	0.3	0	0	0.3	0	2.8	0	0.3
Cars & Light Goods	0	1701	301	0	0	0	0	0	24	1928	0	0	335	0	30	0	4319
% Cars & Light Goods	0	96.6	95.3	0	0	0	0	0	92.3	96.6	0	0	98.2	0	83.3	0	96.5
Buses	0	7	10	0	0	0	0	0	1	18	0	0	2	0	1	0	39
% Buses	0	0.4	3.2	0	0	0	0	0	3.8	0.9	0	0	0.6	0	2.8	0	0.9
Single-Unit Trucks	0	26	2	0	0	0	0	0	1	31	0	0	3	0	2	0	65
% Single-Unit Trucks	0	1.5	0.6	0	0	0	0	0	3.8	1.6	0	0	0.9	0	5.6	0	1.5
Articulated Trucks	0	1	1	0	0	0	0	0	0	3	0	0	0	0	1	0	6
% Articulated Trucks	0	0.1	0.3	0	0	0	0	0	0	0.2	0	0	0	0	2.8	0	0.1
Bicycles on Road	0	21	1	0	0	0	0	0	0	10	0	0	0	0	1	0	33
% Bicycles on Road	0	1.2	0.3	0	0	0	0	0	0	0.5	0	0	0	0	2.8	0	0.7
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0

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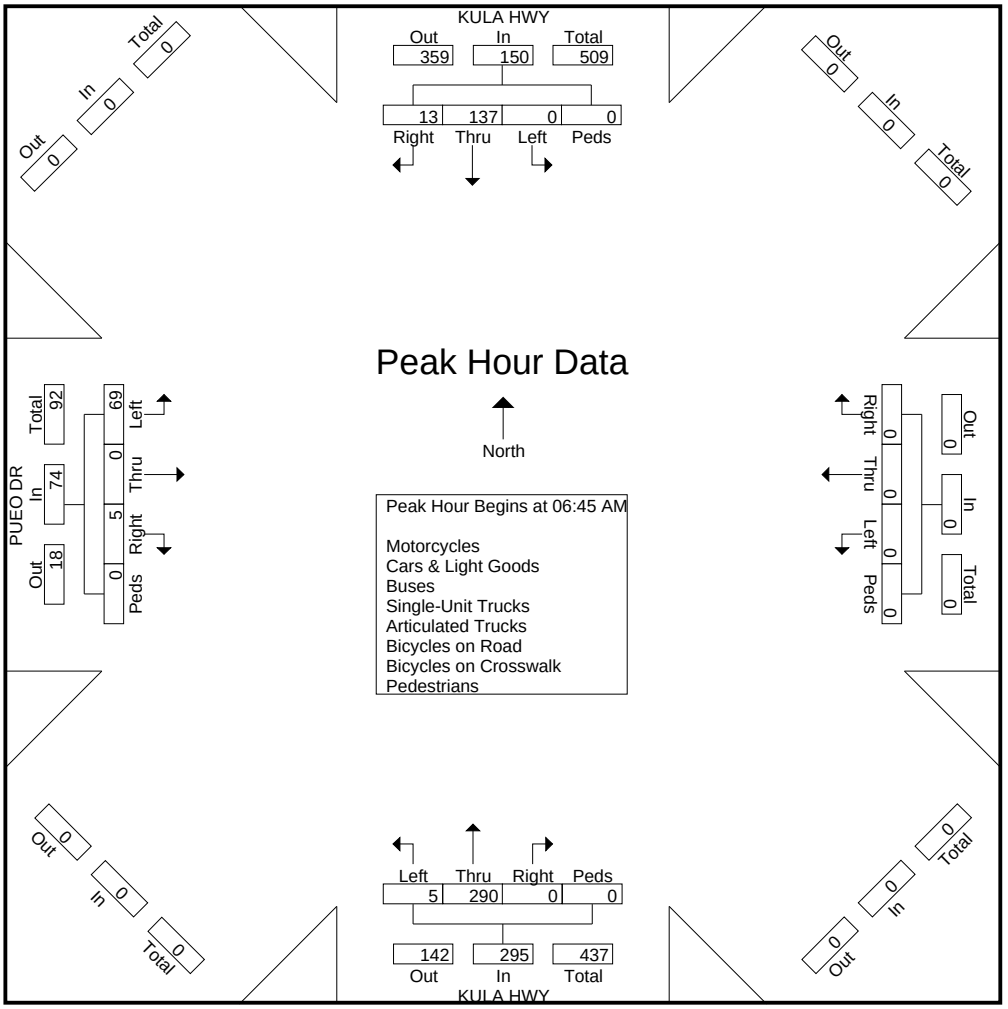
	KULA HWY From North					From East					KULA HWY From South					PUEO DR From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	0	**46**	1	0	47	0	0	0	0	0	**2**	64	0	0	66	9	0	1	0	10	123
07:00 AM	0	21	1	0	22	0	0	0	0	0	1	74	0	0	75	20	0	**2**	0	22	119
07:15 AM	0	24	5	0	29	0	0	0	0	0	2	**88**	0	0	**90**	**25**	0	2	0	**27**	**146**
07:30 AM	0	46	**6**	0	**52**	0	0	0	0	0	0	64	0	0	64	15	0	0	0	15	131
Total Volume	0	137	13	0	150	0	0	0	0	0	5	290	0	0	295	69	0	5	0	74	519
% App. Total	0	91.3	8.7	0		0	0	0	0		1.7	98.3	0	0		93.2	0	6.8	0		
PHF	.000	.745	.542	.000	.721	.000	.000	.000	.000	.000	.625	.824	.000	.000	.819	.690	.000	.625	.000	.685	.889



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File Name : Kula Hwy - Pueo Dr
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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				From East				KULA HWY From South				PUEO DR From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	0	33	0	0	0	0	0	0	0	43	0	0	8	0	1	0	85
06:45 AM	0	46	1	0	0	0	0	0	2	64	0	0	9	0	1	0	123
Total	0	79	1	0	0	0	0	0	2	107	0	0	17	0	2	0	208
07:00 AM	0	21	1	0	0	0	0	0	1	74	0	0	20	0	2	0	119
07:15 AM	0	24	5	0	0	0	0	0	2	88	0	0	25	0	2	0	146
07:30 AM	0	46	6	0	0	0	0	0	0	64	0	0	15	0	0	0	131
07:45 AM	0	46	7	0	0	0	0	0	0	44	0	0	9	0	1	0	107
Total	0	137	19	0	0	0	0	0	3	270	0	0	69	0	5	0	503
08:00 AM	0	48	5	0	0	0	0	0	1	34	0	0	9	0	2	0	99
08:15 AM	0	36	7	0	0	0	0	0	0	54	0	0	9	0	0	0	106
Grand Total	0	300	32	0	0	0	0	0	6	465	0	0	104	0	9	0	916
Apprch %	0	90.4	9.6	0	0	0	0	0	1.3	98.7	0	0	92	0	8	0	
Total %	0	32.8	3.5	0	0	0	0	0	0.7	50.8	0	0	11.4	0	1	0	
Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cars & Light Goods	0	294	31	0	0	0	0	0	6	454	0	0	103	0	8	0	896
% Cars & Light Goods	0	98	96.9	0	0	0	0	0	100	97.6	0	0	99	0	88.9	0	97.8
Buses	0	2	1	0	0	0	0	0	0	6	0	0	1	0	1	0	11
% Buses	0	0.7	3.1	0	0	0	0	0	0	1.3	0	0	1	0	11.1	0	1.2
Single-Unit Trucks	0	4	0	0	0	0	0	0	0	3	0	0	0	0	0	0	7
% Single-Unit Trucks	0	1.3	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0.8
Articulated Trucks	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0.2
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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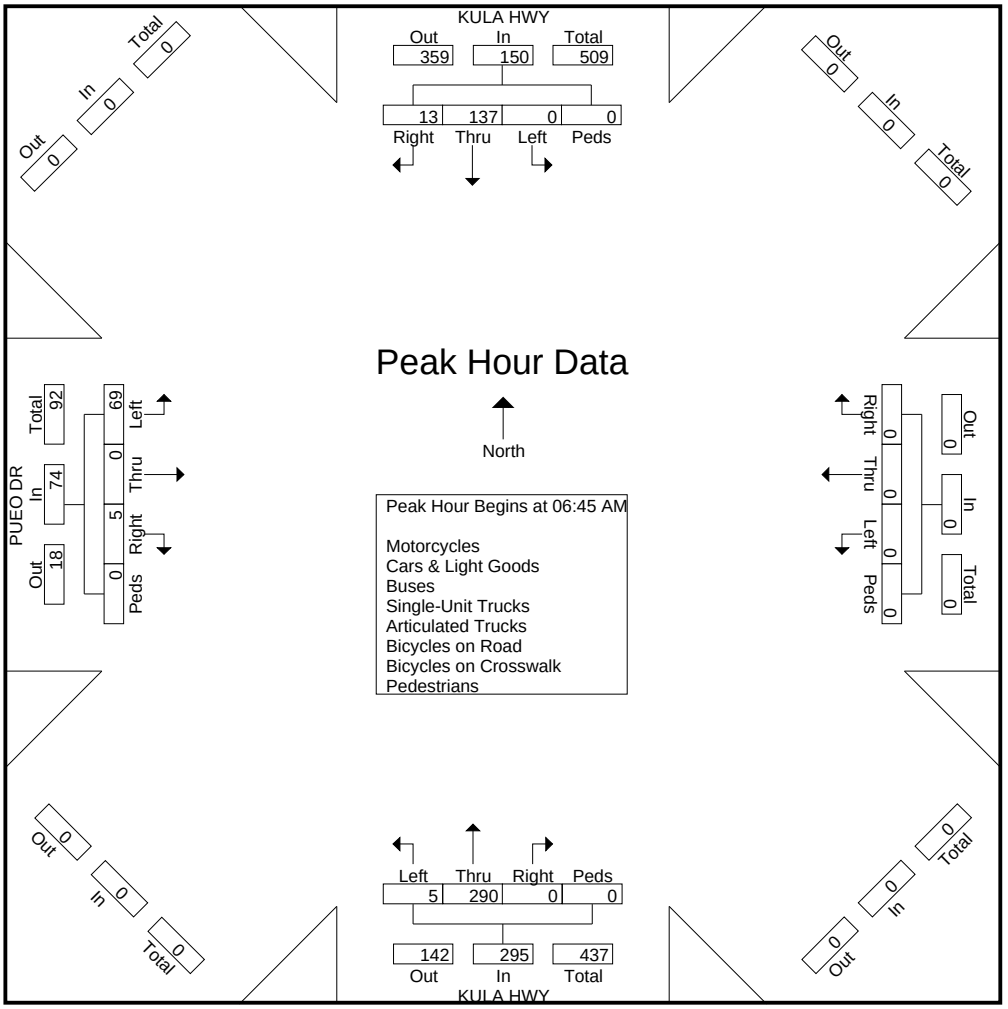
	KULA HWY From North					From East					KULA HWY From South					PUEO DR From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	0	**46**	1	0	47	0	0	0	0	0	**2**	64	0	0	66	9	0	1	0	10	123
07:00 AM	0	21	1	0	22	0	0	0	0	0	1	74	0	0	75	20	0	**2**	0	22	119
07:15 AM	0	24	5	0	29	0	0	0	0	0	2	**88**	0	0	**90**	**25**	0	2	0	**27**	**146**
07:30 AM	0	46	**6**	0	**52**	0	0	0	0	0	0	64	0	0	64	15	0	0	0	15	131
Total Volume	0	137	13	0	150	0	0	0	0	0	5	290	0	0	295	69	0	5	0	74	519
% App. Total	0	91.3	8.7	0		0	0	0	0		1.7	98.3	0	0		93.2	0	6.8	0		
PHF	.000	.745	.542	.000	.721	.000	.000	.000	.000	.000	.625	.824	.000	.000	.819	.690	.000	.625	.000	.685	.889



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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				From East				KULA HWY From South				PUEO DR From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:30 PM	0	45	7	0	0	0	0	0	1	60	0	0	10	0	1	0	124
03:45 PM	0	37	10	0	0	0	0	0	2	42	0	0	4	0	0	0	95
Total	0	82	17	0	0	0	0	0	3	102	0	0	14	0	1	0	219
04:00 PM	0	42	10	0	0	0	0	0	1	53	0	0	2	0	0	0	108
04:15 PM	0	50	9	0	0	0	0	0	0	33	0	0	4	0	1	0	97
04:30 PM	0	37	12	0	0	0	0	0	0	28	0	0	8	0	2	0	87
04:45 PM	0	54	17	0	0	0	0	0	2	44	0	0	5	0	0	0	122
Total	0	183	48	0	0	0	0	0	3	158	0	0	19	0	3	0	414
05:00 PM	0	53	12	0	0	0	0	0	1	30	0	1	6	0	1	0	104
05:15 PM	0	55	11	0	0	0	0	0	1	40	0	0	6	0	0	0	113
Grand Total	0	373	88	0	0	0	0	0	8	330	0	1	45	0	5	0	850
Apprch %	0	80.9	19.1	0	0	0	0	0	2.4	97.3	0	0.3	90	0	10	0	
Total %	0	43.9	10.4	0	0	0	0	0	0.9	38.8	0	0.1	5.3	0	0.6	0	
Motorcycles	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3
% Motorcycles	0	0.3	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0.4
Cars & Light Goods	0	367	88	0	0	0	0	0	8	326	0	0	45	0	5	0	839
% Cars & Light Goods	0	98.4	100	0	0	0	0	0	100	98.8	0	0	100	0	100	0	98.7
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Single-Unit Trucks	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	6
% Single-Unit Trucks	0	1.1	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0.7
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Bicycles on Road	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0.1

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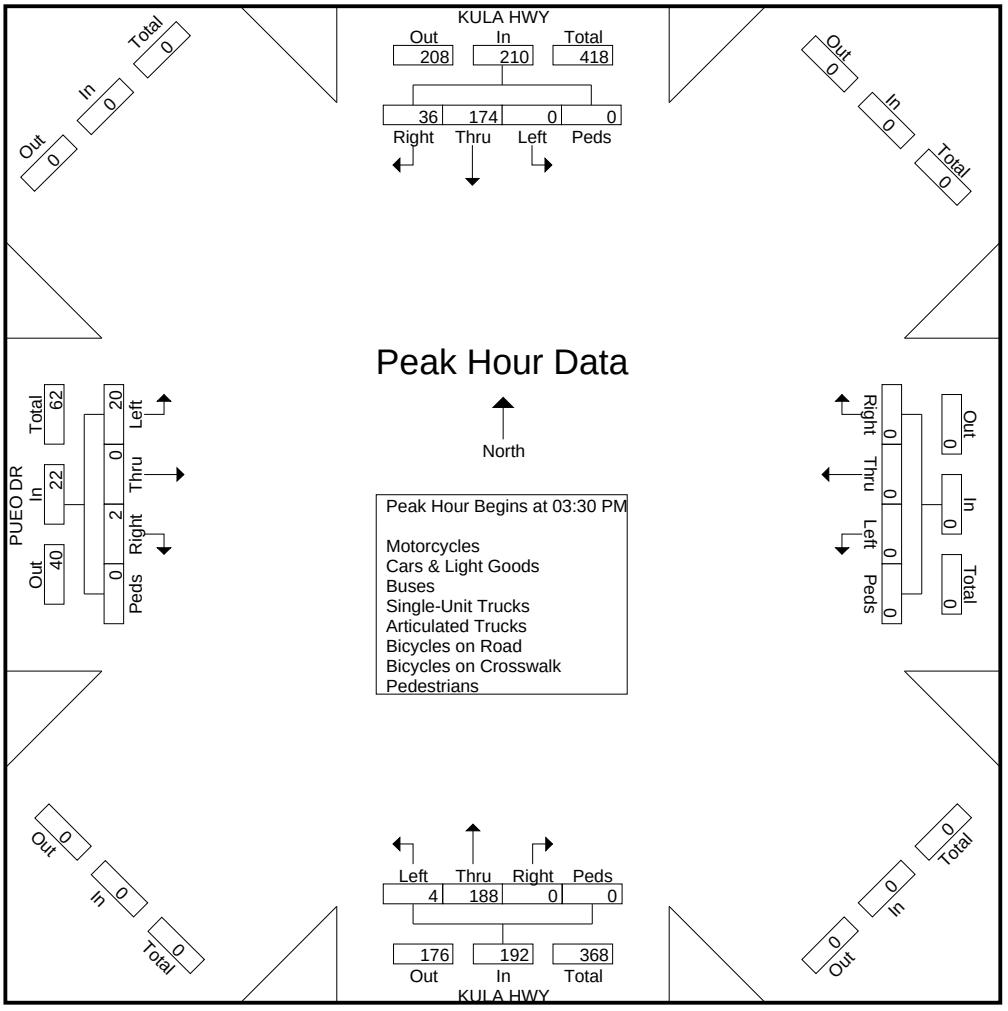
	KULA HWY From North					From East					KULA HWY From South					PUEO DR From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	45	7	0	52	0	0	0	0	0	1	**60**	0	0	**61**	**10**	0	**1**	0	**11**	**124**
03:45 PM	0	37	**10**	0	47	0	0	0	0	0	**2**	42	0	0	44	4	0	0	0	4	95
04:00 PM	0	42	10	0	52	0	0	0	0	0	1	53	0	0	54	2	0	0	0	2	108
04:15 PM	0	**50**	9	0	**59**	0	0	0	0	0	0	33	0	0	33	4	0	1	0	5	97
Total Volume	0	174	36	0	210	0	0	0	0	0	4	188	0	0	192	20	0	2	0	22	424
% App. Total	0	82.9	17.1	0		0	0	0	0		2.1	97.9	0	0		90.9	0	9.1	0		
PHF	.000	.870	.900	.000	.890	.000	.000	.000	.000	.000	.500	.783	.000	.000	.787	.500	.000	.500	.000	.500	.855



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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				THOMPSON RD From East				KULA HWY From South				PRIVATE DWY From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	16	13	1	0	0	0	0	0	1	6	0	0	1	0	0	0	38
06:45 AM	31	9	1	0	0	0	4	0	0	15	1	0	2	1	0	0	64
Total	47	22	2	0	0	0	4	0	1	21	1	0	3	1	0	0	102
07:00 AM	5	7	0	0	0	0	5	0	0	22	0	0	0	0	0	0	39
07:15 AM	10	6	0	0	0	0	3	0	0	17	1	0	2	0	0	0	39
07:30 AM	10	13	0	0	0	0	12	1	0	14	0	0	1	0	0	0	51
07:45 AM	16	9	0	0	0	0	2	0	0	11	0	0	0	0	0	0	38
Total	41	35	0	0	0	0	22	1	0	64	1	0	3	0	0	0	167
08:00 AM	6	19	0	0	1	0	4	0	0	17	0	0	1	0	0	0	48
08:15 AM	4	16	1	0	0	0	3	2	0	19	0	0	1	0	0	0	46
Grand Total	98	92	3	0	1	0	33	3	1	121	2	0	8	1	0	0	363
Apprch %	50.8	47.7	1.6	0	2.7	0	89.2	8.1	0.8	97.6	1.6	0	88.9	11.1	0	0	
Total %	27	25.3	0.8	0	0.3	0	9.1	0.8	0.3	33.3	0.6	0	2.2	0.3	0	0	
Motorcycles	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Motorcycles	0	0	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	0.3
Cars & Light Goods	97	91	3	0	1	0	33	0	1	114	2	0	8	1	0	0	351
% Cars & Light Goods	99	98.9	100	0	100	0	100	0	100	94.2	100	0	100	100	0	0	96.7
Buses	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
% Buses	0	0	0	0	0	0	0	0	0	2.5	0	0	0	0	0	0	0.8
Single-Unit Trucks	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
% Single-Unit Trucks	1	1.1	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	0.8
Articulated Trucks	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	0.3
Bicycles on Road	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	0.3
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0.8

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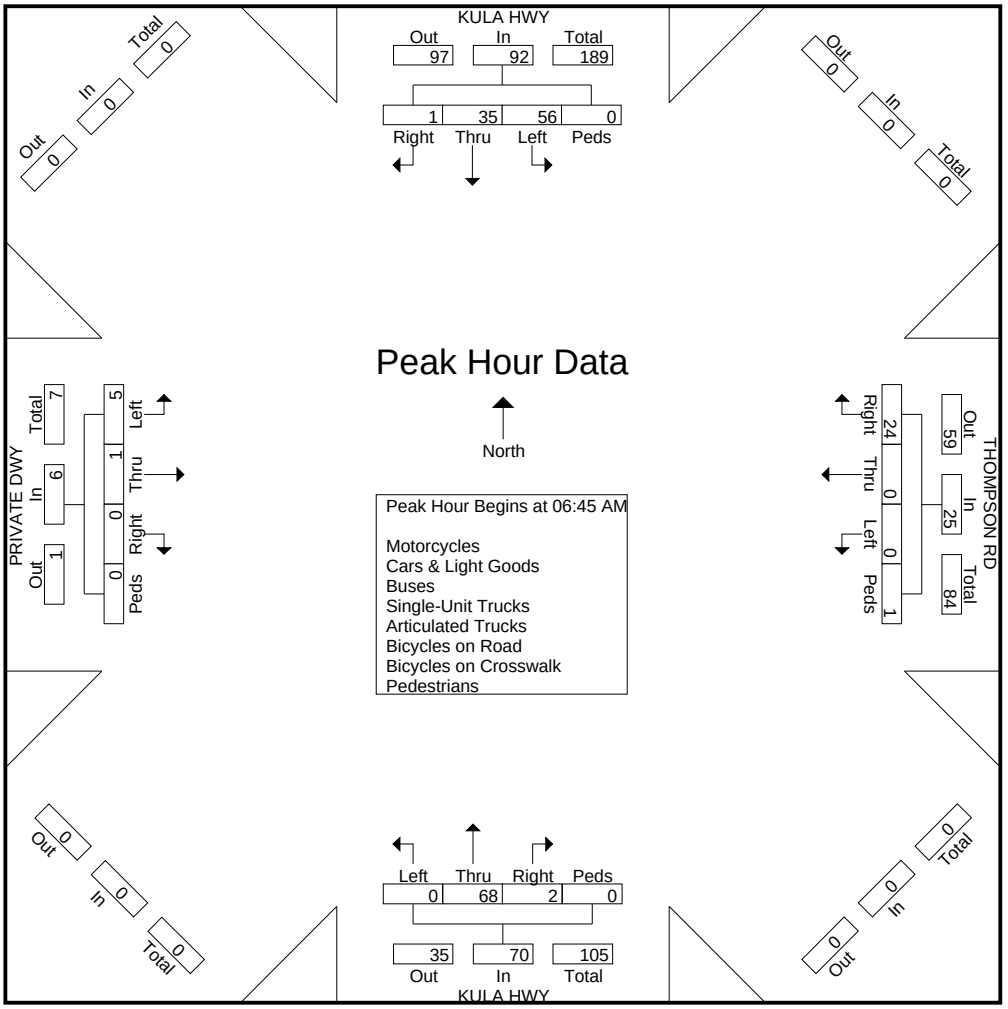
	KULA HWY From North					THOMPSON RD From East					KULA HWY From South					PRIVATE DWY From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	**31**	9	**1**	0	**41**	0	0	4	0	4	0	15	**1**	0	16	**2**	**1**	0	0	**3**	**64**
07:00 AM	5	7	0	0	12	0	0	5	0	5	0	**22**	0	0	**22**	0	0	0	0	0	39
07:15 AM	10	6	0	0	16	0	0	3	0	3	0	17	1	0	18	2	0	0	0	2	39
07:30 AM	10	**13**	0	0	23	0	0	**12**	**1**	**13**	0	14	0	0	14	1	0	0	0	1	51
Total Volume	56	35	1	0	92	0	0	24	1	25	0	68	2	0	70	5	1	0	0	6	193
% App. Total	60.9	38	1.1	0		0	0	96	4		0	97.1	2.9	0		83.3	16.7	0	0		
PHF	.452	.673	.250	.000	.561	.000	.000	.500	.250	.481	.000	.773	.500	.000	.795	.625	.250	.000	.000	.500	.754



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Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KULA HWY From North				THOMPSON RD From East				KULA HWY From South				PRIVATE DWY From West				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:30 PM	4	18	0	0	1	0	27	0	0	29	0	0	0	0	0	0	79
03:45 PM	1	16	2	0	0	0	14	0	0	14	0	0	0	0	0	0	47
Total	5	34	2	0	1	0	41	0	0	43	0	0	0	0	0	0	126
04:00 PM	5	12	1	0	0	0	19	0	0	18	1	0	1	0	0	0	57
04:15 PM	2	17	1	0	0	0	8	0	0	7	0	0	0	0	1	0	36
04:30 PM	4	13	1	0	1	0	11	0	0	14	0	0	0	0	0	0	44
04:45 PM	4	11	1	0	0	1	6	0	0	18	0	0	1	0	0	0	42
Total	15	53	4	0	1	1	44	0	0	57	1	0	2	0	1	0	179
05:00 PM	8	18	2	0	0	0	0	0	0	14	1	0	1	0	0	0	44
05:15 PM	5	12	1	0	0	0	4	0	0	15	1	0	1	0	0	0	39
Grand Total	33	117	9	0	2	1	89	0	0	129	3	0	4	0	1	0	388
Apprch %	20.8	73.6	5.7	0	2.2	1.1	96.7	0	0	97.7	2.3	0	80	0	20	0	
Total %	8.5	30.2	2.3	0	0.5	0.3	22.9	0	0	33.2	0.8	0	1	0	0.3	0	
Motorcycles	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3
% Motorcycles	0	0.9	0	0	0	0	0	0	0	1.6	0	0	0	0	0	0	0.8
Cars & Light Goods	31	115	9	0	2	1	87	0	0	125	3	0	4	0	1	0	378
% Cars & Light Goods	93.9	98.3	100	0	100	100	97.8	0	0	96.9	100	0	100	0	100	0	97.4
Buses	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Buses	0	0	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	0.3
Single-Unit Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Single-Unit Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	2	1	0	0	0	0	2	0	0	1	0	0	0	0	0	0	6
% Bicycles on Road	6.1	0.9	0	0	0	0	2.2	0	0	0.8	0	0	0	0	0	0	1.5
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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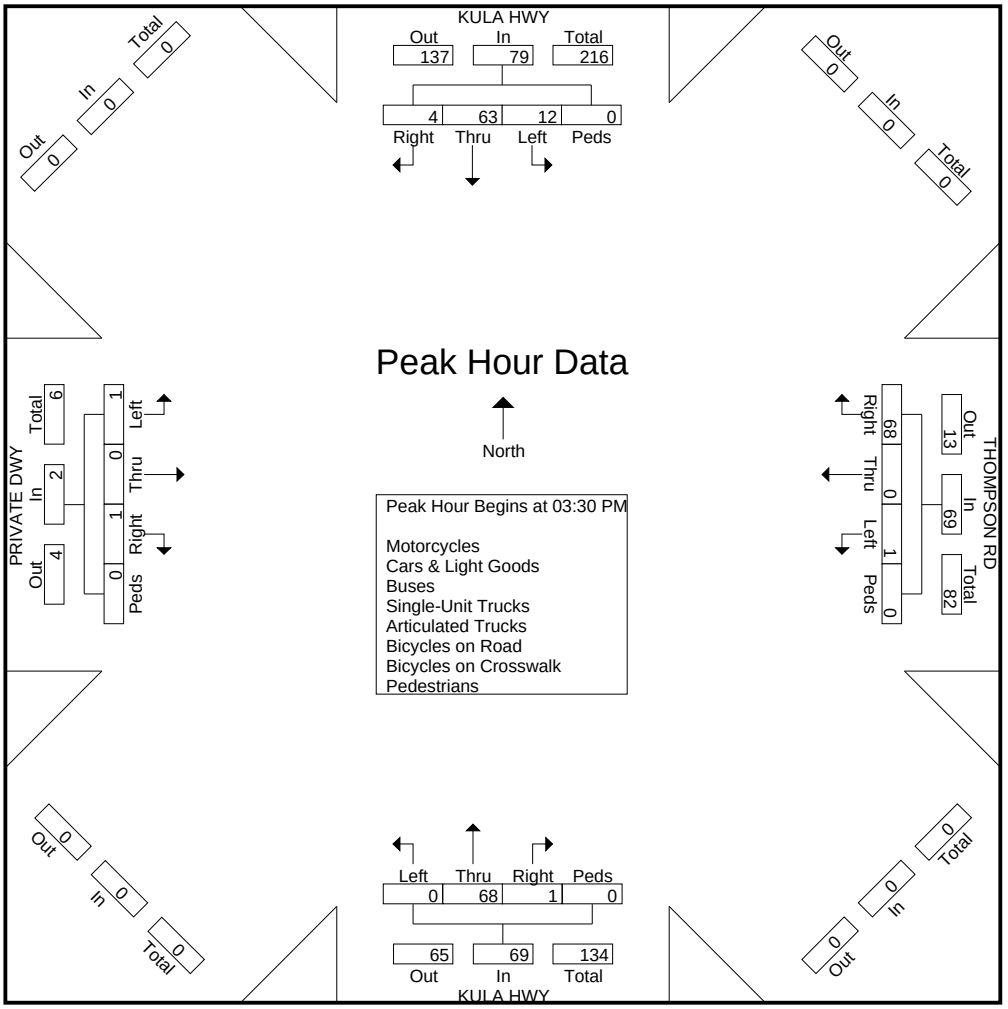
File Name : Kula Hwy - Thompson Rd
Site Code : 24-506 Waiohuli Economic Development
Start Date : 2/13/2024
Page No : 2

	KULA HWY From North					THOMPSON RD From East					KULA HWY From South					PRIVATE DWY From West					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 05:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	4	**18**	0	0	**22**	**1**	0	**27**	0	**28**	0	**29**	0	0	**29**	0	0	0	0	0	**79**
03:45 PM	1	16	**2**	0	19	0	0	14	0	14	0	14	0	0	14	0	0	0	0	0	47
04:00 PM	**5**	12	1	0	18	0	0	19	0	19	0	18	**1**	0	19	**1**	0	0	0	**1**	57
04:15 PM	2	17	1	0	20	0	0	8	0	8	0	7	0	0	7	0	0	**1**	0	1	36
Total Volume	12	63	4	0	79	1	0	68	0	69	0	68	1	0	69	1	0	1	0	2	219
% App. Total	15.2	79.7	5.1	0		1.4	0	98.6	0		0	98.6	1.4	0		50	0	50	0		
PHF	.600	.875	.500	.000	.898	.250	.000	.630	.000	.616	.000	.586	.250	.000	.595	.250	.000	.250	.000	.500	.693



APPENDIX B

LEVEL OF SERVICE CRITERIA

APPENDIX A – LEVEL OF SERVICE (LOS) CRITERIA

VEHICULAR LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS (HCM 7th EDITION)

Level of service for vehicles at signalized intersections is directly related to delay values and is assigned on that basis. Level of Service is a measure of the acceptability of delay values to motorists at a given intersection. The criteria are given in the table below.

Level-of Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (sec./veh.)
A	< 10.0
B	>10.0 and ≤ 20.0
C	>20.0 and ≤ 35.0
D	>35.0 and ≤ 55.0
E	>55.0 and ≤ 80.0
F	> 80.0

Delay is a complex measure, and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group or approach in question.

VEHICULAR LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS (HCM 7th EDITION)

The level of service criteria for vehicles at unsignalized intersections is defined as the average control delay, in seconds per vehicle.

LOS delay threshold values are lower for two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections than those of signalized intersections. This is because more vehicles pass through signalized intersections, and therefore, drivers expect and tolerate greater delays. While the criteria for level of service for TWSC and AWSC intersections are the same, procedures to calculate the average total delay may differ.

Level of Service Criteria for Two-Way Stop-Controlled Intersections

Level of Service	Average Control Delay (sec/veh)
A	≤ 10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	> 50

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Existing AM

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	1	10	0	59	1	374	19	28	136	1
Future Vol, veh/h	1	0	1	10	0	59	1	374	19	28	136	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	1	11	0	64	1	407	21	30	148	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	618	639	148	628	629	417	149	0	0	427	0	0
Stage 1	209	209	-	419	419	-	-	-	-	-	-	-
Stage 2	409	429	-	209	210	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	402	394	898	396	399	636	1433	-	-	1132	-	-
Stage 1	793	729	-	612	590	-	-	-	-	-	-	-
Stage 2	620	584	-	793	729	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	350	382	898	383	387	636	1433	-	-	1132	-	-
Mov Cap-2 Maneuver	350	382	-	383	387	-	-	-	-	-	-	-
Stage 1	792	708	-	611	589	-	-	-	-	-	-	-
Stage 2	557	583	-	769	707	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	12.18	12.12	0.02	1.4
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1433	-	-	504	580	1132	-	-
HCM Lane V/C Ratio	0.001	-	-	0.004	0.129	0.027	-	-
HCM Control Delay (s/veh)	7.5	0	-	12.2	12.1	8.3	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.4	0.1	-	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	69	5	5	290	137	13
Future Vol, veh/h	69	5	5	290	137	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	75	5	5	315	149	14

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	482	156	163	0	-	0
Stage 1	156	-	-	-	-	-
Stage 2	326	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	543	890	1416	-	-	-
Stage 1	872	-	-	-	-	-
Stage 2	731	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	541	890	1416	-	-	-
Mov Cap-2 Maneuver	541	-	-	-	-	-
Stage 1	868	-	-	-	-	-
Stage 2	731	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	12.58	0.13	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1416	-	555	-	-
HCM Lane V/C Ratio	0.004	-	0.145	-	-
HCM Control Delay (s/veh)	7.6	0	12.6	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.5	-	-

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	146	2	0	150	111	26
Future Vol, veh/h	146	2	0	150	111	26
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	159	2	0	163	121	28

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	298	135	149	0	-	0
Stage 1	135	-	-	-	-	-
Stage 2	163	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	693	914	1433	-	-	-
Stage 1	892	-	-	-	-	-
Stage 2	866	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	693	914	1433	-	-	-
Mov Cap-2 Maneuver	693	-	-	-	-	-
Stage 1	892	-	-	-	-	-
Stage 2	866	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	11.72	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1433	-	696	-	-
HCM Lane V/C Ratio	-	-	0.231	-	-
HCM Control Delay (s/veh)	0	-	11.7	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0	-	0.9	-	-

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	1	0	0	0	24	0	68	2	56	35	1
Future Vol, veh/h	5	1	0	0	0	24	0	68	2	56	35	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	1	0	0	0	26	0	74	2	61	38	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	234	236	39	235	236	75	39	0	0	76	0	0
Stage 1	160	160	-	75	75	-	-	-	-	-	-	-
Stage 2	74	76	-	160	161	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	-	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	-	-	-	2.218	-	-
Pot Cap-1 Maneuver	720	664	1033	719	665	986	0	-	-	1523	-	-
Stage 1	842	765	-	934	833	-	0	-	-	-	-	-
Stage 2	935	832	-	842	765	-	0	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	673	637	1033	689	638	986	-	-	-	1523	-	-
Mov Cap-2 Maneuver	673	637	-	689	638	-	-	-	-	-	-	-
Stage 1	842	734	-	934	833	-	-	-	-	-	-	-
Stage 2	911	832	-	806	734	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	10.45	8.75	0	4.54
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	-	-	666	986	1523	-	-
HCM Lane V/C Ratio	-	-	0.01	0.026	0.04	-	-
HCM Control Delay (s/veh)	-	-	10.5	8.7	7.5	0	-
HCM Lane LOS	-	-	B	A	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	22	0	0	49	29	7
Future Vol, veh/h	22	0	0	49	29	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	24	0	0	53	32	8

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	89	35	39	0	-	0
Stage 1	35	-	-	-	-	-
Stage 2	53	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	912	1037	1571	-	-	-
Stage 1	987	-	-	-	-	-
Stage 2	969	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	912	1037	1571	-	-	-
Mov Cap-2 Maneuver	912	-	-	-	-	-
Stage 1	987	-	-	-	-	-
Stage 2	969	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	9.05	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1571	-	912	-	-
HCM Lane V/C Ratio	-	-	0.026	-	-
HCM Control Delay (s/veh)	0	-	9.1	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Existing PM

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	2	1	14	1	40	2	214	26	57	229	1
Future Vol, veh/h	0	2	1	14	1	40	2	214	26	57	229	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2	1	15	1	43	2	233	28	62	249	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	611	639	249	625	625	247	250	0	0	261	0	0
Stage 1	373	373	-	251	251	-	-	-	-	-	-	-
Stage 2	238	265	-	374	374	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	406	394	789	397	401	792	1316	-	-	1304	-	-
Stage 1	647	618	-	753	699	-	-	-	-	-	-	-
Stage 2	766	689	-	647	618	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	361	372	789	372	378	792	1316	-	-	1304	-	-
Mov Cap-2 Maneuver	361	372	-	372	378	-	-	-	-	-	-	-
Stage 1	646	584	-	752	698	-	-	-	-	-	-	-
Stage 2	721	688	-	608	584	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	13.04	11.59	0.06	1.57
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1316	-	-	451	606	1304	-	-
HCM Lane V/C Ratio	0.002	-	-	0.007	0.099	0.048	-	-
HCM Control Delay (s/veh)	7.7	0	-	13	11.6	7.9	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.3	0.1	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	20	2	4	188	174	36
Future Vol, veh/h	20	2	4	188	174	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	2	4	204	189	39

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	422	209	228	0	-	0
Stage 1	209	-	-	-	-	-
Stage 2	213	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	589	832	1340	-	-	-
Stage 1	826	-	-	-	-	-
Stage 2	822	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	586	832	1340	-	-	-
Mov Cap-2 Maneuver	586	-	-	-	-	-
Stage 1	823	-	-	-	-	-
Stage 2	822	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	11.22	0.16	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1340	-	603	-	-
HCM Lane V/C Ratio	0.003	-	0.04	-	-
HCM Control Delay (s/veh)	7.7	0	11.2	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	32	1	3	157	102	64
Future Vol, veh/h	32	1	3	157	102	64
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	35	1	3	171	111	70

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	323	146	180	0	-	0
Stage 1	146	-	-	-	-	-
Stage 2	177	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	671	901	1395	-	-	-
Stage 1	882	-	-	-	-	-
Stage 2	854	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	669	901	1395	-	-	-
Mov Cap-2 Maneuver	669	-	-	-	-	-
Stage 1	879	-	-	-	-	-
Stage 2	854	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	10.64	0.14	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1395	-	674	-	-
HCM Lane V/C Ratio	0.002	-	0.053	-	-
HCM Control Delay (s/veh)	7.6	0	10.6	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	1	1	0	68	0	68	1	12	63	4
Future Vol, veh/h	1	0	1	1	0	68	0	68	1	12	63	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	1	1	0	74	0	74	1	13	68	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	171	172	71	169	173	74	73	0	0	75	0	0
Stage 1	97	97	-	74	74	-	-	-	-	-	-	-
Stage 2	74	75	-	95	99	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	793	721	992	795	720	987	1527	-	-	1524	-	-
Stage 1	910	815	-	935	833	-	-	-	-	-	-	-
Stage 2	935	833	-	912	813	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	727	715	992	787	713	987	1527	-	-	1524	-	-
Mov Cap-2 Maneuver	727	715	-	787	713	-	-	-	-	-	-	-
Stage 1	910	808	-	935	833	-	-	-	-	-	-	-
Stage 2	865	833	-	903	806	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	9.3	8.96	0	1.12
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1527	-	-	839	983	1524	-	-
HCM Lane V/C Ratio	-	-	-	0.003	0.076	0.009	-	-
HCM Control Delay (s/veh)	0	-	-	9.3	9	7.4	0	-
HCM Lane LOS	A	-	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.2	0	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	0	1	67	49	14
Future Vol, veh/h	3	0	1	67	49	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	0	1	73	53	15

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	136	61	68	0	-	0
Stage 1	61	-	-	-	-	-
Stage 2	75	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	858	1004	1533	-	-	-
Stage 1	962	-	-	-	-	-
Stage 2	948	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	857	1004	1533	-	-	-
Mov Cap-2 Maneuver	857	-	-	-	-	-
Stage 1	961	-	-	-	-	-
Stage 2	948	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	9.22	0.11	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1533	-	857	-	-
HCM Lane V/C Ratio	0.001	-	0.004	-	-
HCM Control Delay (s/veh)	7.4	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Base Year AM (No Mitigation)

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	1	10	0	59	1	702	19	28	348	1
Future Vol, veh/h	1	0	1	10	0	59	1	702	19	28	348	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	1	11	0	64	1	763	21	30	378	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1205	1226	379	1215	1216	773	379	0	0	784	0	0
Stage 1	440	440	-	776	776	-	-	-	-	-	-	-
Stage 2	765	786	-	439	440	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	161	179	668	158	181	399	1179	-	-	835	-	-
Stage 1	596	578	-	391	408	-	-	-	-	-	-	-
Stage 2	396	403	-	597	577	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	128	170	668	150	172	399	1179	-	-	835	-	-
Mov Cap-2 Maneuver	128	170	-	150	172	-	-	-	-	-	-	-
Stage 1	595	551	-	390	407	-	-	-	-	-	-	-
Stage 2	332	403	-	568	551	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	21.88	19.56	0.01	0.7
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1179	-	-	215	322	835	-	-
HCM Lane V/C Ratio	0.001	-	-	0.01	0.233	0.036	-	-
HCM Control Delay (s/veh)	8.1	0	-	21.9	19.6	9.5	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.9	0.1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	31	676	2	6	368
Future Vol, veh/h	2	31	676	2	6	368
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	34	735	2	7	400

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1149	736	0	0	737	0
Stage 1	736	-	-	-	-	-
Stage 2	413	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	219	419	-	-	869	-
Stage 1	474	-	-	-	-	-
Stage 2	668	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	217	419	-	-	869	-
Mov Cap-2 Maneuver	217	-	-	-	-	-
Stage 1	474	-	-	-	-	-
Stage 2	661	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	14.97	0	0.15
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	397	869	-
HCM Lane V/C Ratio	-	-	0.09	0.008	-
HCM Control Delay (s/veh)	-	-	15	9.2	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	69	5	5	606	350	13
Future Vol, veh/h	69	5	5	606	350	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	75	5	5	659	380	14

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1057	388	395	0	-	0
Stage 1	388	-	-	-	-	-
Stage 2	670	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	249	661	1164	-	-	-
Stage 1	686	-	-	-	-	-
Stage 2	509	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	247	661	1164	-	-	-
Mov Cap-2 Maneuver	247	-	-	-	-	-
Stage 1	681	-	-	-	-	-
Stage 2	509	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	25.12	0.07	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1164	-	258	-	-
HCM Lane V/C Ratio	0.005	-	0.311	-	-
HCM Control Delay (s/veh)	8.1	0	25.1	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0	-	1.3	-	-

Intersection	
Int Delay, s/veh	11.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	309	2	0	284	260	86
Future Vol, veh/h	309	2	0	284	260	86
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	336	2	0	309	283	93

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	638	329	376	0	-	0
Stage 1	329	-	-	-	-	-
Stage 2	309	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	441	712	1182	-	-	-
Stage 1	729	-	-	-	-	-
Stage 2	745	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	441	712	1182	-	-	-
Mov Cap-2 Maneuver	441	-	-	-	-	-
Stage 1	729	-	-	-	-	-
Stage 2	745	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	35.11	0	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1182	-	442	-	-
HCM Lane V/C Ratio	-	-	0.765	-	-
HCM Control Delay (s/veh)	0	-	35.1	-	-
HCM Lane LOS	A	-	E	-	-
HCM 95th %tile Q(veh)	0	-	6.5	-	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↰			↕	
Traffic Vol, veh/h	14	1	1	0	0	24	1	182	2	56	164	11
Future Vol, veh/h	14	1	1	0	0	24	1	182	2	56	164	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	1	1	0	0	26	1	198	2	61	178	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	506	508	184	502	513	199	190	0	0	200	0	0
Stage 1	306	306	-	201	201	-	-	-	-	-	-	-
Stage 2	200	202	-	301	312	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	477	468	858	480	465	842	1384	-	-	1372	-	-
Stage 1	704	662	-	801	735	-	-	-	-	-	-	-
Stage 2	802	734	-	708	658	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	439	444	858	454	441	842	1384	-	-	1372	-	-
Mov Cap-2 Maneuver	439	444	-	454	441	-	-	-	-	-	-	-
Stage 1	703	629	-	800	734	-	-	-	-	-	-	-
Stage 2	776	733	-	671	625	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	13.27	9.41	0.04	1.88
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1384	-	-	453	842	1372	-	-
HCM Lane V/C Ratio	0.001	-	-	0.038	0.031	0.044	-	-
HCM Control Delay (s/veh)	7.6	0	-	13.3	9.4	7.7	0	-
HCM Lane LOS	A	A	-	B	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	125	21	7	59	123	43
Future Vol, veh/h	125	21	7	59	123	43
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	136	23	8	64	134	47

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	236	157	180	0	-	0
Stage 1	157	-	-	-	-	-
Stage 2	79	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	752	888	1395	-	-	-
Stage 1	871	-	-	-	-	-
Stage 2	944	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	748	888	1395	-	-	-
Mov Cap-2 Maneuver	748	-	-	-	-	-
Stage 1	866	-	-	-	-	-
Stage 2	944	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	10.93	0.81	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1395	-	765	-	-
HCM Lane V/C Ratio	0.005	-	0.207	-	-
HCM Control Delay (s/veh)	7.6	0	10.9	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.8	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Base Year PM (No Mitigation)

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	2	1	14	1	40	2	536	26	57	650	1
Future Vol, veh/h	0	2	1	14	1	40	2	536	26	57	650	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2	1	15	1	43	2	583	28	62	707	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1418	1446	707	1433	1433	597	708	0	0	611	0	0
Stage 1	831	831	-	601	601	-	-	-	-	-	-	-
Stage 2	588	615	-	832	832	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	114	132	435	112	134	503	891	-	-	968	-	-
Stage 1	364	384	-	487	489	-	-	-	-	-	-	-
Stage 2	495	482	-	364	384	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	92	117	435	98	119	503	891	-	-	968	-	-
Mov Cap-2 Maneuver	92	117	-	98	119	-	-	-	-	-	-	-
Stage 1	363	344	-	485	487	-	-	-	-	-	-	-
Stage 2	450	480	-	322	344	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	28.73	25.12	0.03	0.72
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	891	-	-	155	238	968	-	-
HCM Lane V/C Ratio	0.002	-	-	0.021	0.251	0.064	-	-
HCM Control Delay (s/veh)	9.1	0	-	28.7	25.1	9	0	-
HCM Lane LOS	A	A	-	D	D	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1	0.2	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	24	525	3	27	618
Future Vol, veh/h	0	24	525	3	27	618
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	26	571	3	29	672

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1303	572	0	0	574	0
Stage 1	572	-	-	-	-	-
Stage 2	730	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	177	519	-	-	999	-
Stage 1	564	-	-	-	-	-
Stage 2	477	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	169	519	-	-	999	-
Mov Cap-2 Maneuver	169	-	-	-	-	-
Stage 1	564	-	-	-	-	-
Stage 2	454	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	12.3	0	0.36
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	519	999	-
HCM Lane V/C Ratio	-	-	0.05	0.029	-
HCM Control Delay (s/veh)	-	-	12.3	8.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	20	2	4	506	588	36
Future Vol, veh/h	20	2	4	506	588	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	2	4	550	639	39

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1217	659	678	0	-	0
Stage 1	659	-	-	-	-	-
Stage 2	559	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	200	464	914	-	-	-
Stage 1	515	-	-	-	-	-
Stage 2	573	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	198	464	914	-	-	-
Mov Cap-2 Maneuver	198	-	-	-	-	-
Stage 1	511	-	-	-	-	-
Stage 2	573	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	24.43	0.07	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	914	-	209	-	-
HCM Lane V/C Ratio	0.005	-	0.114	-	-
HCM Control Delay (s/veh)	9	0	24.4	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	0.4	-	-

Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	138	1	3	365	319	251
Future Vol, veh/h	138	1	3	365	319	251
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	150	1	3	397	347	273

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	886	483	620	0	-	0
Stage 1	483	-	-	-	-	-
Stage 2	403	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	315	583	961	-	-	-
Stage 1	620	-	-	-	-	-
Stage 2	675	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	313	583	961	-	-	-
Mov Cap-2 Maneuver	313	-	-	-	-	-
Stage 1	618	-	-	-	-	-
Stage 2	675	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	26.59	0.07	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	961	-	315	-	-
HCM Lane V/C Ratio	0.003	-	0.48	-	-
HCM Control Delay (s/veh)	8.8	0	26.6	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0	-	2.5	-	-

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	28	0	3	1	0	68	2	237	1	12	245	34
Future Vol, veh/h	28	0	3	1	0	68	2	237	1	12	245	34
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	30	0	3	1	0	74	2	258	1	13	266	37

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	573	574	285	555	592	258	303	0	0	259	0	0
Stage 1	311	311	-	262	262	-	-	-	-	-	-	-
Stage 2	262	263	-	292	329	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	430	429	754	442	419	780	1258	-	-	1306	-	-
Stage 1	700	658	-	743	691	-	-	-	-	-	-	-
Stage 2	743	691	-	716	646	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	384	423	754	434	413	780	1258	-	-	1306	-	-
Mov Cap-2 Maneuver	384	423	-	434	413	-	-	-	-	-	-	-
Stage 1	698	650	-	741	690	-	-	-	-	-	-	-
Stage 2	671	689	-	704	638	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	14.74	10.17	0.07	0.32
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1258	-	-	403	772	1306	-	-
HCM Lane V/C Ratio	0.002	-	-	0.084	0.097	0.01	-	-
HCM Control Delay (s/veh)	7.9	0	-	14.7	10.2	7.8	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0.3	0	-	-

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	154	21	27	87	91	155
Future Vol, veh/h	154	21	27	87	91	155
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	167	23	29	95	99	168

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	336	183	267	0	-	0
Stage 1	183	-	-	-	-	-
Stage 2	153	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	659	859	1296	-	-	-
Stage 1	848	-	-	-	-	-
Stage 2	875	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	643	859	1296	-	-	-
Mov Cap-2 Maneuver	643	-	-	-	-	-
Stage 1	828	-	-	-	-	-
Stage 2	875	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	12.6	1.86	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1296	-	663	-	-
HCM Lane V/C Ratio	0.023	-	0.287	-	-
HCM Control Delay (s/veh)	7.8	0	12.6	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	1.2	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Base Year AM (With Median Refuge Lane)

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	1	10	0	59	1	702	19	28	348	1
Future Vol, veh/h	1	0	1	10	0	59	1	702	19	28	348	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	1	11	0	64	1	763	21	30	378	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1205	1226	379	1215	1216	773	379	0	0	784	0	0
Stage 1	440	440	-	776	776	-	-	-	-	-	-	-
Stage 2	765	786	-	439	440	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	161	179	668	158	181	399	1179	-	-	835	-	-
Stage 1	596	578	-	391	408	-	-	-	-	-	-	-
Stage 2	396	403	-	597	577	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	128	170	668	150	172	399	1179	-	-	835	-	-
Mov Cap-2 Maneuver	128	170	-	150	172	-	-	-	-	-	-	-
Stage 1	595	551	-	390	407	-	-	-	-	-	-	-
Stage 2	332	403	-	568	551	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	21.88	19.56	0.01	0.7
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1179	-	-	215	322	835	-	-
HCM Lane V/C Ratio	0.001	-	-	0.01	0.233	0.036	-	-
HCM Control Delay (s/veh)	8.1	0	-	21.9	19.6	9.5	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.9	0.1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	31	676	2	6	368
Future Vol, veh/h	2	31	676	2	6	368
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	34	735	2	7	400

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1149	736	0	0	737	0
Stage 1	736	-	-	-	-	-
Stage 2	413	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	219	419	-	-	869	-
Stage 1	474	-	-	-	-	-
Stage 2	668	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	217	419	-	-	869	-
Mov Cap-2 Maneuver	217	-	-	-	-	-
Stage 1	474	-	-	-	-	-
Stage 2	661	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	14.97	0	0.15
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	397	869	-
HCM Lane V/C Ratio	-	-	0.09	0.008	-
HCM Control Delay (s/veh)	-	-	15	9.2	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	69	5	5	606	350	13
Future Vol, veh/h	69	5	5	606	350	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	75	5	5	659	380	14

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1057	388	395	0	-	0
Stage 1	388	-	-	-	-	-
Stage 2	670	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	249	661	1164	-	-	-
Stage 1	686	-	-	-	-	-
Stage 2	509	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	247	661	1164	-	-	-
Mov Cap-2 Maneuver	247	-	-	-	-	-
Stage 1	681	-	-	-	-	-
Stage 2	509	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	25.12	0.07	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1164	-	258	-	-
HCM Lane V/C Ratio	0.005	-	0.311	-	-
HCM Control Delay (s/veh)	8.1	0	25.1	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0	-	1.3	-	-

Intersection	
Int Delay, s/veh	7.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	309	2	0	284	260	86
Future Vol, veh/h	309	2	0	284	260	86
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	336	2	0	309	283	93

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	638	329	376	0	-	0
Stage 1	329	-	-	-	-	-
Stage 2	309	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	441	712	1182	-	-	-
Stage 1	729	-	-	-	-	-
Stage 2	745	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	441	712	1182	-	-	-
Mov Cap-2 Maneuver	537	-	-	-	-	-
Stage 1	729	-	-	-	-	-
Stage 2	745	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	22.31	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1182	-	538	-	-
HCM Lane V/C Ratio	-	-	0.628	-	-
HCM Control Delay (s/veh)	0	-	22.3	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	4.3	-	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↰			↕	
Traffic Vol, veh/h	14	1	1	0	0	24	1	182	2	56	164	11
Future Vol, veh/h	14	1	1	0	0	24	1	182	2	56	164	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	1	1	0	0	26	1	198	2	61	178	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	506	508	184	502	513	199	190	0	0	200	0	0
Stage 1	306	306	-	201	201	-	-	-	-	-	-	-
Stage 2	200	202	-	301	312	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	477	468	858	480	465	842	1384	-	-	1372	-	-
Stage 1	704	662	-	801	735	-	-	-	-	-	-	-
Stage 2	802	734	-	708	658	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	439	444	858	454	441	842	1384	-	-	1372	-	-
Mov Cap-2 Maneuver	439	444	-	454	441	-	-	-	-	-	-	-
Stage 1	703	629	-	800	734	-	-	-	-	-	-	-
Stage 2	776	733	-	671	625	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	13.27	9.41	0.04	1.88
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1384	-	-	453	842	1372	-	-
HCM Lane V/C Ratio	0.001	-	-	0.038	0.031	0.044	-	-
HCM Control Delay (s/veh)	7.6	0	-	13.3	9.4	7.7	0	-
HCM Lane LOS	A	A	-	B	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	125	21	7	59	123	43
Future Vol, veh/h	125	21	7	59	123	43
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	136	23	8	64	134	47

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	236	157	180	0	-	0
Stage 1	157	-	-	-	-	-
Stage 2	79	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	752	888	1395	-	-	-
Stage 1	871	-	-	-	-	-
Stage 2	944	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	748	888	1395	-	-	-
Mov Cap-2 Maneuver	748	-	-	-	-	-
Stage 1	866	-	-	-	-	-
Stage 2	944	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	10.93	0.81	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1395	-	765	-	-
HCM Lane V/C Ratio	0.005	-	0.207	-	-
HCM Control Delay (s/veh)	7.6	0	10.9	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.8	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Base Year PM (With Median Refuge Lane)

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	2	1	14	1	40	2	536	26	57	650	1
Future Vol, veh/h	0	2	1	14	1	40	2	536	26	57	650	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2	1	15	1	43	2	583	28	62	707	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1418	1446	707	1433	1433	597	708	0	0	611	0	0
Stage 1	831	831	-	601	601	-	-	-	-	-	-	-
Stage 2	588	615	-	832	832	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	114	132	435	112	134	503	891	-	-	968	-	-
Stage 1	364	384	-	487	489	-	-	-	-	-	-	-
Stage 2	495	482	-	364	384	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	92	117	435	98	119	503	891	-	-	968	-	-
Mov Cap-2 Maneuver	92	117	-	98	119	-	-	-	-	-	-	-
Stage 1	363	344	-	485	487	-	-	-	-	-	-	-
Stage 2	450	480	-	322	344	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	28.73	25.12	0.03	0.72
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	891	-	-	155	238	968	-	-
HCM Lane V/C Ratio	0.002	-	-	0.021	0.251	0.064	-	-
HCM Control Delay (s/veh)	9.1	0	-	28.7	25.1	9	0	-
HCM Lane LOS	A	A	-	D	D	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1	0.2	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	24	525	3	27	618
Future Vol, veh/h	0	24	525	3	27	618
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	26	571	3	29	672

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1303	572	0	0	574	0
Stage 1	572	-	-	-	-	-
Stage 2	730	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	177	519	-	-	999	-
Stage 1	564	-	-	-	-	-
Stage 2	477	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	169	519	-	-	999	-
Mov Cap-2 Maneuver	169	-	-	-	-	-
Stage 1	564	-	-	-	-	-
Stage 2	454	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	12.3	0	0.36
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	519	999	-
HCM Lane V/C Ratio	-	-	0.05	0.029	-
HCM Control Delay (s/veh)	-	-	12.3	8.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	20	2	4	506	588	36
Future Vol, veh/h	20	2	4	506	588	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	2	4	550	639	39

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1217	659	678	0	-	0
Stage 1	659	-	-	-	-	-
Stage 2	559	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	200	464	914	-	-	-
Stage 1	515	-	-	-	-	-
Stage 2	573	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	198	464	914	-	-	-
Mov Cap-2 Maneuver	198	-	-	-	-	-
Stage 1	511	-	-	-	-	-
Stage 2	573	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	24.43	0.07	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	914	-	209	-	-
HCM Lane V/C Ratio	0.005	-	0.114	-	-
HCM Control Delay (s/veh)	9	0	24.4	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	0.4	-	-

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	138	1	3	365	319	251
Future Vol, veh/h	138	1	3	365	319	251
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	150	1	3	397	347	273

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	886	483	620	0	-	0
Stage 1	483	-	-	-	-	-
Stage 2	403	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	315	583	961	-	-	-
Stage 1	620	-	-	-	-	-
Stage 2	675	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	313	583	961	-	-	-
Mov Cap-2 Maneuver	437	-	-	-	-	-
Stage 1	618	-	-	-	-	-
Stage 2	675	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	17.5	0.07	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	961	-	438	-	-
HCM Lane V/C Ratio	0.003	-	0.345	-	-
HCM Control Delay (s/veh)	8.8	0	17.5	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	1.5	-	-

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	28	0	3	1	0	68	2	237	1	12	245	34
Future Vol, veh/h	28	0	3	1	0	68	2	237	1	12	245	34
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	30	0	3	1	0	74	2	258	1	13	266	37

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	573	574	285	555	592	258	303	0	0	259	0	0
Stage 1	311	311	-	262	262	-	-	-	-	-	-	-
Stage 2	262	263	-	292	329	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	430	429	754	442	419	780	1258	-	-	1306	-	-
Stage 1	700	658	-	743	691	-	-	-	-	-	-	-
Stage 2	743	691	-	716	646	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	384	423	754	434	413	780	1258	-	-	1306	-	-
Mov Cap-2 Maneuver	384	423	-	434	413	-	-	-	-	-	-	-
Stage 1	698	650	-	741	690	-	-	-	-	-	-	-
Stage 2	671	689	-	704	638	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	14.74	10.17	0.07	0.32
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1258	-	-	403	772	1306	-	-
HCM Lane V/C Ratio	0.002	-	-	0.084	0.097	0.01	-	-
HCM Control Delay (s/veh)	7.9	0	-	14.7	10.2	7.8	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0.3	0	-	-

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	154	21	27	87	91	155
Future Vol, veh/h	154	21	27	87	91	155
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	167	23	29	95	99	168

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	336	183	267	0	-	0
Stage 1	183	-	-	-	-	-
Stage 2	153	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	659	859	1296	-	-	-
Stage 1	848	-	-	-	-	-
Stage 2	875	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	643	859	1296	-	-	-
Mov Cap-2 Maneuver	643	-	-	-	-	-
Stage 1	828	-	-	-	-	-
Stage 2	875	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	12.6	1.86	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1296	-	663	-	-
HCM Lane V/C Ratio	0.023	-	0.287	-	-
HCM Control Delay (s/veh)	7.8	0	12.6	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	1.2	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Base Year AM (With Signal)

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	1	10	0	59	1	702	19	28	348	1
Future Vol, veh/h	1	0	1	10	0	59	1	702	19	28	348	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	1	11	0	64	1	763	21	30	378	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1205	1226	379	1215	1216	773	379	0	0	784	0	0
Stage 1	440	440	-	776	776	-	-	-	-	-	-	-
Stage 2	765	786	-	439	440	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	161	179	668	158	181	399	1179	-	-	835	-	-
Stage 1	596	578	-	391	408	-	-	-	-	-	-	-
Stage 2	396	403	-	597	577	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	128	170	668	150	172	399	1179	-	-	835	-	-
Mov Cap-2 Maneuver	128	170	-	150	172	-	-	-	-	-	-	-
Stage 1	595	551	-	390	407	-	-	-	-	-	-	-
Stage 2	332	403	-	568	551	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	21.88	19.56	0.01	0.7
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1179	-	-	215	322	835	-	-
HCM Lane V/C Ratio	0.001	-	-	0.01	0.233	0.036	-	-
HCM Control Delay (s/veh)	8.1	0	-	21.9	19.6	9.5	0	-
HCM Lane LOS	A	A	-	C	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0.9	0.1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	31	676	2	6	368
Future Vol, veh/h	2	31	676	2	6	368
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	34	735	2	7	400

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1149	736	0	0	737	0
Stage 1	736	-	-	-	-	-
Stage 2	413	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	219	419	-	-	869	-
Stage 1	474	-	-	-	-	-
Stage 2	668	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	217	419	-	-	869	-
Mov Cap-2 Maneuver	217	-	-	-	-	-
Stage 1	474	-	-	-	-	-
Stage 2	661	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	14.97	0	0.15
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	397	869	-
HCM Lane V/C Ratio	-	-	0.09	0.008	-
HCM Control Delay (s/veh)	-	-	15	9.2	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	69	5	5	606	350	13
Future Vol, veh/h	69	5	5	606	350	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	75	5	5	659	380	14

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1057	388	395	0	-	0
Stage 1	388	-	-	-	-	-
Stage 2	670	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	249	661	1164	-	-	-
Stage 1	686	-	-	-	-	-
Stage 2	509	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	247	661	1164	-	-	-
Mov Cap-2 Maneuver	247	-	-	-	-	-
Stage 1	681	-	-	-	-	-
Stage 2	509	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	25.12	0.07	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1164	-	258	-	-
HCM Lane V/C Ratio	0.005	-	0.311	-	-
HCM Control Delay (s/veh)	8.1	0	25.1	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0	-	1.3	-	-

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	309	2	0	284	260	86
Future Volume (veh/h)	309	2	0	284	260	86
Initial Q (Qb), veh	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	336	2	0	309	283	93
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	475	3	0	677	488	160
Arrive On Green	0.27	0.27	0.00	0.36	0.36	0.36
Sat Flow, veh/h	1764	11	0	1870	1348	443
Grp Volume(v), veh/h	339	0	0	309	0	376
Grp Sat Flow(s),veh/h/ln	1780	0	0	1870	0	1791
Q Serve(g_s), s	3.7	0.0	0.0	2.7	0.0	3.7
Cycle Q Clear(g_c), s	3.7	0.0	0.0	2.7	0.0	3.7
Prop In Lane	0.99	0.01	0.00			0.25
Lane Grp Cap(c), veh/h	480	0	0	677	0	648
V/C Ratio(X)	0.71	0.00	0.00	0.46	0.00	0.58
Avail Cap(c_a), veh/h	2133	0	0	2241	0	2146
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.2	0.0	0.0	5.3	0.0	5.6
Incr Delay (d2), s/veh	1.9	0.0	0.0	0.5	0.0	0.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	0.4	0.0	0.6
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	9.1	0.0	0.0	5.8	0.0	6.4
LnGrp LOS	A			A		A
Approach Vol, veh/h	339			309	376	
Approach Delay, s/veh	9.1			5.8	6.4	
Approach LOS	A			A	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		11.8		9.8		11.8
Change Period (Y+Rc), s		4.0		4.0		4.0
Max Green Setting (Gmax), s		26.0		26.0		26.0
Max Q Clear Time (g_c+I1), s		4.7		5.7		5.7
Green Ext Time (p_c), s		1.8		1.0		2.3

Intersection Summary	
HCM 7th Control Delay, s/veh	7.1
HCM 7th LOS	A

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↰			↕	
Traffic Vol, veh/h	14	1	1	0	0	24	1	182	2	56	164	11
Future Vol, veh/h	14	1	1	0	0	24	1	182	2	56	164	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	1	1	0	0	26	1	198	2	61	178	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	506	508	184	502	513	199	190	0	0	200	0	0
Stage 1	306	306	-	201	201	-	-	-	-	-	-	-
Stage 2	200	202	-	301	312	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	477	468	858	480	465	842	1384	-	-	1372	-	-
Stage 1	704	662	-	801	735	-	-	-	-	-	-	-
Stage 2	802	734	-	708	658	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	439	444	858	454	441	842	1384	-	-	1372	-	-
Mov Cap-2 Maneuver	439	444	-	454	441	-	-	-	-	-	-	-
Stage 1	703	629	-	800	734	-	-	-	-	-	-	-
Stage 2	776	733	-	671	625	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	13.27	9.41	0.04	1.88
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1384	-	-	453	842	1372	-	-
HCM Lane V/C Ratio	0.001	-	-	0.038	0.031	0.044	-	-
HCM Control Delay (s/veh)	7.6	0	-	13.3	9.4	7.7	0	-
HCM Lane LOS	A	A	-	B	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	125	21	7	59	123	43
Future Vol, veh/h	125	21	7	59	123	43
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	136	23	8	64	134	47

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	236	157	180	0	-	0
Stage 1	157	-	-	-	-	-
Stage 2	79	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	752	888	1395	-	-	-
Stage 1	871	-	-	-	-	-
Stage 2	944	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	748	888	1395	-	-	-
Mov Cap-2 Maneuver	748	-	-	-	-	-
Stage 1	866	-	-	-	-	-
Stage 2	944	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	10.93	0.81	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1395	-	765	-	-
HCM Lane V/C Ratio	0.005	-	0.207	-	-
HCM Control Delay (s/veh)	7.6	0	10.9	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.8	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Base Year PM (With Signal)

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	2	1	14	1	40	2	536	26	57	650	1
Future Vol, veh/h	0	2	1	14	1	40	2	536	26	57	650	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2	1	15	1	43	2	583	28	62	707	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1418	1446	707	1433	1433	597	708	0	0	611	0	0
Stage 1	831	831	-	601	601	-	-	-	-	-	-	-
Stage 2	588	615	-	832	832	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	114	132	435	112	134	503	891	-	-	968	-	-
Stage 1	364	384	-	487	489	-	-	-	-	-	-	-
Stage 2	495	482	-	364	384	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	92	117	435	98	119	503	891	-	-	968	-	-
Mov Cap-2 Maneuver	92	117	-	98	119	-	-	-	-	-	-	-
Stage 1	363	344	-	485	487	-	-	-	-	-	-	-
Stage 2	450	480	-	322	344	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	28.73	25.12	0.03	0.72
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	891	-	-	155	238	968	-	-
HCM Lane V/C Ratio	0.002	-	-	0.021	0.251	0.064	-	-
HCM Control Delay (s/veh)	9.1	0	-	28.7	25.1	9	0	-
HCM Lane LOS	A	A	-	D	D	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1	0.2	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	24	525	3	27	618
Future Vol, veh/h	0	24	525	3	27	618
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	26	571	3	29	672

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1303	572	0	0	574	0
Stage 1	572	-	-	-	-	-
Stage 2	730	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	177	519	-	-	999	-
Stage 1	564	-	-	-	-	-
Stage 2	477	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	169	519	-	-	999	-
Mov Cap-2 Maneuver	169	-	-	-	-	-
Stage 1	564	-	-	-	-	-
Stage 2	454	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	12.3	0	0.36
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	519	999	-
HCM Lane V/C Ratio	-	-	0.05	0.029	-
HCM Control Delay (s/veh)	-	-	12.3	8.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	20	2	4	506	588	36
Future Vol, veh/h	20	2	4	506	588	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	2	4	550	639	39

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1217	659	678	0	-	0
Stage 1	659	-	-	-	-	-
Stage 2	559	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	200	464	914	-	-	-
Stage 1	515	-	-	-	-	-
Stage 2	573	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	198	464	914	-	-	-
Mov Cap-2 Maneuver	198	-	-	-	-	-
Stage 1	511	-	-	-	-	-
Stage 2	573	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	24.43	0.07	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	914	-	209	-	-
HCM Lane V/C Ratio	0.005	-	0.114	-	-
HCM Control Delay (s/veh)	9	0	24.4	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	0.4	-	-

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	138	1	3	365	319	251
Future Volume (veh/h)	138	1	3	365	319	251
Initial Q (Qb), veh	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	150	1	3	397	347	273
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	203	1	161	994	517	407
Arrive On Green	0.12	0.12	0.53	0.53	0.53	0.53
Sat Flow, veh/h	1757	12	3	1863	970	763
Grp Volume(v), veh/h	152	0	400	0	0	620
Grp Sat Flow(s),veh/h/ln	1780	0	1866	0	0	1733
Q Serve(g_s), s	1.9	0.0	0.0	0.0	0.0	5.9
Cycle Q Clear(g_c), s	1.9	0.0	2.9	0.0	0.0	5.9
Prop In Lane	0.99	0.01	0.01			0.44
Lane Grp Cap(c), veh/h	206	0	1154	0	0	924
V/C Ratio(X)	0.74	0.00	0.35	0.00	0.00	0.67
Avail Cap(c_a), veh/h	2030	0	2279	0	0	1976
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	9.7	0.0	3.2	0.0	0.0	3.9
Incr Delay (d2), s/veh	5.1	0.0	0.2	0.0	0.0	0.9
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.1	0.0	0.0	0.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	14.8	0.0	3.3	0.0	0.0	4.7
LnGrp LOS	B		A			A
Approach Vol, veh/h	152			400	620	
Approach Delay, s/veh	14.8			3.3	4.7	
Approach LOS	B			A	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		16.2		6.6		16.2
Change Period (Y+Rc), s		4.0		4.0		4.0
Max Green Setting (Gmax), s		26.0		26.0		26.0
Max Q Clear Time (g_c+I1), s		4.9		3.9		7.9
Green Ext Time (p_c), s		2.4		0.4		4.3

Intersection Summary	
HCM 7th Control Delay, s/veh	5.6
HCM 7th LOS	A

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	28	0	3	1	0	68	2	237	1	12	245	34
Future Vol, veh/h	28	0	3	1	0	68	2	237	1	12	245	34
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	30	0	3	1	0	74	2	258	1	13	266	37

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	573	574	285	555	592	258	303	0	0	259	0	0
Stage 1	311	311	-	262	262	-	-	-	-	-	-	-
Stage 2	262	263	-	292	329	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	430	429	754	442	419	780	1258	-	-	1306	-	-
Stage 1	700	658	-	743	691	-	-	-	-	-	-	-
Stage 2	743	691	-	716	646	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	384	423	754	434	413	780	1258	-	-	1306	-	-
Mov Cap-2 Maneuver	384	423	-	434	413	-	-	-	-	-	-	-
Stage 1	698	650	-	741	690	-	-	-	-	-	-	-
Stage 2	671	689	-	704	638	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	14.74	10.17	0.07	0.32
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1258	-	-	403	772	1306	-	-
HCM Lane V/C Ratio	0.002	-	-	0.084	0.097	0.01	-	-
HCM Control Delay (s/veh)	7.9	0	-	14.7	10.2	7.8	0	-
HCM Lane LOS	A	A	-	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0.3	0	-	-

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	154	21	27	87	91	155
Future Vol, veh/h	154	21	27	87	91	155
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	167	23	29	95	99	168

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	336	183	267	0	-	0
Stage 1	183	-	-	-	-	-
Stage 2	153	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	659	859	1296	-	-	-
Stage 1	848	-	-	-	-	-
Stage 2	875	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	643	859	1296	-	-	-
Mov Cap-2 Maneuver	643	-	-	-	-	-
Stage 1	828	-	-	-	-	-
Stage 2	875	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	12.6	1.86	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1296	-	663	-	-
HCM Lane V/C Ratio	0.023	-	0.287	-	-
HCM Control Delay (s/veh)	7.8	0	12.6	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	1.2	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Future Year AM (No Mitigation)

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	1	10	0	59	1	838	19	28	462	1
Future Vol, veh/h	1	0	1	10	0	59	1	838	19	28	462	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	1	11	0	64	1	911	21	30	502	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1477	1497	503	1486	1488	921	503	0	0	932	0	0
Stage 1	564	564	-	923	923	-	-	-	-	-	-	-
Stage 2	913	934	-	563	564	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	104	122	569	103	124	328	1061	-	-	735	-	-
Stage 1	511	509	-	323	348	-	-	-	-	-	-	-
Stage 2	328	345	-	511	508	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	79	115	569	96	117	328	1061	-	-	735	-	-
Mov Cap-2 Maneuver	79	115	-	96	117	-	-	-	-	-	-	-
Stage 1	509	479	-	323	348	-	-	-	-	-	-	-
Stage 2	263	344	-	481	479	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	31.41	26.28	0.01	0.58
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1061	-	-	138	243	735	-	-
HCM Lane V/C Ratio	0.001	-	-	0.016	0.309	0.041	-	-
HCM Control Delay (s/veh)	8.4	0	-	31.4	26.3	10.1	0	-
HCM Lane LOS	A	A	-	D	D	B	A	-
HCM 95th %tile Q(veh)	0	-	-	0	1.3	0.1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	31	812	2	6	482
Future Vol, veh/h	2	31	812	2	6	482
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	34	883	2	7	524

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1421	884	0	0	885	0
Stage 1	884	-	-	-	-	-
Stage 2	537	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	150	345	-	-	765	-
Stage 1	404	-	-	-	-	-
Stage 2	586	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	148	345	-	-	765	-
Mov Cap-2 Maneuver	148	-	-	-	-	-
Stage 1	404	-	-	-	-	-
Stage 2	579	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	17.71	0	0.12
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	319	765	-
HCM Lane V/C Ratio	-	-	0.112	0.009	-
HCM Control Delay (s/veh)	-	-	17.7	9.7	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0	-

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	69	5	5	742	464	13
Future Vol, veh/h	69	5	5	742	464	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	75	5	5	807	504	14

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1329	511	518	0	-	0
Stage 1	511	-	-	-	-	-
Stage 2	817	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	171	562	1048	-	-	-
Stage 1	602	-	-	-	-	-
Stage 2	434	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	169	562	1048	-	-	-
Mov Cap-2 Maneuver	169	-	-	-	-	-
Stage 1	596	-	-	-	-	-
Stage 2	434	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	41.01	0.06	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1048	-	178	-	-
HCM Lane V/C Ratio	0.005	-	0.453	-	-
HCM Control Delay (s/veh)	8.5	0	41	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0	-	2.1	-	-

Intersection	
Int Delay, s/veh	53.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	442	7	0	287	260	200
Future Vol, veh/h	442	7	0	287	260	200
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	480	8	0	312	283	217

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	703	391	500	0	-	0
Stage 1	391	-	-	-	-	-
Stage 2	312	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 404	657	1064	-	-	-
Stage 1	683	-	-	-	-	-
Stage 2	742	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 404	657	1064	-	-	-
Mov Cap-2 Maneuver	~ 404	-	-	-	-	-
Stage 1	683	-	-	-	-	-
Stage 2	742	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/veh	142.01	0	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1064	-	406	-	-
HCM Lane V/C Ratio	-	-	1.202	-	-
HCM Control Delay (s/veh)	0	-	142	-	-
HCM Lane LOS	A	-	F	-	-
HCM 95th %tile Q(veh)	0	-	19.6	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	14	1	1	0	0	24	1	185	2	56	169	11
Future Vol, veh/h	14	1	1	0	0	24	1	185	2	56	169	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	1	1	0	0	26	1	201	2	61	184	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	515	517	190	510	522	202	196	0	0	203	0	0
Stage 1	311	311	-	204	204	-	-	-	-	-	-	-
Stage 2	203	205	-	306	317	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	471	462	852	474	459	839	1377	-	-	1368	-	-
Stage 1	699	658	-	798	732	-	-	-	-	-	-	-
Stage 2	799	732	-	704	654	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	433	439	852	448	436	839	1377	-	-	1368	-	-
Mov Cap-2 Maneuver	433	439	-	448	436	-	-	-	-	-	-	-
Stage 1	698	625	-	797	732	-	-	-	-	-	-	-
Stage 2	773	731	-	667	621	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	13.38	9.43	0.04	1.84
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1377	-	-	447	839	1368	-	-
HCM Lane V/C Ratio	0.001	-	-	0.039	0.031	0.044	-	-
HCM Control Delay (s/veh)	7.6	0	-	13.4	9.4	7.8	0	-
HCM Lane LOS	A	A	-	B	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	128	21	7	59	128	43
Future Vol, veh/h	128	21	7	59	128	43
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	139	23	8	64	139	47

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	242	163	186	0	-	0
Stage 1	163	-	-	-	-	-
Stage 2	79	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	746	882	1389	-	-	-
Stage 1	867	-	-	-	-	-
Stage 2	944	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	742	882	1389	-	-	-
Mov Cap-2 Maneuver	742	-	-	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	944	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	11.02	0.81	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1389	-	759	-	-
HCM Lane V/C Ratio	0.005	-	0.213	-	-
HCM Control Delay (s/veh)	7.6	0	11	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.8	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Future Year PM (No Mitigation)

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	2	1	14	1	40	2	703	26	57	860	1
Future Vol, veh/h	0	2	1	14	1	40	2	703	26	57	860	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2	1	15	1	43	2	764	28	62	935	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1828	1856	935	1842	1842	778	936	0	0	792	0	0
Stage 1	1059	1059	-	783	783	-	-	-	-	-	-	-
Stage 2	769	797	-	1060	1060	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	59	74	322	58	75	396	732	-	-	828	-	-
Stage 1	271	301	-	387	405	-	-	-	-	-	-	-
Stage 2	394	399	-	271	301	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	44	62	322	47	63	396	732	-	-	828	-	-
Mov Cap-2 Maneuver	44	62	-	47	63	-	-	-	-	-	-	-
Stage 1	270	254	-	385	403	-	-	-	-	-	-	-
Stage 2	348	397	-	226	254	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	49.23	52.87	0.03	0.6
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	732	-	-	85	132	828	-	-
HCM Lane V/C Ratio	0.003	-	-	0.039	0.452	0.075	-	-
HCM Control Delay (s/veh)	9.9	0	-	49.2	52.9	9.7	0	-
HCM Lane LOS	A	A	-	E	F	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	2	0.2	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	24	692	3	27	828
Future Vol, veh/h	0	24	692	3	27	828
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	26	752	3	29	900

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1713	754	0	0	755	0
Stage 1	754	-	-	-	-	-
Stage 2	959	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	99	409	-	-	855	-
Stage 1	465	-	-	-	-	-
Stage 2	372	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	93	409	-	-	855	-
Mov Cap-2 Maneuver	93	-	-	-	-	-
Stage 1	465	-	-	-	-	-
Stage 2	347	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	14.4	0	0.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	409	855	-
HCM Lane V/C Ratio	-	-	0.064	0.034	-
HCM Control Delay (s/veh)	-	-	14.4	9.4	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	20	2	4	673	798	36
Future Vol, veh/h	20	2	4	673	798	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	2	4	732	867	39

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1627	887	907	0	-	0
Stage 1	887	-	-	-	-	-
Stage 2	740	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	112	343	751	-	-	-
Stage 1	403	-	-	-	-	-
Stage 2	472	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	111	343	751	-	-	-
Mov Cap-2 Maneuver	111	-	-	-	-	-
Stage 1	399	-	-	-	-	-
Stage 2	472	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	42.92	0.06	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	751	-	118	-	-
HCM Lane V/C Ratio	0.006	-	0.202	-	-
HCM Control Delay (s/veh)	9.8	0	42.9	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0	-	0.7	-	-

Intersection	
Int Delay, s/veh	43.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	305	6	13	365	319	461
Future Vol, veh/h	305	6	13	365	319	461
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	332	7	14	397	347	501

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1022	597	848	0	-	0
Stage 1	597	-	-	-	-	-
Stage 2	425	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 261	503	790	-	-	-
Stage 1	550	-	-	-	-	-
Stage 2	659	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 255	503	790	-	-	-
Mov Cap-2 Maneuver	~ 255	-	-	-	-	-
Stage 1	537	-	-	-	-	-
Stage 2	659	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	203.58	0.33	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	790	-	258	-	-
HCM Lane V/C Ratio	0.018	-	1.311	-	-
HCM Control Delay (s/veh)	9.6	0	203.6	-	-
HCM Lane LOS	A	A	F	-	-
HCM 95th %tile Q(veh)	0.1	-	17.3	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	28	0	3	1	0	68	2	247	1	12	250	34
Future Vol, veh/h	28	0	3	1	0	68	2	247	1	12	250	34
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	30	0	3	1	0	74	2	268	1	13	272	37

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	589	590	290	571	608	269	309	0	0	270	0	0
Stage 1	316	316	-	273	273	-	-	-	-	-	-	-
Stage 2	273	274	-	298	335	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	420	420	749	431	410	770	1252	-	-	1294	-	-
Stage 1	695	655	-	733	684	-	-	-	-	-	-	-
Stage 2	733	683	-	711	643	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	374	414	749	423	404	770	1252	-	-	1294	-	-
Mov Cap-2 Maneuver	374	414	-	423	404	-	-	-	-	-	-	-
Stage 1	693	647	-	731	682	-	-	-	-	-	-	-
Stage 2	661	682	-	699	635	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	15.01	10.25	0.06	0.32
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1252	-	-	393	761	1294	-	-
HCM Lane V/C Ratio	0.002	-	-	0.086	0.099	0.01	-	-
HCM Control Delay (s/veh)	7.9	0	-	15	10.2	7.8	0	-
HCM Lane LOS	A	A	-	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0.3	0	-	-

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	154	21	27	97	96	155
Future Vol, veh/h	154	21	27	97	96	155
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	167	23	29	105	104	168

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	353	189	273	0	-	0
Stage 1	189	-	-	-	-	-
Stage 2	164	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	645	853	1290	-	-	-
Stage 1	844	-	-	-	-	-
Stage 2	865	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	629	853	1290	-	-	-
Mov Cap-2 Maneuver	629	-	-	-	-	-
Stage 1	823	-	-	-	-	-
Stage 2	865	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	12.82	1.71	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1290	-	650	-	-
HCM Lane V/C Ratio	0.023	-	0.293	-	-
HCM Control Delay (s/veh)	7.9	0	12.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	1.2	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Future Year AM (With Median Refuge Lane)

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	1	10	0	59	1	838	19	28	462	1
Future Vol, veh/h	1	0	1	10	0	59	1	838	19	28	462	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	1	11	0	64	1	911	21	30	502	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1477	1497	503	1486	1488	921	503	0	0	932	0	0
Stage 1	564	564	-	923	923	-	-	-	-	-	-	-
Stage 2	913	934	-	563	564	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	104	122	569	103	124	328	1061	-	-	735	-	-
Stage 1	511	509	-	323	348	-	-	-	-	-	-	-
Stage 2	328	345	-	511	508	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	79	115	569	96	117	328	1061	-	-	735	-	-
Mov Cap-2 Maneuver	79	115	-	96	117	-	-	-	-	-	-	-
Stage 1	509	479	-	323	348	-	-	-	-	-	-	-
Stage 2	263	344	-	481	479	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	31.41	26.28	0.01	0.58
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1061	-	-	138	243	735	-	-
HCM Lane V/C Ratio	0.001	-	-	0.016	0.309	0.041	-	-
HCM Control Delay (s/veh)	8.4	0	-	31.4	26.3	10.1	0	-
HCM Lane LOS	A	A	-	D	D	B	A	-
HCM 95th %tile Q(veh)	0	-	-	0	1.3	0.1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	31	812	2	6	482
Future Vol, veh/h	2	31	812	2	6	482
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	34	883	2	7	524

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1421	884	0	0	885	0
Stage 1	884	-	-	-	-	-
Stage 2	537	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	150	345	-	-	765	-
Stage 1	404	-	-	-	-	-
Stage 2	586	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	148	345	-	-	765	-
Mov Cap-2 Maneuver	148	-	-	-	-	-
Stage 1	404	-	-	-	-	-
Stage 2	579	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	17.71	0	0.12
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	319	765	-
HCM Lane V/C Ratio	-	-	0.112	0.009	-
HCM Control Delay (s/veh)	-	-	17.7	9.7	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0	-

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	69	5	5	742	464	13
Future Vol, veh/h	69	5	5	742	464	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	75	5	5	807	504	14

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1329	511	518	0	-	0
Stage 1	511	-	-	-	-	-
Stage 2	817	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	171	562	1048	-	-	-
Stage 1	602	-	-	-	-	-
Stage 2	434	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	169	562	1048	-	-	-
Mov Cap-2 Maneuver	169	-	-	-	-	-
Stage 1	596	-	-	-	-	-
Stage 2	434	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	41.01	0.06	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1048	-	178	-	-
HCM Lane V/C Ratio	0.005	-	0.453	-	-
HCM Control Delay (s/veh)	8.5	0	41	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0	-	2.1	-	-

Intersection	
Int Delay, s/veh	21.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	442	7	0	287	260	200
Future Vol, veh/h	442	7	0	287	260	200
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	480	8	0	312	283	217

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	703	391	500	0	-	0
Stage 1	391	-	-	-	-	-
Stage 2	312	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 404	657	1064	-	-	-
Stage 1	683	-	-	-	-	-
Stage 2	742	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 404	657	1064	-	-	-
Mov Cap-2 Maneuver	508	-	-	-	-	-
Stage 1	683	-	-	-	-	-
Stage 2	742	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	58.33	0	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1064	-	510	-	-
HCM Lane V/C Ratio	-	-	0.957	-	-
HCM Control Delay (s/veh)	0	-	58.3	-	-
HCM Lane LOS	A	-	F	-	-
HCM 95th %tile Q(veh)	0	-	12.2	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	14	1	1	0	0	24	1	185	2	56	169	11
Future Vol, veh/h	14	1	1	0	0	24	1	185	2	56	169	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	1	1	0	0	26	1	201	2	61	184	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	515	517	190	510	522	202	196	0	0	203	0	0
Stage 1	311	311	-	204	204	-	-	-	-	-	-	-
Stage 2	203	205	-	306	317	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	471	462	852	474	459	839	1377	-	-	1368	-	-
Stage 1	699	658	-	798	732	-	-	-	-	-	-	-
Stage 2	799	732	-	704	654	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	433	439	852	448	436	839	1377	-	-	1368	-	-
Mov Cap-2 Maneuver	433	439	-	448	436	-	-	-	-	-	-	-
Stage 1	698	625	-	797	732	-	-	-	-	-	-	-
Stage 2	773	731	-	667	621	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	13.38	9.43	0.04	1.84
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1377	-	-	447	839	1368	-	-
HCM Lane V/C Ratio	0.001	-	-	0.039	0.031	0.044	-	-
HCM Control Delay (s/veh)	7.6	0	-	13.4	9.4	7.8	0	-
HCM Lane LOS	A	A	-	B	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	128	21	7	59	128	43
Future Vol, veh/h	128	21	7	59	128	43
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	139	23	8	64	139	47

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	242	163	186	0	-	0
Stage 1	163	-	-	-	-	-
Stage 2	79	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	746	882	1389	-	-	-
Stage 1	867	-	-	-	-	-
Stage 2	944	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	742	882	1389	-	-	-
Mov Cap-2 Maneuver	742	-	-	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	944	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	11.02	0.81	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1389	-	759	-	-
HCM Lane V/C Ratio	0.005	-	0.213	-	-
HCM Control Delay (s/veh)	7.6	0	11	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.8	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Future Year PM (With Median Refuge Lane)

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	2	1	14	1	40	2	703	26	57	860	1
Future Vol, veh/h	0	2	1	14	1	40	2	703	26	57	860	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2	1	15	1	43	2	764	28	62	935	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1828	1856	935	1842	1842	778	936	0	0	792	0	0
Stage 1	1059	1059	-	783	783	-	-	-	-	-	-	-
Stage 2	769	797	-	1060	1060	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	59	74	322	58	75	396	732	-	-	828	-	-
Stage 1	271	301	-	387	405	-	-	-	-	-	-	-
Stage 2	394	399	-	271	301	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	44	62	322	47	63	396	732	-	-	828	-	-
Mov Cap-2 Maneuver	44	62	-	47	63	-	-	-	-	-	-	-
Stage 1	270	254	-	385	403	-	-	-	-	-	-	-
Stage 2	348	397	-	226	254	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	49.23	52.87	0.03	0.6
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	732	-	-	85	132	828	-	-
HCM Lane V/C Ratio	0.003	-	-	0.039	0.452	0.075	-	-
HCM Control Delay (s/veh)	9.9	0	-	49.2	52.9	9.7	0	-
HCM Lane LOS	A	A	-	E	F	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	2	0.2	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	24	692	3	27	828
Future Vol, veh/h	0	24	692	3	27	828
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	26	752	3	29	900

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1713	754	0	0	755	0
Stage 1	754	-	-	-	-	-
Stage 2	959	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	99	409	-	-	855	-
Stage 1	465	-	-	-	-	-
Stage 2	372	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	93	409	-	-	855	-
Mov Cap-2 Maneuver	93	-	-	-	-	-
Stage 1	465	-	-	-	-	-
Stage 2	347	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	14.4	0	0.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	409	855	-
HCM Lane V/C Ratio	-	-	0.064	0.034	-
HCM Control Delay (s/veh)	-	-	14.4	9.4	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	20	2	4	673	798	36
Future Vol, veh/h	20	2	4	673	798	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	2	4	732	867	39

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1627	887	907	0	-	0
Stage 1	887	-	-	-	-	-
Stage 2	740	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	112	343	751	-	-	-
Stage 1	403	-	-	-	-	-
Stage 2	472	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	111	343	751	-	-	-
Mov Cap-2 Maneuver	111	-	-	-	-	-
Stage 1	399	-	-	-	-	-
Stage 2	472	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	42.92	0.06	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	751	-	118	-	-
HCM Lane V/C Ratio	0.006	-	0.202	-	-
HCM Control Delay (s/veh)	9.8	0	42.9	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0	-	0.7	-	-

Intersection	
Int Delay, s/veh	11.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	305	6	13	365	319	461
Future Vol, veh/h	305	6	13	365	319	461
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	332	7	14	397	347	501

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1022	597	848	0	-	0
Stage 1	597	-	-	-	-	-
Stage 2	425	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	~ 261	503	790	-	-	-
Stage 1	550	-	-	-	-	-
Stage 2	659	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 255	503	790	-	-	-
Mov Cap-2 Maneuver	385	-	-	-	-	-
Stage 1	537	-	-	-	-	-
Stage 2	659	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	52.97	0.33	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	790	-	386	-	-
HCM Lane V/C Ratio	0.018	-	0.875	-	-
HCM Control Delay (s/veh)	9.6	0	53	-	-
HCM Lane LOS	A	A	F	-	-
HCM 95th %tile Q(veh)	0.1	-	8.6	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	28	0	3	1	0	68	2	247	1	12	250	34
Future Vol, veh/h	28	0	3	1	0	68	2	247	1	12	250	34
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	30	0	3	1	0	74	2	268	1	13	272	37

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	589	590	290	571	608	269	309	0	0	270	0	0
Stage 1	316	316	-	273	273	-	-	-	-	-	-	-
Stage 2	273	274	-	298	335	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	420	420	749	431	410	770	1252	-	-	1294	-	-
Stage 1	695	655	-	733	684	-	-	-	-	-	-	-
Stage 2	733	683	-	711	643	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	374	414	749	423	404	770	1252	-	-	1294	-	-
Mov Cap-2 Maneuver	374	414	-	423	404	-	-	-	-	-	-	-
Stage 1	693	647	-	731	682	-	-	-	-	-	-	-
Stage 2	661	682	-	699	635	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	15.01	10.25	0.06	0.32
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1252	-	-	393	761	1294	-	-
HCM Lane V/C Ratio	0.002	-	-	0.086	0.099	0.01	-	-
HCM Control Delay (s/veh)	7.9	0	-	15	10.2	7.8	0	-
HCM Lane LOS	A	A	-	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0.3	0	-	-

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	154	21	27	97	96	155
Future Vol, veh/h	154	21	27	97	96	155
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	167	23	29	105	104	168

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	353	189	273	0	-	0
Stage 1	189	-	-	-	-	-
Stage 2	164	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	645	853	1290	-	-	-
Stage 1	844	-	-	-	-	-
Stage 2	865	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	629	853	1290	-	-	-
Mov Cap-2 Maneuver	629	-	-	-	-	-
Stage 1	823	-	-	-	-	-
Stage 2	865	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	12.82	1.71	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1290	-	650	-	-
HCM Lane V/C Ratio	0.023	-	0.293	-	-
HCM Control Delay (s/veh)	7.9	0	12.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	1.2	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Future Year AM (With Signal)

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	0	1	10	0	59	1	838	19	28	462	1
Future Vol, veh/h	1	0	1	10	0	59	1	838	19	28	462	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	1	11	0	64	1	911	21	30	502	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1477	1497	503	1486	1488	921	503	0	0	932	0	0
Stage 1	564	564	-	923	923	-	-	-	-	-	-	-
Stage 2	913	934	-	563	564	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	104	122	569	103	124	328	1061	-	-	735	-	-
Stage 1	511	509	-	323	348	-	-	-	-	-	-	-
Stage 2	328	345	-	511	508	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	79	115	569	96	117	328	1061	-	-	735	-	-
Mov Cap-2 Maneuver	79	115	-	96	117	-	-	-	-	-	-	-
Stage 1	509	479	-	323	348	-	-	-	-	-	-	-
Stage 2	263	344	-	481	479	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	31.41	26.28	0.01	0.58
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1061	-	-	138	243	735	-	-
HCM Lane V/C Ratio	0.001	-	-	0.016	0.309	0.041	-	-
HCM Control Delay (s/veh)	8.4	0	-	31.4	26.3	10.1	0	-
HCM Lane LOS	A	A	-	D	D	B	A	-
HCM 95th %tile Q(veh)	0	-	-	0	1.3	0.1	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	2	31	812	2	6	482
Future Vol, veh/h	2	31	812	2	6	482
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	34	883	2	7	524

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1421	884	0	0	885	0
Stage 1	884	-	-	-	-	-
Stage 2	537	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	150	345	-	-	765	-
Stage 1	404	-	-	-	-	-
Stage 2	586	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	148	345	-	-	765	-
Mov Cap-2 Maneuver	148	-	-	-	-	-
Stage 1	404	-	-	-	-	-
Stage 2	579	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	17.71	0	0.12
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	319	765	-
HCM Lane V/C Ratio	-	-	0.112	0.009	-
HCM Control Delay (s/veh)	-	-	17.7	9.7	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0	-

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	69	5	5	742	464	13
Future Vol, veh/h	69	5	5	742	464	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	75	5	5	807	504	14

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1329	511	518	0	-	0
Stage 1	511	-	-	-	-	-
Stage 2	817	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	171	562	1048	-	-	-
Stage 1	602	-	-	-	-	-
Stage 2	434	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	169	562	1048	-	-	-
Mov Cap-2 Maneuver	169	-	-	-	-	-
Stage 1	596	-	-	-	-	-
Stage 2	434	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	41.01	0.06	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1048	-	178	-	-
HCM Lane V/C Ratio	0.005	-	0.453	-	-
HCM Control Delay (s/veh)	8.5	0	41	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0	-	2.1	-	-

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	442	7	0	287	260	200
Future Volume (veh/h)	442	7	0	287	260	200
Initial Q (Qb), veh	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	480	8	0	312	283	217
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	611	10	0	749	393	302
Arrive On Green	0.35	0.35	0.00	0.40	0.40	0.40
Sat Flow, veh/h	1745	29	0	1870	982	753
Grp Volume(v), veh/h	489	0	0	312	0	500
Grp Sat Flow(s),veh/h/ln	1778	0	0	1870	0	1735
Q Serve(g_s), s	7.9	0.0	0.0	3.9	0.0	7.8
Cycle Q Clear(g_c), s	7.9	0.0	0.0	3.9	0.0	7.8
Prop In Lane	0.98	0.02	0.00			0.43
Lane Grp Cap(c), veh/h	622	0	0	749	0	695
V/C Ratio(X)	0.79	0.00	0.00	0.42	0.00	0.72
Avail Cap(c_a), veh/h	1440	0	0	1515	0	1405
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	9.3	0.0	0.0	6.9	0.0	8.1
Incr Delay (d2), s/veh	2.2	0.0	0.0	0.4	0.0	1.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	0.0	0.0	1.0	0.0	2.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	11.6	0.0	0.0	7.3	0.0	9.5
LnGrp LOS	B			A		A
Approach Vol, veh/h	489			312	500	
Approach Delay, s/veh	11.6			7.3	9.5	
Approach LOS	B			A	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		16.9		15.2		16.9
Change Period (Y+Rc), s		4.0		4.0		4.0
Max Green Setting (Gmax), s		26.0		26.0		26.0
Max Q Clear Time (g_c+I1), s		5.9		9.9		9.8
Green Ext Time (p_c), s		1.8		1.5		3.1

Intersection Summary		
HCM 7th Control Delay, s/veh	9.8	
HCM 7th LOS	A	

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	14	1	1	0	0	24	1	185	2	56	169	11
Future Vol, veh/h	14	1	1	0	0	24	1	185	2	56	169	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	1	1	0	0	26	1	201	2	61	184	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	515	517	190	510	522	202	196	0	0	203	0	0
Stage 1	311	311	-	204	204	-	-	-	-	-	-	-
Stage 2	203	205	-	306	317	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	471	462	852	474	459	839	1377	-	-	1368	-	-
Stage 1	699	658	-	798	732	-	-	-	-	-	-	-
Stage 2	799	732	-	704	654	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	433	439	852	448	436	839	1377	-	-	1368	-	-
Mov Cap-2 Maneuver	433	439	-	448	436	-	-	-	-	-	-	-
Stage 1	698	625	-	797	732	-	-	-	-	-	-	-
Stage 2	773	731	-	667	621	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	13.38	9.43	0.04	1.84
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1377	-	-	447	839	1368	-	-
HCM Lane V/C Ratio	0.001	-	-	0.039	0.031	0.044	-	-
HCM Control Delay (s/veh)	7.6	0	-	13.4	9.4	7.8	0	-
HCM Lane LOS	A	A	-	B	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0.1	-	-

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	128	21	7	59	128	43
Future Vol, veh/h	128	21	7	59	128	43
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	139	23	8	64	139	47

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	242	163	186	0	-	0
Stage 1	163	-	-	-	-	-
Stage 2	79	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	746	882	1389	-	-	-
Stage 1	867	-	-	-	-	-
Stage 2	944	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	742	882	1389	-	-	-
Mov Cap-2 Maneuver	742	-	-	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	944	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	11.02	0.81	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1389	-	759	-	-
HCM Lane V/C Ratio	0.005	-	0.213	-	-
HCM Control Delay (s/veh)	7.6	0	11	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.8	-	-

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

Future Year PM (With Signal)

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	2	1	14	1	40	2	703	26	57	860	1
Future Vol, veh/h	0	2	1	14	1	40	2	703	26	57	860	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	2	1	15	1	43	2	764	28	62	935	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1828	1856	935	1842	1842	778	936	0	0	792	0	0
Stage 1	1059	1059	-	783	783	-	-	-	-	-	-	-
Stage 2	769	797	-	1060	1060	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	59	74	322	58	75	396	732	-	-	828	-	-
Stage 1	271	301	-	387	405	-	-	-	-	-	-	-
Stage 2	394	399	-	271	301	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	44	62	322	47	63	396	732	-	-	828	-	-
Mov Cap-2 Maneuver	44	62	-	47	63	-	-	-	-	-	-	-
Stage 1	270	254	-	385	403	-	-	-	-	-	-	-
Stage 2	348	397	-	226	254	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	49.23	52.87	0.03	0.6
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	732	-	-	85	132	828	-	-
HCM Lane V/C Ratio	0.003	-	-	0.039	0.452	0.075	-	-
HCM Control Delay (s/veh)	9.9	0	-	49.2	52.9	9.7	0	-
HCM Lane LOS	A	A	-	E	F	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	2	0.2	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	24	692	3	27	828
Future Vol, veh/h	0	24	692	3	27	828
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	26	752	3	29	900

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1713	754	0	0	755	0
Stage 1	754	-	-	-	-	-
Stage 2	959	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	99	409	-	-	855	-
Stage 1	465	-	-	-	-	-
Stage 2	372	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	93	409	-	-	855	-
Mov Cap-2 Maneuver	93	-	-	-	-	-
Stage 1	465	-	-	-	-	-
Stage 2	347	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	14.4	0	0.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	409	855	-
HCM Lane V/C Ratio	-	-	0.064	0.034	-
HCM Control Delay (s/veh)	-	-	14.4	9.4	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	20	2	4	673	798	36
Future Vol, veh/h	20	2	4	673	798	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	2	4	732	867	39

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1627	887	907	0	-	0
Stage 1	887	-	-	-	-	-
Stage 2	740	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	112	343	751	-	-	-
Stage 1	403	-	-	-	-	-
Stage 2	472	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	111	343	751	-	-	-
Mov Cap-2 Maneuver	111	-	-	-	-	-
Stage 1	399	-	-	-	-	-
Stage 2	472	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	42.92	0.06	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	751	-	118	-	-
HCM Lane V/C Ratio	0.006	-	0.202	-	-
HCM Control Delay (s/veh)	9.8	0	42.9	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0	-	0.7	-	-

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	305	6	13	365	319	461
Future Volume (veh/h)	305	6	13	365	319	461
Initial Q (Qb), veh	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	332	7	14	397	347	501
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	425	9	97	917	389	562
Arrive On Green	0.24	0.24	0.56	0.56	0.56	0.56
Sat Flow, veh/h	1735	37	13	1631	692	999
Grp Volume(v), veh/h	340	0	411	0	0	848
Grp Sat Flow(s),veh/h/ln	1777	0	1644	0	0	1691
Q Serve(g_s), s	7.4	0.0	0.8	0.0	0.0	18.3
Cycle Q Clear(g_c), s	7.4	0.0	19.0	0.0	0.0	18.3
Prop In Lane	0.98	0.02	0.03			0.59
Lane Grp Cap(c), veh/h	435	0	1014	0	0	951
V/C Ratio(X)	0.78	0.00	0.41	0.00	0.00	0.89
Avail Cap(c_a), veh/h	1114	0	1128	0	0	1060
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	14.6	0.0	5.2	0.0	0.0	8.0
Incr Delay (d2), s/veh	3.1	0.0	0.3	0.0	0.0	9.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	0.0	1.2	0.0	0.0	6.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	17.7	0.0	5.5	0.0	0.0	17.0
LnGrp LOS	B		A			B
Approach Vol, veh/h	340			411	848	
Approach Delay, s/veh	17.7			5.5	17.0	
Approach LOS	B			A	B	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		27.3		14.1		27.3
Change Period (Y+Rc), s		4.0		4.0		4.0
Max Green Setting (Gmax), s		26.0		26.0		26.0
Max Q Clear Time (g_c+I1), s		21.0		9.4		20.3
Green Ext Time (p_c), s		1.1		0.9		3.0

Intersection Summary		
HCM 7th Control Delay, s/veh	14.2	
HCM 7th LOS	B	

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	28	0	3	1	0	68	2	247	1	12	250	34
Future Vol, veh/h	28	0	3	1	0	68	2	247	1	12	250	34
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	30	0	3	1	0	74	2	268	1	13	272	37

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	589	590	290	571	608	269	309	0	0	270	0	0
Stage 1	316	316	-	273	273	-	-	-	-	-	-	-
Stage 2	273	274	-	298	335	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	420	420	749	431	410	770	1252	-	-	1294	-	-
Stage 1	695	655	-	733	684	-	-	-	-	-	-	-
Stage 2	733	683	-	711	643	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	374	414	749	423	404	770	1252	-	-	1294	-	-
Mov Cap-2 Maneuver	374	414	-	423	404	-	-	-	-	-	-	-
Stage 1	693	647	-	731	682	-	-	-	-	-	-	-
Stage 2	661	682	-	699	635	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	15.01	10.25	0.06	0.32
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1252	-	-	393	761	1294	-	-
HCM Lane V/C Ratio	0.002	-	-	0.086	0.099	0.01	-	-
HCM Control Delay (s/veh)	7.9	0	-	15	10.2	7.8	0	-
HCM Lane LOS	A	A	-	C	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0.3	0	-	-

Intersection	
Int Delay, s/veh	4.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	154	21	27	97	96	155
Future Vol, veh/h	154	21	27	97	96	155
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	167	23	29	105	104	168

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	353	189	273	0	-	0
Stage 1	189	-	-	-	-	-
Stage 2	164	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	645	853	1290	-	-	-
Stage 1	844	-	-	-	-	-
Stage 2	865	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	629	853	1290	-	-	-
Mov Cap-2 Maneuver	629	-	-	-	-	-
Stage 1	823	-	-	-	-	-
Stage 2	865	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	12.82	1.71	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1290	-	650	-	-
HCM Lane V/C Ratio	0.023	-	0.293	-	-
HCM Control Delay (s/veh)	7.9	0	12.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	1.2	-	-

APPENDIX D

TRAFFIC SIGNAL WARRANT

APPENDIX D

TRAFFIC SIGNAL WARRANT

Kula Highway/Kekaulike Avenue
Existing Conditions

Weekday Kula Highway/Parking Lot 8-Hour Signal Warrant

Wednesday, May 8, 2019

Condition A - Minimum volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	500	400	350	280	150	120	105	84
2+	1	600	480	420	336	150	120	105	84
2+	2+	600	480	420	336	200	160	140	112
1	2+	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	750	600	525	420	75	60	53	42
2+	1	900	720	630	504	75	60	53	42
2+	2+	900	720	630	504	100	80	70	56
1	2+	750	600	525	420	100	80	70	56

	Kula Highway						Parking Lot			Kekaulike Avenu			70 % Warrant			Minor 1 (EB)			Minor 1 (WB)			Combination		
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold			350	525	420	350	525	420			
	1						1			1			Minor Threshold			105	53	84	105	53	84			
							RT Reduction:		0%	RT Reduction:		0%												
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	A	B	A+B	A	B	A+B	A	B	A+B
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:15	0	0	0	0	0	0	0	0	0	0	0	0	58	0	8	-	-	-	-	-	-			
5:30	0	0	0	0	0	0	0	0	0	0	0	0	123	0	12	-	-	-	-	-	-			
5:45	0	0	0	0	0	0	0	0	0	0	0	0	225	1	18	-	-	-	-	-	-			
6:00	0	49	2	0	7	0	0	0	0	0	0	8	346	1	36	-	-	-	-	-	-			
6:15	0	51	0	5	9	0	0	0	0	0	0	4	420	2	35	-	-	-	-	-	-			
6:30	0	63	0	1	38	0	0	1	0	0	0	6	527	3	47	-	-	-	-	-	-			
6:45	0	77	4	3	37	0	0	0	0	0	0	18	559	2	49	-	-	-	-	-	-			
7:00	0	97	7	8	19	1	0	0	1	0	0	7	562	3	33	-	-	-	-	-	-			
7:15	1	121	4	10	36	0	1	0	0	0	0	16	533	3	26	-	-	-	-	-	-			
7:30	0	79	4	7	44	0	0	0	0	0	0	8	470	4	10	-	-	-	-	-	-			
7:45	0	57	4	7	54	2	1	0	0	0	0	2	441	6	9	-	-	-	-	-	-			
8:00	0	49	2	13	39	0	0	1	0	0	0	0	441	6	17	-	-	-	-	-	-			
8:15	0	63	5	4	36	1	0	2	0	0	0	0	414	5	28	-	-	-	-	-	-			
8:30	0	52	2	9	42	0	1	1	0	0	0	7	400	4	30	-	-	-	-	-	-			
8:45	1	52	2	13	56	0	1	0	0	0	0	10	381	2	29	-	-	-	-	-	-			
9:00	0	35	2	5	34	0	0	0	0	0	0	11	342	2	24	-	-	-	-	-	-			
9:15	0	46	6	7	36	0	0	1	0	0	0	2	355	3	21	-	-	-	-	-	-			
9:30	0	41	2	10	33	0	0	0	0	0	0	6	356	3	33	-	-	-	-	-	-			
9:45	0	41	5	5	34	0	1	0	0	0	0	5	361	4	38	-	-	-	-	-	-			
10:00	0	50	2	12	24	1	0	0	1	0	0	8	378	4	40	-	-	-	-	-	-			
10:15	1	36	5	8	46	0	0	1	0	0	0	14	388	4	43	-	-	-	-	-	-			
10:30	0	51	3	7	30	0	1	0	0	0	0	11	379	3	37	-	-	-	-	-	-			
10:45	0	48	3	13	37	1	1	0	0	0	0	7	382	2	30	-	-	-	-	-	-			
11:00	0	49	2	10	37	1	1	0	0	0	0	11	362	1	30	-	-	-	-	-	-			
11:15	0	37	6	11	33	0	0	0	0	0	0	8	346	1	25	-	-	-	-	-	-			
11:30	0	43	2	9	40	0	0	0	0	0	0	4	332	1	25	-	-	-	-	-	-			
11:45	0	37	2	12	31	0	0	0	0	0	0	7	345	2	31	-	-	-	-	-	-			
12:00	0	37	4	4	38	0	1	0	0	0	0	6	338	2	28	-	-	-	-	-	-			
12:15	0	30	5	6	32	0	0	0	0	0	0	8	346	1	30	-	-	-	-	-	-			
12:30	0	49	3	9	45	1	0	0	1	0	0	10	372	2	27	-	-	-	-	-	-			
12:45	0	28	2	10	35	0	0	0	0	0	0	4	356	1	23	-	-	-	-	-	-			
13:00	0	38	3	6	44	0	0	0	0	0	0	8	384	1	31	-	-	-	-	-	-			
13:15	1	49	4	7	38	0	1	0	0	0	0	5	403	1	30	-	-	-	-	-	-			
13:30	0	53	2	12	24	0	0	0	0	0	0	6	419	2	26	-	-	-	-	-	-			
13:45	0	45	2	10	46	0	0	0	0	0	0	12	458	2	28	-	-	-	-	-	-			
14:00	0	45	4	9	51	1	0	0	0	0	0	7	478	3	19	-	-	-	-	-	-			
14:15	0	54	4	7	50	0	0	0	2	0	0	1	486	3	20	-	-	-	-	-	-			
14:30	0	48	5	10	67	0	0	0	0	0	0	8	499	1	31	-	-	-	-	-	-			
14:45	0	46	3	15	58	1	0	0	1	0	0	3	520	1	33	-	-	-	-	-	-			
15:00	0	41	5	10	62	0	0	0	0	0	0	8	516	2	32	-	-	-	-	-	-			
15:15	0	58	4	12	54	0	0	0	0	0	0	12	534	2	30	-	-	-	-	-	-			
15:30	0	71	7	10	63	0	0	0	0	0	0	10	529	3	26	-	-	-	-	-	-			
15:45	1	51	5	10	52	0	0	1	1	0	0	2	487	4	19	-	-	-	-	-	-			
16:00	1	54	5	22	53	1	0	0	0	0	0	6	509	2	23	-	-	-	-	-	-			
16:15	0	38	9	15	61	0	0	1	0	0	0	8	499	2	18	-	-	-	-	-	-			
16:30	0	34	4	17	53	1	1	0	0	0	0	3	498	1	15	-	-	-	-	-	-			
16:45	0	44	5	15	77	0	0	0	0	0	0	6	521	0	16	-	-	-	-	-	-			
17:00	0	36	2	22	66	0	0	0	0	0	0	1	511	0	12	-	-	-	-	-	-			
17:15	0	42	3	14	63	0	0	0	0	0	0	5	385	0	11	-	-	-	-	-	-			
17:30	0	39	5	24	64	0	0	0	0	0	0	4	263	0	6	-	-	-	-	-	-			
17:45	0	48	2	16	65	0	0	0	0	0	0	2	131	0	2	-	-	-	-	-	-			
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
															Hours where condition met:						0	0	0
															Signal Warranted?						No		
															Notes								

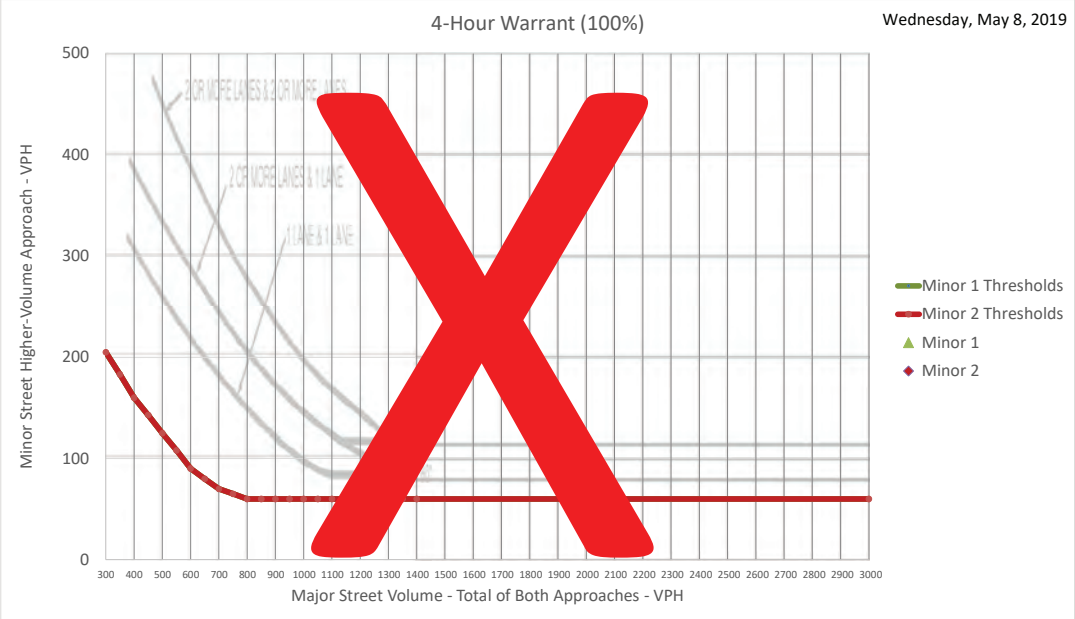
Weekday Kula Highway/Parking Lot 4-Hour Signal Warrant

Wednesday, May 8, 2019

	Kula Highway						Parking Lot			Kekaulike Avenu			70 % Warrant								
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold								
	1						1			1											
							RT Reduction:		0%	RT Reduction:		0%									
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:15	0	0	0	0	0	0	0	0	0	0	0	0	58	0	8						
5:30	0	0	0	0	0	0	0	0	0	0	0	0	123	0	12						
5:45	0	0	0	0	0	0	0	0	0	0	0	0	225	1	18						
6:00	0	49	2	0	7	0	0	0	0	0	0	8	346	1	36						
6:15	0	51	0	5	9	0	0	0	0	0	0	4	420	2	35						
6:30	0	63	0	1	38	0	0	1	0	0	0	6	527	3	47						
6:45	0	77	4	3	37	0	0	0	0	0	0	18	559	2	49						
7:00	0	97	7	8	19	1	0	0	1	0	0	7	562	3	33						
7:15	1	121	4	10	36	0	1	0	0	0	0	16	533	3	26						
7:30	0	79	4	7	44	0	0	0	0	0	0	8	470	4	10						
7:45	0	57	4	7	54	2	1	0	0	0	0	2	441	6	9						
8:00	0	49	2	13	39	0	0	1	0	0	0	0	441	6	17						
8:15	0	63	5	4	36	1	0	2	0	0	0	0	414	5	28						
8:30	0	52	2	9	42	0	1	1	0	0	0	7	400	4	30						
8:45	1	52	2	13	56	0	1	0	0	0	0	10	381	2	29						
9:00	0	35	2	5	34	0	0	0	0	0	0	11	342	2	24						
9:15	0	46	6	7	36	0	0	1	0	0	0	2	355	3	21						
9:30	0	41	2	10	33	0	0	0	0	0	0	6	356	3	33						
9:45	0	41	5	5	34	0	1	0	0	0	0	5	361	4	38						
10:00	0	50	2	12	24	1	0	0	1	0	0	8	378	4	40						
10:15	1	36	5	8	46	0	0	1	0	0	0	14	388	4	43						
10:30	0	51	3	7	30	0	1	0	0	0	0	11	379	3	37						
10:45	0	48	3	13	37	1	1	0	0	0	0	7	382	2	30						
11:00	0	49	2	10	37	1	1	0	0	0	0	11	362	1	30						
11:15	0	37	6	11	33	0	0	0	0	0	0	8	346	1	25						
11:30	0	43	2	9	40	0	0	0	0	0	0	4	332	1	25						
11:45	0	37	2	12	31	0	0	0	0	0	0	7	345	2	31						
12:00	0	37	4	4	38	0	1	0	0	0	0	6	338	2	28						
12:15	0	30	5	6	32	0	0	0	0	0	0	8	346	1	30						
12:30	0	49	3	9	45	1	0	0	1	0	0	10	372	2	27						
12:45	0	28	2	10	35	0	0	0	0	0	0	4	356	1	23						
13:00	0	38	3	6	44	0	0	0	0	0	0	8	384	1	31						
13:15	1	49	4	7	38	0	1	0	0	0	0	5	403	1	30						
13:30	0	53	2	12	24	0	0	0	0	0	0	6	419	2	26						
13:45	0	45	2	10	46	0	0	0	0	0	0	12	458	2	28						
14:00	0	45	4	9	51	1	0	0	0	0	0	7	478	3	19						
14:15	0	54	4	7	50	0	0	0	2	0	0	1	486	3	20						
14:30	0	48	5	10	67	0	0	0	0	0	0	8	499	1	31						
14:45	0	46	3	15	58	1	0	0	1	0	0	3	520	1	33						
15:00	0	41	5	10	62	0	0	0	0	0	0	8	516	2	32						
15:15	0	58	4	12	54	0	0	0	0	0	0	12	534	2	30						
15:30	0	71	7	10	63	0	0	0	0	0	0	10	529	3	26						
15:45	1	51	5	10	52	0	0	1	1	0	0	2	487	4	19						
16:00	1	54	5	22	53	1	0	0	0	0	0	6	509	2	23						
16:15	0	38	9	15	61	0	0	1	0	0	0	8	499	2	18						
16:30	0	34	4	17	53	1	1	0	0	0	0	3	498	1	15						
16:45	0	44	5	15	77	0	0	0	0	0	0	6	521	0	16						
17:00	0	36	2	22	66	0	0	0	0	0	0	1	511	0	12						
17:15	0	42	3	14	63	0	0	0	0	0	0	5	385	0	11						
17:30	0	39	5	24	64	0	0	0	0	0	0	4	263	0	6						
17:45	0	48	2	16	65	0	0	0	0	0	0	2	131	0	2						
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						

Hours Where Condition Met: 0

Signal Warranted? No


4-Hour Warrant (100%)
Wednesday, May 8, 2019
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2


4-Hour Warrant (70%)
Wednesday, May 8, 2019
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2

APPENDIX D

TRAFFIC SIGNAL WARRANT

Kula Highway/Kekaulike Avenue
Future Year Conditions

Weekday Kula Highway/Kekaulike Avenue 8-Hour Signal Warrant

Tuesday, February 13, 2024

Condition A - Minimum volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	500	400	350	280	150	120	105	84
2+	1	600	480	420	336	150	120	105	84
2+	2+	600	480	420	336	200	160	140	112
1	2+	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	750	600	525	420	75	60	53	42
2+	1	900	720	630	504	75	60	53	42
2+	2+	900	720	630	504	100	80	70	56
1	2+	750	600	525	420	100	80	70	56

	Kula Highway						Kekaulike Avenu			0			100 % Warrant			Minor 1 (EB)			Minor 1 (WB)			Combination		
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold			500	750	600	500	750	600			
	1						1			1			Minor Threshold			150	75	120	150	75	120			
							RT Reduction:		0%	RT Reduction:		0%												
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	A	B	A+B	A	B	A+B	A	B	A+B
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:15	0	0	0	0	0	0	0	0	0	0	0	0	136	1	6	-	-	-	-	-	-			
5:30	0	0	0	0	0	0	0	0	0	0	0	0	285	2	8	-	-	-	-	-	-			
5:45	0	0	0	0	0	0	0	0	0	0	0	0	554	3	11	-	-	-	-	-	-			
6:00	0	109	3	1	23	0	0	0	1	0	0	6	856	4	28	-	-	-	-	-	-			
6:15	0	113	1	5	30	0	0	0	1	0	0	2	1016	4	27	-	-	-	-	-	-			
6:30	0	140	1	1	127	0	0	0	1	0	0	3	1271	4	39	-	-	-	-	-	-			
6:45	0	171	5	3	123	0	0	0	1	0	0	17	1336	4	41	-	-	-	-	-	-			
7:00	0	215	10	8	63	0	0	0	1	0	0	5	1353	4	24	-	-	-	-	-	-			
7:15	0	269	5	10	120	0	0	0	1	0	0	14	1312	4	19	-	-	-	-	-	-			
7:30	0	175	5	7	147	0	0	0	1	0	0	5	1179	4	5	-	-	-	-	-	-			
7:45	0	126	5	7	180	1	0	0	1	0	0	0	1112	4	4	-	-	-	-	-	-			
8:00	0	109	3	13	130	0	0	0	1	0	0	0	1111	4	12	-	-	-	-	-	-			
8:15	0	140	7	4	120	0	0	0	1	0	0	0	1055	4	21	-	-	-	-	-	-			
8:30	0	115	3	9	140	0	0	0	1	0	0	4	1021	4	21	-	-	-	-	-	-			
8:45	0	115	3	13	187	0	0	0	1	0	0	8	968	4	19	-	-	-	-	-	-			
9:00	0	78	3	5	113	0	0	0	1	0	0	9	866	4	14	-	-	-	-	-	-			
9:15	0	102	8	7	120	0	0	0	1	0	0	0	873	4	11	-	-	-	-	-	-			
9:30	0	91	3	10	110	0	0	0	1	0	0	2	884	4	24	-	-	-	-	-	-			
9:45	0	91	7	5	113	0	0	0	1	0	0	3	894	4	30	-	-	-	-	-	-			
10:00	0	111	3	12	80	0	0	0	1	0	0	6	925	4	32	-	-	-	-	-	-			
10:15	0	80	7	8	153	0	0	0	1	0	0	13	964	4	34	-	-	-	-	-	-			
10:30	0	113	4	7	100	0	0	0	1	0	0	8	927	4	27	-	-	-	-	-	-			
10:45	0	107	4	13	123	0	0	0	1	0	0	5	943	4	19	-	-	-	-	-	-			
11:00	0	109	3	10	123	0	0	0	1	0	0	8	896	4	19	-	-	-	-	-	-			
11:15	0	82	8	11	110	0	0	0	1	0	0	6	918	5	12	-	-	-	-	-	-			
11:30	0	95	3	9	133	0	0	0	1	0	0	0	935	6	7	-	-	-	-	-	-			
11:45	0	82	3	12	103	0	0	0	1	0	0	5	1030	7	12	-	-	-	-	-	-			
12:00	1	114	8	5	139	0	0	1	1	0	0	1	1063	8	7	-	-	-	-	-	-			
12:15	1	92	10	8	117	0	0	1	1	0	0	1	1089	8	9	-	-	-	-	-	-			
12:30	1	151	6	12	165	0	0	1	1	0	0	5	1170	8	8	-	-	-	-	-	-			
12:45	1	86	4	14	128	0	0	1	1	0	0	0	1107	8	3	-	-	-	-	-	-			
13:00	1	117	6	8	161	0	0	1	1	0	0	3	1201	8	6	-	-	-	-	-	-			
13:15	1	151	8	10	139	0	0	1	1	0	0	0	1255	8	8	-	-	-	-	-	-			
13:30	1	163	4	16	88	0	0	1	1	0	0	0	1314	8	8	-	-	-	-	-	-			
13:45	1	139	4	14	169	0	0	1	1	0	0	3	1461	8	12	-	-	-	-	-	-			
14:00	1	139	8	12	187	0	0	1	1	0	0	5	1516	8	9	-	-	-	-	-	-			
14:15	1	166	8	10	183	0	0	1	1	0	0	0	1547	8	7	-	-	-	-	-	-			
14:30	1	148	10	14	246	0	0	1	1	0	0	4	1581	8	17	-	-	-	-	-	-			
14:45	1	142	6	20	213	0	0	1	1	0	0	0	1642	8	16	-	-	-	-	-	-			
15:00	1	126	10	14	227	0	0	1	1	0	0	3	1633	8	16	-	-	-	-	-	-			
15:15	1	179	8	16	198	0	0	1	1	0	0	10	1656	8	13	-	-	-	-	-	-			
15:30	1	219	15	14	231	0	0	1	1	0	0	3	1635	8	4	-	-	-	-	-	-			
15:45	1	157	10	14	191	0	0	1	1	0	0	0	1486	8	1	-	-	-	-	-	-			
16:00	1	166	10	30	194	0	0	1	1	0	0	0	1562	8	2	-	-	-	-	-	-			
16:15	1	117	19	20	224	0	0	1	1	0	0	1	1549	8	2	-	-	-	-	-	-			
16:30	1	105	8	23	194	0	0	1	1	0	0	0	1554	8	1	-	-	-	-	-	-			
16:45	1	136	10	20	282	0	0	1	1	0	0	1	1622	8	1	-	-	-	-	-	-			
17:00	1	111	4	30	242	0	0	1	1	0	0	0	1586	8	0	-	-	-	-	-	-			
17:15	1	129	6	19	231	0	0	1	1	0	0	0	1198	6	0	-	-	-	-	-	-			
17:30	1	120	10	33	235	0	0	1	1	0	0	0	812	4	0	-	-	-	-	-	-			
17:45	1	148	4	22	238	0	0	1	1	0	0	0	413	2	0	-	-	-	-	-	-			
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
															Hours where condition met:							0	0	0
															Signal Warranted?							No		
															Notes									

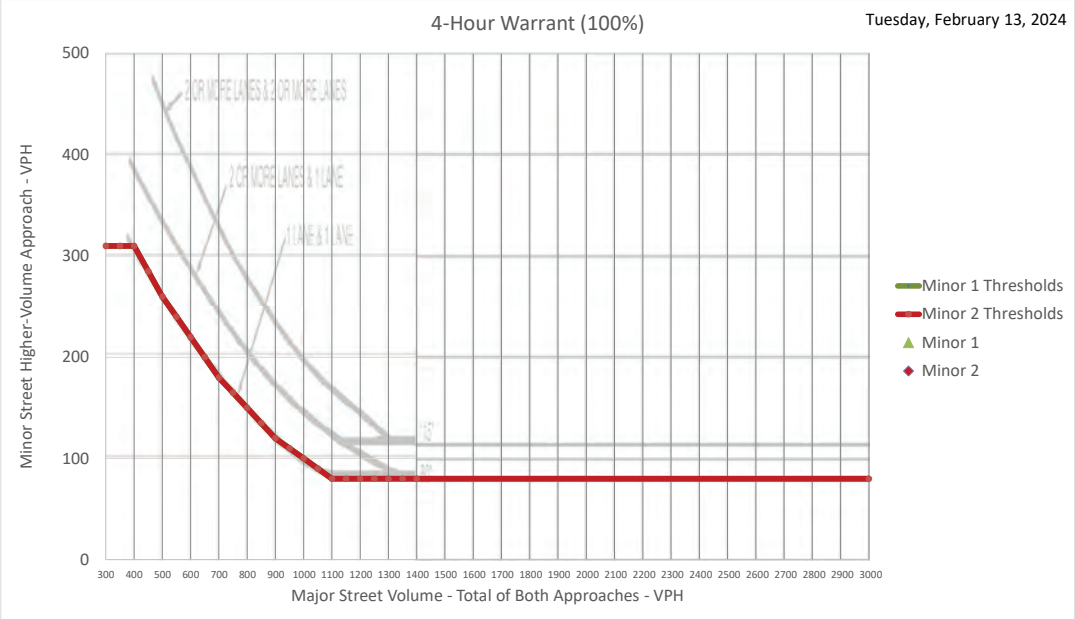
Weekday Kula Highway/Kekaulike Avenue 4-Hour Signal Warrant

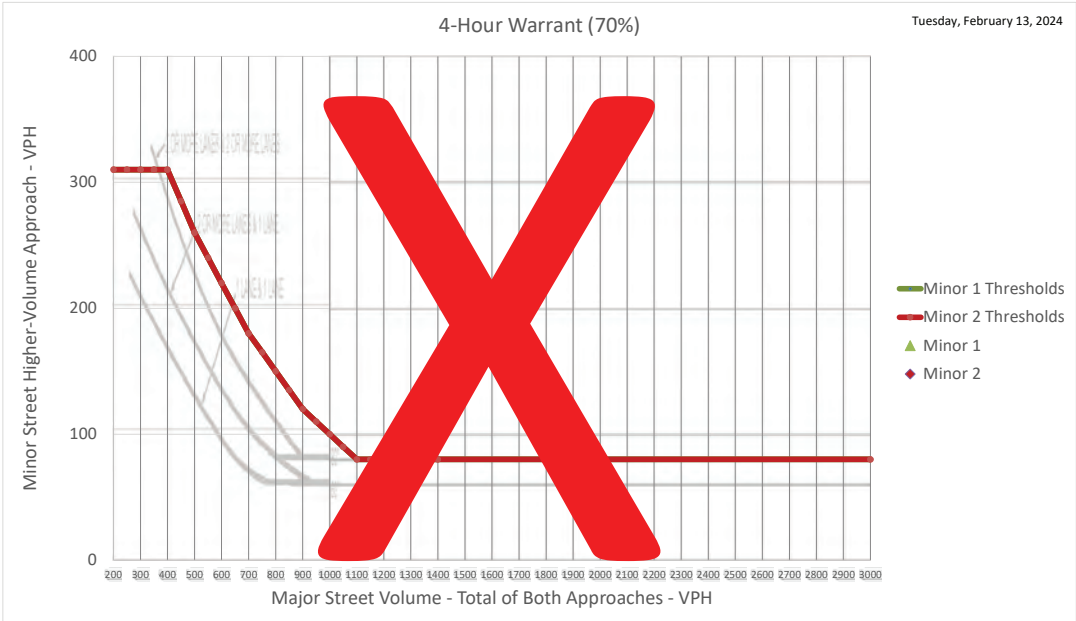
Tuesday, February 13, 2024

	Kula Highway						Kekaulike Avenu						0			100 % Warrant								
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes						Major Threshold								
	1						1			1														
							RT Reduction:		0%	RT Reduction:		0%												
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour			
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
5:15	0	0	0	0	0	0	0	0	0	0	0	0	136	1	6									
5:30	0	0	0	0	0	0	0	0	0	0	0	0	285	2	8									
5:45	0	0	0	0	0	0	0	0	0	0	0	0	554	3	11									
6:00	0	109	3	1	23	0	0	0	1	0	0	6	856	4	28									
6:15	0	113	1	5	30	0	0	0	1	0	0	2	1016	4	27									
6:30	0	140	1	1	127	0	0	0	1	0	0	3	1271	4	39									
6:45	0	171	5	3	123	0	0	0	1	0	0	17	1336	4	41									
7:00	0	215	10	8	63	0	0	0	1	0	0	5	1353	4	24									
7:15	0	269	5	10	120	0	0	0	1	0	0	14	1312	4	19									
7:30	0	175	5	7	147	0	0	0	1	0	0	5	1179	4	5									
7:45	0	126	5	7	180	1	0	0	1	0	0	0	1112	4	4									
8:00	0	109	3	13	130	0	0	0	1	0	0	0	1111	4	12									
8:15	0	140	7	4	120	0	0	0	1	0	0	0	1055	4	21									
8:30	0	115	3	9	140	0	0	0	1	0	0	4	*1021*	4	21									
8:45	0	115	3	13	187	0	0	0	1	0	0	8	968	4	19									
9:00	0	78	3	5	113	0	0	0	1	0	0	9	866	4	14									
9:15	0	102	8	7	120	0	0	0	1	0	0	0	873	4	11									
9:30	0	91	3	10	110	0	0	0	1	0	0	2	884	4	24									
9:45	0	91	7	5	113	0	0	0	1	0	0	3	894	4	30									
10:00	0	111	3	12	80	0	0	0	1	0	0	6	925	4	32									
10:15	0	80	7	8	153	0	0	0	1	0	0	13	964	4	34									
10:30	0	113	4	7	100	0	0	0	1	0	0	8	927	4	27									
10:45	0	107	4	13	123	0	0	0	1	0	0	5	943	4	19									
11:00	0	109	3	10	123	0	0	0	1	0	0	8	896	4	19									
11:15	0	82	8	11	110	0	0	0	1	0	0	6	918	5	12									
11:30	0	95	3	9	133	0	0	0	1	0	0	0	935	6	7									
11:45	0	82	3	12	103	0	0	0	1	0	0	5	1030	7	12									
12:00	1	114	8	5	139	0	0	1	1	0	0	1	1063	8	7									
12:15	1	92	10	8	117	0	0	1	1	0	0	1	1089	8	9									
12:30	1	151	6	12	165	0	0	1	1	0	0	5	1170	8	8									
12:45	1	86	4	14	128	0	0	1	1	0	0	0	1107	8	3									
13:00	1	117	6	8	161	0	0	1	1	0	0	3	1201	8	6									
13:15	1	151	8	10	139	0	0	1	1	0	0	0	1255	8	8									
13:30	1	163	4	16	88	0	0	1	1	0	0	0	1314	8	8									
13:45	1	139	4	14	169	0	0	1	1	0	0	3	1461	8	12									
14:00	1	139	8	12	187	0	0	1	1	0	0	5	1516	8	9									
14:15	1	166	8	10	183	0	0	1	1	0	0	0	1547	8	7									
14:30	1	148	10	14	246	0	0	1	1	0	0	4	1581	8	17									
14:45	1	142	6	20	213	0	0	1	1	0	0	0	1642	8	16									
15:00	1	126	10	14	227	0	0	1	1	0	0	3	1633	8	16									
15:15	1	179	8	16	198	0	0	1	1	0	0	10	1656	8	13									
15:30	1	219	15	14	231	0	0	1	1	0	0	3	1635	8	4									
15:45	1	157	10	14	191	0	0	1	1	0	0	0	1486	8	1									
16:00	1	166	10	30	194	0	0	1	1	0	0	0	1562	8	2									
16:15	1	117	19	20	224	0	0	1	1	0	0	1	1549	8	2									
16:30	1	105	8	23	194	0	0	1	1	0	0	0	1554	8	1									
16:45	1	136	10	20	282	0	0	1	1	0	0	1	1622	8	1									
17:00	1	111	4	30	242	0	0	1	1	0	0	0	1586	8	0									
17:15	1	129	6	19	231	0	0	1	1	0	0	0	1198	6	0									
17:30	1	120	10	33	235	0	0	1	1	0	0	0	812	4	0									
17:45	1	148	4	22	238	0	0	1	1	0	0	0	413	2	0									
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0									

Hours Where Condition Met: 0

Signal Warranted? No


4-Hour Warrant (100%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2


4-Hour Warrant (70%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2

APPENDIX D

TRAFFIC SIGNAL WARRANT

Kula Highway/Polipoli Road
Future Year Conditions

Weekday Kula Highway/Polipoli Road 8-Hour Signal Warrant

Tuesday, February 13, 2024

Condition A - Minimum volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	500	400	350	280	150	120	105	84
2+	1	600	480	420	336	150	120	105	84
2+	2+	600	480	420	336	200	160	140	112
1	2+	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	750	600	525	420	75	60	53	42
2+	1	900	720	630	504	75	60	53	42
2+	2+	900	720	630	504	100	80	70	56
1	2+	750	600	525	420	100	80	70	56

	Kula Highway						Polipoli Road			0			70 % Warrant			Minor 1 (EB)			Minor 1 (WB)			Combination		
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold			350	525	420	350	525	420			
	1						1			1			Minor Threshold			105	53	84	105	53	84			
							RT Reduction:		0%	RT Reduction:		0%													
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	A	B	A+B	A	B	A+B	A	B	A+B
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:15	0	0	0	0	0	0	0	0	0	0	0	0	136	0	5	-	-	-	-	-	-			
5:30	0	0	0	0	0	0	0	0	0	0	0	0	289	0	9	-	-	-	-	-	-			
5:45	0	0	0	0	0	0	0	0	0	0	0	0	511	0	17	-	-	-	-	-	-			
6:00	0	102	1	1	32	0	0	0	0	1	0	4	823	0	31	-	-	-	-	-	-			
6:15	0	122	1	2	28	0	0	0	0	1	0	3	976	0	35	-	-	-	-	-	-			
6:30	0	116	1	1	104	0	0	0	0	1	0	7	1196	0	38	-	-	-	-	-	-			
6:45	0	159	1	1	151	0	0	0	0	1	0	13	1303	0	35	-	-	-	-	-	-			
7:00	0	220	1	2	66	0	0	0	0	1	0	8	1283	0	28	-	-	-	-	-	-			
7:15	0	259	1	3	110	0	0	0	0	1	0	6	1262	0	25	-	-	-	-	-	-			
7:30	0	173	1	1	154	0	0	0	0	1	0	4	1175	0	23	-	-	-	-	-	-			
7:45	0	127	1	3	161	0	0	0	0	1	0	6	1102	0	24	-	-	-	-	-	-			
8:00	0	97	1	3	167	0	0	0	0	1	0	5	1094	0	25	-	-	-	-	-	-			
8:15	0	146	1	4	135	0	0	0	0	1	0	4	1028	0	23	-	-	-	-	-	-			
8:30	0	122	1	4	129	0	0	0	0	1	0	5	978	0	24	-	-	-	-	-	-			
8:45	0	106	1	4	173	0	0	0	0	1	0	7	937	0	25	-	-	-	-	-	-			
9:00	0	90	1	1	110	0	0	0	0	1	0	3	856	0	25	-	-	-	-	-	-			
9:15	0	109	1	3	123	0	0	0	0	1	0	5	866	0	25	-	-	-	-	-	-			
9:30	0	90	1	1	123	0	0	0	0	1	0	6	850	0	24	-	-	-	-	-	-			
9:45	0	90	2	1	110	0	0	0	0	1	0	7	852	0	22	-	-	-	-	-	-			
10:00	0	109	1	4	98	0	0	0	0	1	0	3	880	0	19	-	-	-	-	-	-			
10:15	0	83	1	4	132	0	0	0	0	1	0	4	884	0	20	-	-	-	-	-	-			
10:30	0	116	1	2	98	0	0	0	0	1	0	4	853	0	20	-	-	-	-	-	-			
10:45	0	104	1	3	123	0	0	0	0	1	0	4	863	0	21	-	-	-	-	-	-			
11:00	0	104	2	3	107	0	0	0	0	1	0	4	828	0	21	-	-	-	-	-	-			
11:15	0	90	1	7	91	0	0	0	0	1	0	4	850	0	21	-	-	-	-	-	-			
11:30	0	90	1	1	135	0	0	0	0	1	0	5	875	0	20	-	-	-	-	-	-			
11:45	0	85	1	3	107	0	0	0	0	1	0	4	944	0	20	-	-	-	-	-	-			
12:00	0	93	1	3	141	0	0	0	0	0	0	5	979	0	19	-	-	-	-	-	-			
12:15	0	90	1	5	118	0	0	0	0	0	0	4	980	0	21	-	-	-	-	-	-			
12:30	0	141	1	6	148	0	0	0	0	0	0	6	1111	0	20	-	-	-	-	-	-			
12:45	0	77	1	5	148	0	0	0	0	0	0	4	1093	0	17	-	-	-	-	-	-			
13:00	0	93	3	14	129	0	0	0	0	0	0	7	1170	0	15	-	-	-	-	-	-			
13:15	0	157	1	5	182	0	0	0	0	0	0	3	1278	0	13	-	-	-	-	-	-			
13:30	0	157	1	6	114	0	0	0	0	0	0	3	1278	0	12	-	-	-	-	-	-			
13:45	0	141	1	10	156	0	0	0	0	0	0	2	1408	0	12	-	-	-	-	-	-			
14:00	0	157	1	3	186	0	0	0	0	0	0	5	1449	0	13	-	-	-	-	-	-			
14:15	0	144	1	6	194	0	0	0	0	0	0	2	1477	0	14	-	-	-	-	-	-			
14:30	0	173	1	10	224	0	0	0	0	0	0	3	1540	0	15	-	-	-	-	-	-			
14:45	0	141	1	13	194	0	0	0	0	0	0	3	1564	0	18	-	-	-	-	-	-			
15:00	0	128	1	3	243	0	0	0	0	0	0	6	1550	0	23	-	-	-	-	-	-			
15:15	0	199	1	3	205	0	0	0	0	0	0	3	1541	0	21	-	-	-	-	-	-			
15:30	0	215	3	13	201	0	0	0	0	0	0	6	1466	0	22	-	-	-	-	-	-			
15:45	0	147	1	8	179	0	0	0	0	0	0	8	1362	0	19	-	-	-	-	-	-			
16:00	0	176	1	14	175	0	0	0	0	0	0	4	1473	0	14	-	-	-	-	-	-			
16:15	0	115	1	8	209	0	0	0	0	0	0	4	1486	0	12	-	-	-	-	-	-			
16:30	0	115	1	11	201	0	0	0	0	0	0	3	1550	0	9	-	-	-	-	-	-			
16:45	0	151	1	13	281	0	0	0	0	0	0	3	1539	0	10	-	-	-	-	-	-			
17:00	0	119	1	5	254	0	0	0	0	0	0	2	1466	0	11	-	-	-	-	-	-			
17:15	0	151	1	13	232	0	0	0	0	0	0	1	1087	0	9	-	-	-	-	-	-			
17:30	0	125	2	11	179	0	0	0	0	0	0	4	690	0	8	-	-	-	-	-	-			
17:45	0	135	1	13	224	0	0	0	0	0	0	4	373	0	4	-	-	-	-	-	-			
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
															Hours where condition met:						0	0	0
															Signal Warranted?						No		
															Notes								

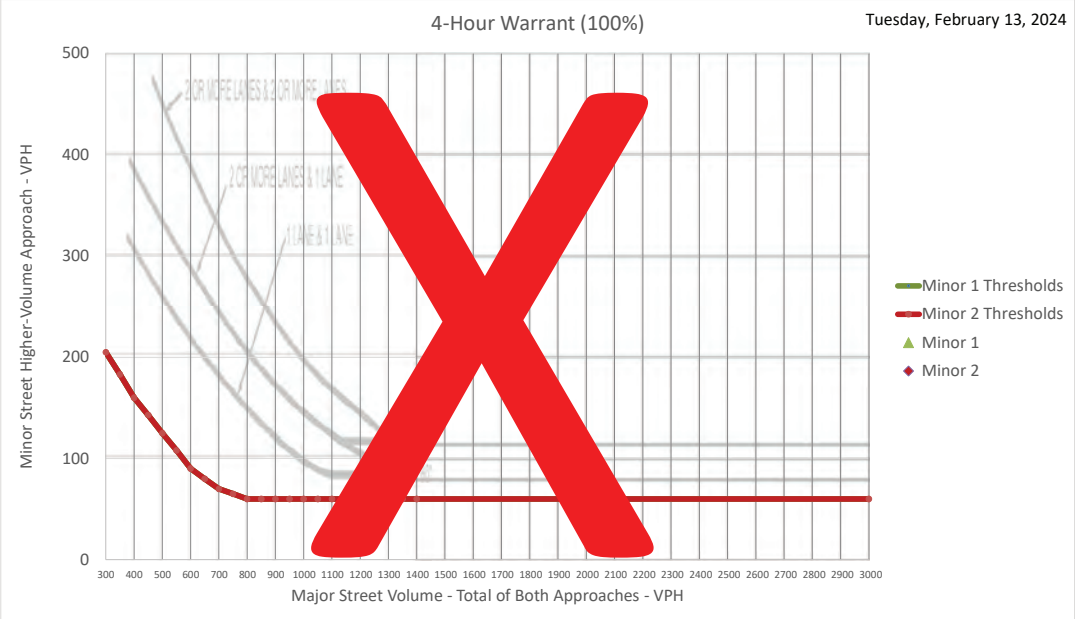
Weekday Kula Highway/Polipoli Road 4-Hour Signal Warrant

Tuesday, February 13, 2024

	Kula Highway						Polipoli Road			0			70 % Warrant									
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold									
	1						1			1												
							RT Reduction:		0%	RT Reduction:		0%										
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:15	0	0	0	0	0	0	0	0	0	0	0	0	136	0	5						
5:30	0	0	0	0	0	0	0	0	0	0	0	0	289	0	9						
5:45	0	0	0	0	0	0	0	0	0	0	0	0	511	0	17						
6:00	0	102	1	1	32	0	0	0	0	1	0	4	823	0	31						
6:15	0	122	1	2	28	0	0	0	0	1	0	3	976	0	35						
6:30	0	116	1	1	104	0	0	0	0	1	0	7	1196	0	38						
6:45	0	159	1	1	151	0	0	0	0	1	0	13	1303	0	35						
7:00	0	220	1	2	66	0	0	0	0	1	0	8	1283	0	28						
7:15	0	259	1	3	110	0	0	0	0	1	0	6	1262	0	25						
7:30	0	173	1	1	154	0	0	0	0	1	0	4	1175	0	23						
7:45	0	127	1	3	161	0	0	0	0	1	0	6	1102	0	24						
8:00	0	97	1	3	167	0	0	0	0	1	0	5	1094	0	25						
8:15	0	146	1	4	135	0	0	0	0	1	0	4	1028	0	23						
8:30	0	122	1	4	129	0	0	0	0	1	0	5	978	0	24						
8:45	0	106	1	4	173	0	0	0	0	1	0	7	937	0	25						
9:00	0	90	1	1	110	0	0	0	0	1	0	3	856	0	25						
9:15	0	109	1	3	123	0	0	0	0	1	0	5	866	0	25						
9:30	0	90	1	1	123	0	0	0	0	1	0	6	850	0	24						
9:45	0	90	2	1	110	0	0	0	0	1	0	7	852	0	22						
10:00	0	109	1	4	98	0	0	0	0	1	0	3	880	0	19						
10:15	0	83	1	4	132	0	0	0	0	1	0	4	884	0	20						
10:30	0	116	1	2	98	0	0	0	0	1	0	4	853	0	20						
10:45	0	104	1	3	123	0	0	0	0	1	0	4	863	0	21						
11:00	0	104	2	3	107	0	0	0	0	1	0	4	828	0	21						
11:15	0	90	1	7	91	0	0	0	0	1	0	4	850	0	21						
11:30	0	90	1	1	135	0	0	0	0	1	0	5	875	0	20						
11:45	0	85	1	3	107	0	0	0	0	1	0	4	944	0	20						
12:00	0	93	1	3	141	0	0	0	0	0	0	5	979	0	19						
12:15	0	90	1	5	118	0	0	0	0	0	0	4	980	0	21						
12:30	0	141	1	6	148	0	0	0	0	0	0	6	1111	0	20						
12:45	0	77	1	5	148	0	0	0	0	0	0	4	1093	0	17						
13:00	0	93	3	14	129	0	0	0	0	0	0	7	1170	0	15						
13:15	0	157	1	5	182	0	0	0	0	0	0	3	1278	0	13						
13:30	0	157	1	6	114	0	0	0	0	0	0	3	1278	0	12						
13:45	0	141	1	10	156	0	0	0	0	0	0	2	1408	0	12						
14:00	0	157	1	3	186	0	0	0	0	0	0	5	1449	0	13						
14:15	0	144	1	6	194	0	0	0	0	0	0	2	1477	0	14						
14:30	0	173	1	10	224	0	0	0	0	0	0	3	1540	0	15						
14:45	0	141	1	13	194	0	0	0	0	0	0	3	1564	0	18						
15:00	0	128	1	3	243	0	0	0	0	0	0	6	1550	0	23						
15:15	0	199	1	3	205	0	0	0	0	0	0	3	1541	0	21						
15:30	0	215	3	13	201	0	0	0	0	0	0	6	1466	0	22						
15:45	0	147	1	8	179	0	0	0	0	0	0	8	1362	0	19						
16:00	0	176	1	14	175	0	0	0	0	0	0	4	1473	0	14						
16:15	0	115	1	8	209	0	0	0	0	0	0	4	1486	0	12						
16:30	0	115	1	11	201	0	0	0	0	0	0	3	1550	0	9						
16:45	0	151	1	13	281	0	0	0	0	0	0	3	1539	0	10						
17:00	0	119	1	5	254	0	0	0	0	0	0	2	1466	0	11						
17:15	0	151	1	13	232	0	0	0	0	0	0	1	1087	0	9						
17:30	0	125	2	11	179	0	0	0	0	0	0	4	690	0	8						
17:45	0	135	1	13	224	0	0	0	0	0	0	4	373	0	4						
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						

Hours Where Condition Met: 0

Signal Warranted? No


4-Hour Warrant (100%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2


4-Hour Warrant (70%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2

APPENDIX D

TRAFFIC SIGNAL WARRANT

Kula Highway/Pueo Drive
Future Year Conditions

Weekday Kula Highway/Pueo Drive 8-Hour Signal Warrant

Tuesday, February 13, 2024

Condition A - Minimum volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	500	400	350	280	150	120	105	84
2+	1	600	480	420	336	150	120	105	84
2+	2+	600	480	420	336	200	160	140	112
1	2+	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	750	600	525	420	75	60	53	42
2+	1	900	720	630	504	75	60	53	42
2+	2+	900	720	630	504	100	80	70	56
1	2+	750	600	525	420	100	80	70	56

	Kula Highway	Pueo Drive	0	70 % Warrant	Minor 1 (EB)			Minor 1 (WB)			Combination
	Major Lanes	Minor 1 Lanes	Minor 2 Lanes	Major Threshold	350	525	420	350	525	420	
	1	1	1	Minor Threshold	105	53	84	105	53	84	
		RT Reduction: 0%	RT Reduction: 0%								

Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	EB A	EB B	EB A+B	WB A	WB B	WB A+B	Comb. A	Comb. B	Comb. A+B
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
5:15	0	0	0	0	0	0	0	0	0	0	0	0	108	10	0	-	-	-	-	-	-	0	0	0
5:30	0	0	0	0	0	0	0	0	0	0	0	0	237	24	0	-	-	-	-	-	-	0	0	0
5:45	0	0	0	0	0	0	0	0	0	0	0	0	461	33	0	-	-	-	-	-	-	0	0	0
6:00	1	95	0	0	10	2	9	0	1	0	0	0	784	43	0	-	-	-	-	-	-	0	0	0
6:15	1	100	0	0	27	1	13	0	1	0	0	0	938	55	0	-	1	-	-	-	-	0	1	0
6:30	1	110	0	0	112	1	8	0	1	0	0	0	1122	68	0	-	1	-	-	-	-	0	2	0
6:45	2	164	0	0	156	1	9	0	1	0	0	0	1225	75	0	-	1	-	-	-	-	0	3	0
7:00	1	189	0	0	71	1	20	0	2	0	0	0	1179	75	0	-	1	-	-	-	-	0	4	0
7:15	2	225	0	0	81	5	25	0	2	0	0	0	1173	64	0	-	1	-	-	-	-	0	1	0
7:30	1	164	0	0	156	6	15	0	1	0	0	0	1128	47	0	-	-	-	-	-	-	0	2	0
7:45	1	113	0	0	156	7	9	0	1	0	0	0	1060	37	0	-	-	-	-	-	-	0	3	0
8:00	1	87	0	0	163	5	9	0	2	0	0	0	1039	37	0	-	-	-	-	-	-	0	4	0
8:15	1	138	0	0	122	7	9	0	1	0	0	0	979	36	0	-	-	-	-	-	-	0	0	0
8:30	1	125	0	0	129	4	5	0	1	0	0	0	967	28	0	-	-	-	-	-	-	0	0	0
8:45	1	90	0	0	159	6	9	0	1	0	0	0	921	30	0	-	-	-	-	-	-	0	0	0
9:00	1	84	0	0	105	6	7	0	3	0	0	0	872	24	0	-	-	-	-	-	-	0	0	0
9:15	1	123	0	0	129	3	1	0	1	0	0	0	883	24	0	-	-	-	-	-	-	0	0	0
9:30	1	87	0	0	122	3	7	0	1	0	0	0	834	30	0	-	-	-	-	-	-	0	0	0
9:45	1	97	0	0	105	4	3	0	1	0	0	0	837	29	0	-	-	-	-	-	-	0	0	0
10:00	1	105	0	0	95	6	9	0	1	0	0	0	880	28	0	-	-	-	-	-	-	0	0	0
10:15	1	79	0	0	125	2	5	0	3	0	0	0	896	25	0	-	-	-	-	-	-	0	0	0
10:30	1	107	0	0	102	6	6	0	1	0	0	0	863	21	0	-	-	-	-	-	-	0	0	0
10:45	1	115	0	0	129	5	2	0	1	0	0	0	865	22	0	-	-	-	-	-	-	0	0	0
11:00	1	113	0	0	105	4	5	0	2	0	0	0	783	26	0	-	-	-	-	-	-	0	0	0
11:15	1	90	0	0	78	5	3	0	1	0	0	0	821	23	0	-	-	-	-	-	-	0	0	0
11:30	1	87	0	0	122	8	7	0	1	0	0	0	874	23	0	-	-	-	-	-	-	0	0	0
11:45	1	67	0	0	95	5	6	0	1	0	0	0	934	20	0	-	-	-	-	-	-	0	0	0
12:00	2	112	0	0	143	4	3	0	1	0	0	0	1018	15	0	-	-	-	-	-	-	0	0	0
12:15	1	90	0	0	134	2	3	0	1	0	0	0	1001	15	0	-	-	-	-	-	-	0	0	0
12:30	1	137	0	0	134	6	4	0	1	0	0	0	1056	17	0	-	-	-	-	-	-	0	0	0
12:45	1	90	0	0	156	5	1	0	1	0	0	0	1017	21	0	-	-	-	-	-	-	0	0	0
13:00	1	101	0	0	139	3	3	0	1	0	0	0	1070	23	0	-	-	-	-	-	-	0	0	0
13:15	1	141	0	0	130	10	5	0	1	0	0	0	1160	24	0	-	-	-	-	-	-	0	0	0
13:30	1	127	0	0	108	3	8	0	1	0	0	0	1228	21	0	-	-	-	-	-	-	0	0	0
13:45	1	141	0	0	156	7	3	0	1	0	0	0	1388	16	0	-	-	-	-	-	-	0	0	0
14:00	1	159	0	0	165	9	4	0	1	0	0	0	1406	17	0	-	-	-	-	-	-	0	0	0
14:15	1	152	0	0	191	6	2	0	1	0	0	0	1439	17	0	-	-	-	-	-	-	0	0	0
14:30	1	181	0	0	204	13	3	0	1	0	0	0	1490	22	0	-	-	-	-	-	-	0	0	0
14:45	1	141	0	0	169	12	4	0	1	0	0	0	1511	25	0	-	-	-	-	-	-	0	0	0
15:00	1	127	0	0	226	13	4	0	1	0	0	0	1512	24	0	-	-	-	-	-	-	0	0	0
15:15	1	177	0	0	217	6	7	0	1	0	0	0	1530	21	0	-	-	-	-	-	-	0	0	0
15:30	1	217	0	0	195	7	6	0	1	0	0	0	1475	17	0	-	-	-	-	-	-	0	0	0
15:45	2	152	0	0	160	10	3	0	1	0	0	0	1329	16	0	-	-	-	-	-	-	0	0	0
16:00	1	192	0	0	182	10	1	0	1	0	0	0	1417	16	0	-	-	-	-	-	-	0	0	0
16:15	1	119	0	0	217	9	3	0	1	0	0	0	1384	19	0	-	-	-	-	-	-	0	0	0
16:30	1	101	0	0	160	12	5	0	1	0	0	0	1434	20	0	-	-	-	-	-	-	0	0	0
16:45	2	159	0	0	234	17	3	0	1	0	0	0	1458	19	0	-	-	-	-	-	-	0	0	0
17:00	1	109	0	0	230	12	4	0	1	0	0	0	1385	20	0	-	-	-	-	-	-	0	0	0
17:15	1	145	0	0	239	11	4	0	1	0	0	0	1033	15	0	-	-	-	-	-	-	0	0	0
17:30	1	123	0	0	160	14	4	0	1	0	0	0	637	10	0	-	-	-	-	-	-	0	0	0
17:45	1	134	0	0	191	13	4	0	1	0	0	0	339	5	0	-	-	-	-	-	-	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0

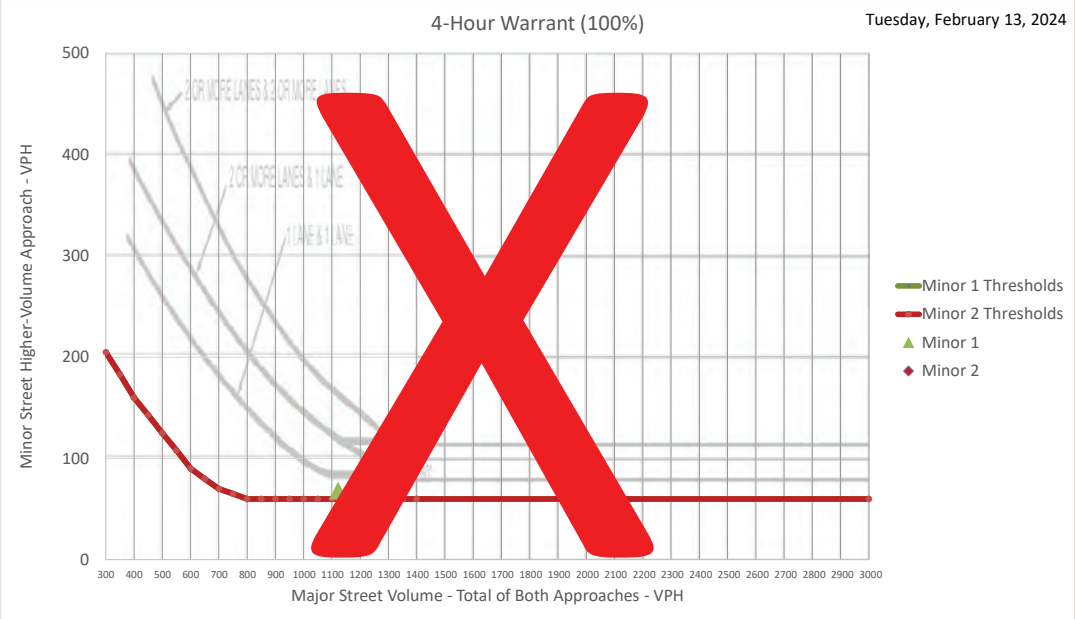
	A	B	A+B
Hours where condition met:	0	2	0
Signal Warranted?	No		
Notes			

Weekday Kula Highway/Pueo Drive 4-Hour Signal Warrant

Tuesday, February 13, 2024

	Kula Highway						Pueo Drive			0			70 % Warrant									
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold									
	1						1			1												
							RT Reduction:		0%	RT Reduction:		0%										
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:15	0	0	0	0	0	0	0	0	0	0	0	0	108	10	0						
5:30	0	0	0	0	0	0	0	0	0	0	0	0	237	24	0						
5:45	0	0	0	0	0	0	0	0	0	0	0	0	461	33	0						
6:00	1	95	0	0	10	2	9	0	1	0	0	0	784	43	0						
6:15	1	100	0	0	27	1	13	0	1	0	0	0	938	55	0						
6:30	1	110	0	0	112	1	8	0	1	0	0	0	1122	68	0	1		1		1	1
6:45	2	164	0	0	156	1	9	0	1	0	0	0	1225	75	0	1		2		1	2
7:00	1	189	0	0	71	1	20	0	2	0	0	0	1179	75	0	1		3		1	3
7:15	2	225	0	0	81	5	25	0	2	0	0	0	1173	64	0	1		4		1	4
7:30	1	164	0	0	156	6	15	0	1	0	0	0	1128	47	0						
7:45	1	113	0	0	156	7	9	0	1	0	0	0	1060	37	0						
8:00	1	87	0	0	163	5	9	0	2	0	0	0	1039	37	0						
8:15	1	138	0	0	122	7	9	0	1	0	0	0	979	36	0						
8:30	1	125	0	0	129	4	5	0	1	0	0	0	967	28	0						
8:45	1	90	0	0	159	6	9	0	1	0	0	0	921	30	0						
9:00	1	84	0	0	105	6	7	0	3	0	0	0	872	24	0						
9:15	1	123	0	0	129	3	1	0	1	0	0	0	883	24	0						
9:30	1	87	0	0	122	3	7	0	1	0	0	0	834	30	0						
9:45	1	97	0	0	105	4	3	0	1	0	0	0	837	29	0						
10:00	1	105	0	0	95	6	9	0	1	0	0	0	880	28	0						
10:15	1	79	0	0	125	2	5	0	3	0	0	0	896	25	0						
10:30	1	107	0	0	102	6	6	0	1	0	0	0	863	21	0						
10:45	1	115	0	0	129	5	2	0	1	0	0	0	865	22	0						
11:00	1	113	0	0	105	4	5	0	2	0	0	0	783	26	0						
11:15	1	90	0	0	78	5	3	0	1	0	0	0	821	23	0						
11:30	1	87	0	0	122	8	7	0	1	0	0	0	874	23	0						
11:45	1	67	0	0	95	5	6	0	1	0	0	0	934	20	0						
12:00	2	112	0	0	143	4	3	0	1	0	0	0	1018	15	0						
12:15	1	90	0	0	134	2	3	0	1	0	0	0	1001	15	0						
12:30	1	137	0	0	134	6	4	0	1	0	0	0	1056	17	0						
12:45	1	90	0	0	156	5	1	0	1	0	0	0	1017	21	0						
13:00	1	101	0	0	139	3	3	0	1	0	0	0	1070	23	0						
13:15	1	141	0	0	130	10	5	0	1	0	0	0	1160	24	0						
13:30	1	127	0	0	108	3	8	0	1	0	0	0	1228	21	0						
13:45	1	141	0	0	156	7	3	0	1	0	0	0	1388	16	0						
14:00	1	159	0	0	165	9	4	0	1	0	0	0	1406	17	0						
14:15	1	152	0	0	191	6	2	0	1	0	0	0	1439	17	0						
14:30	1	181	0	0	204	13	3	0	1	0	0	0	1490	22	0						
14:45	1	141	0	0	169	12	4	0	1	0	0	0	1511	25	0						
15:00	1	127	0	0	226	13	4	0	1	0	0	0	1512	24	0						
15:15	1	177	0	0	217	6	7	0	1	0	0	0	1530	21	0						
15:30	1	217	0	0	195	7	6	0	1	0	0	0	1475	17	0						
15:45	2	152	0	0	160	10	3	0	1	0	0	0	1329	16	0						
16:00	1	192	0	0	182	10	1	0	1	0	0	0	1417	16	0						
16:15	1	119	0	0	217	9	3	0	1	0	0	0	1384	19	0						
16:30	1	101	0	0	160	12	5	0	1	0	0	0	1434	20	0						
16:45	2	159	0	0	234	17	3	0	1	0	0	0	1458	19	0						
17:00	1	109	0	0	230	12	4	0	1	0	0	0	1385	20	0						
17:15	1	145	0	0	239	11	4	0	1	0	0	0	1033	15	0						
17:30	1	123	0	0	160	14	4	0	1	0	0	0	637	10	0						
17:45	1	134	0	0	191	13	4	0	1	0	0	0	339	5	0						
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						

Hours Where Condition Met:	1
Signal Warranted?	No


4-Hour Warrant (100%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2


4-Hour Warrant (70%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
1122, 68
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2

APPENDIX D

TRAFFIC SIGNAL WARRANT

Kula Highway/Lauie Drive
Existing Conditions

Weekday Kula Highway/Lauie Drive 8-Hour Signal Warrant

Tuesday, February 13, 2024

Condition A - Minimum volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	500	400	350	280	150	120	105	84
2+	1	600	480	420	336	150	120	105	84
2+	2+	600	480	420	336	200	160	140	112
1	2+	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	750	600	525	420	75	60	53	42
2+	1	900	720	630	504	75	60	53	42
2+	2+	900	720	630	504	100	80	70	56
1	2+	750	600	525	420	100	80	70	56

Kula Highway	Lauie Drive	0	70 % Warrant	Minor 1 (EB)			Minor 1 (WB)			Combination
Major Lanes	Minor 1 Lanes	Minor 2 Lanes	Major Threshold	350	525	420	350	525	420	
1	1	1	Minor Threshold	105	53	84	105	53	84	
	RT Reduction: 100%	RT Reduction: 100%								

Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	EB A	EB B	EB A+B	WB A	WB B	WB A+B	Comb. A	Comb. B	Comb. A+B
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
5:15	0	0	0	0	0	0	0	0	0	0	0	0	18	17	0	-	-	-	-	-	-	0	0	0
5:30	0	0	0	0	0	0	0	0	0	0	0	0	44	37	0	-	-	-	-	-	-	0	0	0
5:45	0	0	0	0	0	0	0	0	0	0	0	0	96	57	0	-	-	-	-	-	-	0	0	0
6:00	0	16	0	0	1	1	17	0	0	0	0	0	173	90	0	-	-	-	-	-	-	0	0	0
6:15	0	17	0	0	9	0	20	0	0	0	0	0	222	106	0	-	-	-	-	-	-	0	0	0
6:30	0	18	0	0	34	0	20	0	0	0	0	0	259	137	0	-	-	-	-	-	-	0	0	0
6:45	0	34	0	0	40	3	33	0	0	0	0	0	287	146	0	-	-	-	-	-	-	0	0	0
7:00	0	44	0	0	20	3	33	0	0	0	0	0	284	126	0	-	-	-	-	-	-	0	0	0
7:15	0	36	0	0	20	7	51	0	0	0	0	0	285	109	0	-	-	-	-	-	-	0	0	0
7:30	0	36	0	0	31	13	29	0	0	0	0	0	299	74	0	-	-	-	-	-	-	0	0	0
7:45	0	29	0	0	40	5	13	0	0	0	0	0	287	59	0	-	-	-	-	-	-	0	0	0
8:00	0	17	0	0	38	13	16	0	0	0	0	0	294	50	0	-	-	-	-	-	-	0	0	0
8:15	1	39	0	0	30	7	16	0	0	0	0	0	283	43	0	-	-	-	-	-	-	0	0	0
8:30	0	35	0	0	21	12	14	0	0	0	0	0	282	35	0	-	-	-	-	-	-	0	0	0
8:45	0	33	0	0	39	9	4	0	0	0	0	0	274	31	0	-	-	-	-	-	-	0	0	0
9:00	0	22	0	0	28	7	9	0	0	0	0	0	255	35	0	-	-	-	-	-	-	0	0	0
9:15	1	38	0	0	37	0	8	0	0	0	0	0	253	35	0	-	-	-	-	-	-	0	0	0
9:30	0	24	0	0	30	6	10	0	0	0	0	0	245	31	0	-	-	-	-	-	-	0	0	0
9:45	1	31	0	0	26	4	8	0	0	0	0	0	248	32	0	-	-	-	-	-	-	0	0	0
10:00	0	33	0	0	18	4	9	0	0	0	0	0	253	34	0	-	-	-	-	-	-	0	0	0
10:15	0	27	0	0	33	8	4	0	0	0	0	0	261	36	0	-	-	-	-	-	-	0	0	0
10:30	0	31	0	0	25	7	11	0	0	0	0	0	246	40	0	-	-	-	-	-	-	0	0	0
10:45	0	34	0	0	26	7	10	0	0	0	0	0	248	33	0	-	-	-	-	-	-	0	0	0
11:00	0	33	0	0	24	6	11	0	0	0	0	0	229	31	0	-	-	-	-	-	-	0	0	0
11:15	1	28	0	0	17	7	8	0	0	0	0	0	228	24	0	-	-	-	-	-	-	0	0	0
11:30	2	28	0	0	30	5	4	0	0	0	0	0	219	26	0	-	-	-	-	-	-	0	0	0
11:45	0	22	0	0	21	5	8	0	0	0	0	0	208	34	0	-	-	-	-	-	-	0	0	0
12:00	0	28	0	0	25	9	4	0	0	0	0	0	210	36	0	-	-	-	-	-	-	0	0	0
12:15	0	15	0	0	25	4	10	0	0	0	0	0	203	38	0	-	-	-	-	-	-	0	0	0
12:30	0	23	0	0	24	7	12	0	0	0	0	0	218	38	0	-	-	-	-	-	-	0	0	0
12:45	0	14	0	0	26	10	10	0	0	0	0	0	218	35	0	-	-	-	-	-	-	0	0	0
13:00	0	24	0	0	21	10	6	0	0	0	0	0	232	35	0	-	-	-	-	-	-	0	0	0
13:15	1	28	0	0	22	8	10	0	0	0	0	0	252	41	0	-	-	-	-	-	-	0	0	0
13:30	0	27	0	0	23	4	9	0	0	0	0	0	272	40	0	-	-	-	-	-	-	0	0	0
13:45	0	29	0	0	24	11	10	0	0	0	0	0	301	42	0	-	-	-	-	-	-	0	0	0
14:00	1	34	0	0	25	15	12	0	0	0	0	0	307	38	0	-	-	-	-	-	-	0	0	0
14:15	2	34	0	0	28	15	9	0	0	0	0	0	314	35	0	-	-	-	-	-	-	0	0	0
14:30	0	38	0	0	35	10	11	0	0	0	0	0	322	35	0	-	-	-	-	-	-	0	0	0
14:45	1	32	0	0	28	9	6	0	0	0	0	0	339	32	0	-	-	-	-	-	-	0	0	0
15:00	1	27	0	0	37	17	9	0	0	0	0	0	337	35	0	-	-	-	-	-	-	0	0	0
15:15	0	39	0	0	34	14	9	0	0	0	0	0	342	34	0	-	-	-	-	-	-	0	0	0
15:30	1	52	0	0	23	24	8	0	0	0	0	0	326	32	0	-	-	-	-	-	-	0	0	0
15:45	1	35	0	0	22	10	9	0	0	0	0	0	287	29	0	-	-	-	-	-	-	0	0	0
16:00	0	45	0	0	30	12	8	0	0	0	0	0	306	30	0	-	-	-	-	-	-	0	0	0
16:15	1	25	0	0	27	18	7	0	0	0	0	0	299	30	0	-	-	-	-	-	-	0	0	0
16:30	0	24	0	0	28	9	5	0	0	0	0	0	309	38	0	-	-	-	-	-	-	0	0	0
16:45	1	34	0	0	32	20	10	0	0	0	0	0	311	39	0	-	-	-	-	-	-	0	0	0
17:00	0	23	0	0	37	20	8	0	0	0	0	0	298	37	0	-	-	-	-	-	-	0	0	0
17:15	0	27	0	0	33	21	15	0	0	0	0	0	218	29	0	-	-	-	-	-	-	0	0	0
17:30	0	26	0	0	19	18	6	0	0	0	0	0	137	14	0	-	-	-	-	-	-	0	0	0
17:45	1	29	0	0	25	19	8	0	0	0	0	0	74	8	0	-	-	-	-	-	-	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-	0	0	0

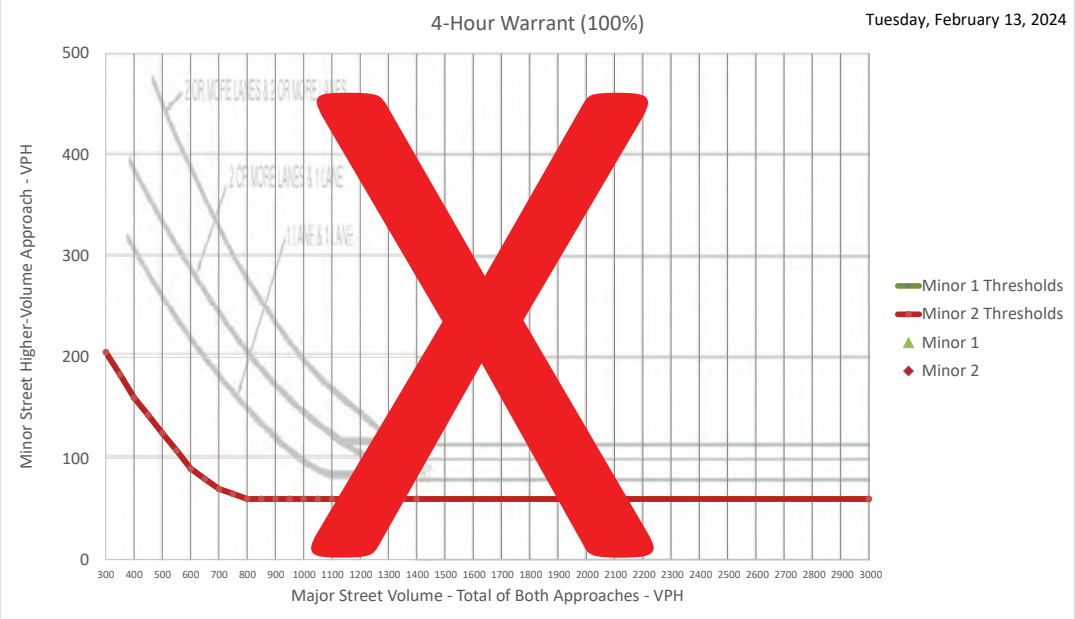
	A	B	A+B
Hours where condition met:	0	0	0
Signal Warranted?	No		
Notes			

Weekday Kula Highway/Lauie Drive 4-Hour Signal Warrant

Tuesday, February 13, 2024

	Kula Highway						Lauie Drive			0			70 % Warrant									
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold									
	1						1			1												
							RT Reduction: 100%			RT Reduction: 100%												
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour	
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
5:15	0	0	0	0	0	0	0	0	0	0	0	0	18	17	0							
5:30	0	0	0	0	0	0	0	0	0	0	0	0	44	37	0							
5:45	0	0	0	0	0	0	0	0	0	0	0	0	96	57	0							
6:00	0	16	0	0	1	1	17	0	0	0	0	0	173	90	0							
6:15	0	17	0	0	9	0	20	0	0	0	0	0	222	106	0							
6:30	0	18	0	0	34	0	20	0	0	0	0	0	259	137	0							
6:45	0	34	0	0	40	3	33	0	0	0	0	0	287	146	0							
7:00	0	44	0	0	20	3	33	0	0	0	0	0	284	126	0							
7:15	0	36	0	0	20	7	51	0	0	0	0	0	285	109	0							
7:30	0	36	0	0	31	13	29	0	0	0	0	0	299	74	0							
7:45	0	29	0	0	40	5	13	0	0	0	0	0	287	59	0							
8:00	0	17	0	0	38	13	16	0	0	0	0	0	294	50	0							
8:15	1	39	0	0	30	7	16	0	0	0	0	0	283	43	0							
8:30	0	35	0	0	21	12	14	0	0	0	0	0	282	35	0							
8:45	0	33	0	0	39	9	4	0	0	0	0	0	274	31	0							
9:00	0	22	0	0	28	7	9	0	0	0	0	0	255	35	0							
9:15	1	38	0	0	37	0	8	0	0	0	0	0	253	35	0							
9:30	0	24	0	0	30	6	10	0	0	0	0	0	245	31	0							
9:45	1	31	0	0	26	4	8	0	0	0	0	0	248	32	0							
10:00	0	33	0	0	18	4	9	0	0	0	0	0	253	34	0							
10:15	0	27	0	0	33	8	4	0	0	0	0	0	261	36	0							
10:30	0	31	0	0	25	7	11	0	0	0	0	0	246	40	0							
10:45	0	34	0	0	26	7	10	0	0	0	0	0	248	33	0							
11:00	0	33	0	0	24	6	11	0	0	0	0	0	229	31	0							
11:15	1	28	0	0	17	7	8	0	0	0	0	0	228	24	0							
11:30	2	28	0	0	30	5	4	0	0	0	0	0	219	26	0							
11:45	0	22	0	0	21	5	8	0	0	0	0	0	208	34	0							
12:00	0	28	0	0	25	9	4	0	0	0	0	0	210	36	0							
12:15	0	15	0	0	25	4	10	0	0	0	0	0	203	38	0							
12:30	0	23	0	0	24	7	12	0	0	0	0	0	218	38	0							
12:45	0	14	0	0	26	10	10	0	0	0	0	0	218	35	0							
13:00	0	24	0	0	21	10	6	0	0	0	0	0	232	35	0							
13:15	1	28	0	0	22	8	10	0	0	0	0	0	252	41	0							
13:30	0	27	0	0	23	4	9	0	0	0	0	0	272	40	0							
13:45	0	29	0	0	24	11	10	0	0	0	0	0	301	42	0							
14:00	1	34	0	0	25	15	12	0	0	0	0	0	307	38	0							
14:15	2	34	0	0	28	15	9	0	0	0	0	0	314	35	0							
14:30	0	38	0	0	35	10	11	0	0	0	0	0	322	35	0							
14:45	1	32	0	0	28	9	6	0	0	0	0	0	339	32	0							
15:00	1	27	0	0	37	17	9	0	0	0	0	0	337	35	0							
15:15	0	39	0	0	34	14	9	0	0	0	0	0	342	34	0							
15:30	1	52	0	0	23	24	8	0	0	0	0	0	326	32	0							
15:45	1	35	0	0	22	10	9	0	0	0	0	0	287	29	0							
16:00	0	45	0	0	30	12	8	0	0	0	0	0	306	30	0							
16:15	1	25	0	0	27	18	7	0	0	0	0	0	299	30	0							
16:30	0	24	0	0	28	9	5	0	0	0	0	0	309	38	0							
16:45	1	34	0	0	32	20	10	0	0	0	0	0	311	39	0							
17:00	0	23	0	0	37	20	8	0	0	0	0	0	298	37	0							
17:15	0	27	0	0	33	21	15	0	0	0	0	0	218	29	0							
17:30	0	26	0	0	19	18	6	0	0	0	0	0	137	14	0							
17:45	1	29	0	0	25	19	8	0	0	0	0	0	74	8	0							
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							

Hours Where Condition Met:	0
Signal Warranted?	No


4-Hour Warrant (100%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2


4-Hour Warrant (70%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2

APPENDIX D

TRAFFIC SIGNAL WARRANT

Kula Highway/Lauie Drive
Base Year Conditions (No Refuge Lane)

Weekday Kula Highway/Lauie Drive 8-Hour Signal Warrant

Tuesday, February 13, 2024

Condition A - Minimum volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	500	400	350	280	150	120	105	84
2+	1	600	480	420	336	150	120	105	84
2+	2+	600	480	420	336	200	160	140	112
1	2+	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	750	600	525	420	75	60	53	42
2+	1	900	720	630	504	75	60	53	42
2+	2+	900	720	630	504	100	80	70	56
1	2+	750	600	525	420	100	80	70	56

	Kula Highway						Lauie Drive			0			100 % Warrant			Minor 1 (EB)			Minor 1 (WB)			Combination		
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold			500	750	600	500	750	600			
	1						1			1			Minor Threshold			150	75	120	150	75	120			
							RT Reduction:		0%	RT Reduction:		0%												
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	A	B	A+B	A	B	A+B	A	B	A+B
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:15	0	0	0	0	0	0	0	0	0	0	0	0	35	37	0	-	-	-	-	-	-			
5:30	0	0	0	0	0	0	0	0	0	0	0	0	91	80	0	-	-	-	-	-	-			
5:45	0	0	0	0	0	0	0	0	0	0	0	0	208	123	0	-	-	-	-	-	-			
6:00	0	30	0	0	2	3	36	0	1	0	0	0	376	194	0	-	-	-	-	-	-			
6:15	0	32	0	0	21	3	42	0	1	0	0	0	481	228	0	-	-	-	-	-	-			
6:30	0	34	0	0	80	3	42	0	1	0	0	0	563	294	0	1	-	-	-	-	-	1		
6:45	0	64	0	0	94	10	70	0	1	0	0	0	630	313	0	1	-	1	-	-	-	2		1
7:00	0	83	0	0	47	10	70	0	1	0	0	0	628	271	0	1	-	1	-	-	-	3		2
7:15	0	68	0	0	47	23	108	0	1	0	0	0	652	235	0	1	-	1	-	-	-	4		3
7:30	0	68	0	0	73	43	61	0	1	0	0	0	681	161	0	1	-	1	-	-	-	1		4
7:45	0	55	0	0	94	17	28	0	1	0	0	0	652	130	0	-	-	1	-	-	-	2		1
8:00	0	32	0	0	89	43	34	0	1	0	0	0	669	110	0	-	-	-	-	-	-	3		2
8:15	0	74	0	0	70	23	34	0	1	0	0	0	636	95	0	-	-	-	-	-	-	4		3
8:30	0	66	0	0	49	40	30	0	1	0	0	0	631	78	0	-	-	-	-	-	-			4
8:45	0	62	0	0	91	30	8	0	1	0	0	0	611	69	0	-	-	-	-	-	-			
9:00	0	42	0	0	66	23	19	0	1	0	0	0	561	78	0	-	-	-	-	-	-			
9:15	0	72	0	0	87	3	17	0	1	0	0	0	547	78	0	-	-	-	-	-	-			
9:30	0	45	0	0	70	20	21	0	1	0	0	0	539	69	0	-	-	-	-	-	-			
9:45	0	59	0	0	61	13	17	0	1	0	0	0	545	71	0	-	-	-	-	-	-			
10:00	0	62	0	0	42	13	19	0	1	0	0	0	560	75	0	-	-	-	-	-	-			
10:15	0	51	0	0	77	26	8	0	1	0	0	0	581	79	0	-	-	-	-	-	-			
10:30	0	59	0	0	59	23	23	0	1	0	0	0	543	88	0	-	-	-	-	-	-			
10:45	0	64	0	0	61	23	21	0	1	0	0	0	542	73	0	-	-	-	-	-	-			
11:00	0	62	0	0	56	20	23	0	1	0	0	0	502	69	0	-	-	-	-	-	-			
11:15	0	53	0	0	40	23	17	0	1	0	0	0	536	61	0	-	-	-	-	-	-			
11:30	0	53	0	0	70	17	8	0	1	0	0	0	541	82	0	-	-	-	-	-	-			
11:45	0	42	0	0	49	17	17	0	1	0	0	0	550	121	0	-	-	-	-	-	-			
12:00	1	67	0	0	69	35	16	0	0	0	0	0	587	143	0	-	-	-	-	-	-			
12:15	1	36	0	0	69	15	39	0	0	0	0	0	570	151	0	1	-	-	-	-	-	1		
12:30	1	55	0	0	66	27	47	0	1	0	0	0	609	151	0	1	-	1	-	-	-	2		1
12:45	1	33	0	0	72	39	39	0	1	0	0	0	603	138	0	-	-	1	-	-	-	3		2
13:00	1	57	0	0	58	39	24	0	0	0	0	0	636	137	0	-	-	1	-	-	-	4		3
13:15	1	67	0	0	61	31	39	0	0	0	0	0	690	160	0	1	-	1	-	-	-	1		4
13:30	1	64	0	0	63	15	35	0	0	0	0	0	748	156	0	1	-	1	-	-	-	2		1
13:45	1	69	0	0	66	42	39	0	0	0	0	0	832	164	0	1	1	1	-	-	-	3	1	2
14:00	1	81	0	0	69	58	47	0	0	0	0	0	843	149	0	-	1	1	-	-	-	4	2	3
14:15	2	81	0	0	77	58	35	0	0	0	0	0	867	137	0	-	1	1	-	-	-		3	4
14:30	1	91	0	0	96	39	43	0	0	0	0	0	891	137	0	-	1	1	-	-	-		4	1
14:45	1	76	0	0	77	35	24	0	0	0	0	0	945	126	0	-	1	1	-	-	-		1	2
15:00	1	64	0	0	102	66	35	0	0	0	0	0	940	137	0	-	1	1	-	-	-		2	3
15:15	1	93	0	0	94	54	35	0	0	0	0	0	944	134	0	-	1	1	-	-	-		3	4
15:30	1	124	0	0	63	93	32	0	0	0	0	0	907	127	0	-	1	1	-	-	-		4	1
15:45	1	83	0	0	61	39	35	0	0	0	0	0	796	115	0	-	1	-	-	-	-		1	2
16:00	1	107	0	0	83	46	32	0	0	0	0	0	859	119	0	-	1	-	-	-	-		2	3
16:15	1	60	0	0	74	70	28	0	0	0	0	0	857	119	0	-	1	-	-	-	-		3	4
16:30	1	57	0	0	77	35	20	0	0	0	0	0	889	150	0	1	1	1	-	-	-	1	4	1
16:45	1	81	0	0	88	77	39	0	0	0	0	0	904	154	0	1	1	1	-	-	-	2	1	2
17:00	1	55	0	0	102	77	32	0	0	0	0	0	869	147	0	-	1	1	-	-	-	3	2	3
17:15	1	64	0	0	91	81	59	0	0	0	0	0	634	115	0	-	-	-	-	-	-	4	3	4
17:30	1	62	0	0	52	70	24	0	0	0	0	0	397	56	0	-	-	-	-	-	-		4	
17:45	1	69	0	0	69	73	32	0	0	0	0	0	212	32	0	-	-	-	-	-	-			
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
															Hours where condition met:						5	4	7
															Signal Warranted?						No		
															Notes								

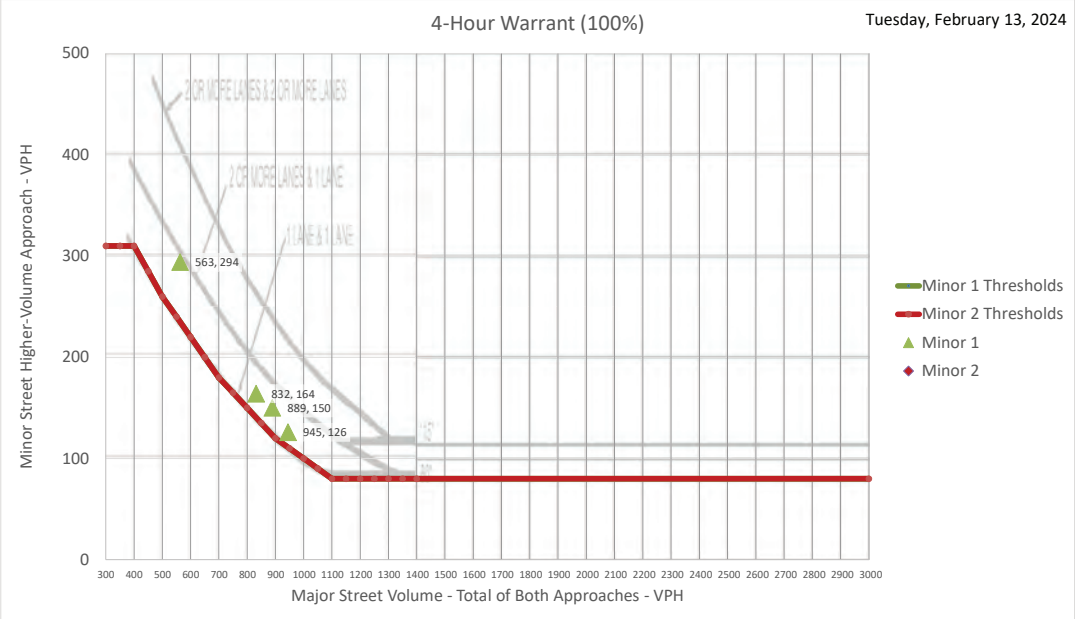
Weekday Kula Highway/Lauie Drive 4-Hour Signal Warrant

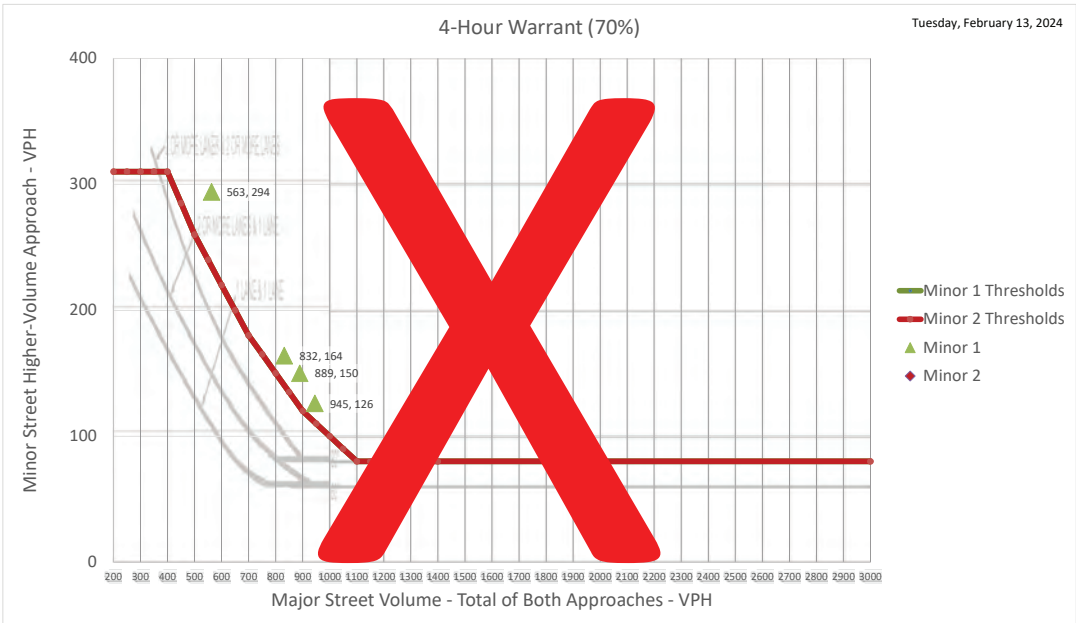
Tuesday, February 13, 2024

	Kula Highway						Lauie Drive			0			100 % Warrant									
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold									
	1						1			1												
							RT Reduction:		0%	RT Reduction:		0%										
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
5:15	0	0	0	0	0	0	0	0	0	0	0	0	35	37	0						
5:30	0	0	0	0	0	0	0	0	0	0	0	0	91	80	0						
5:45	0	0	0	0	0	0	0	0	0	0	0	0	208	123	0						
6:00	0	30	0	0	2	3	36	0	1	0	0	0	376	194	0						
6:15	0	32	0	0	21	3	42	0	1	0	0	0	481	228	0						
6:30	0	34	0	0	80	3	42	0	1	0	0	0	563	294	0	1		1		1	1
6:45	0	64	0	0	94	10	70	0	1	0	0	0	630	313	0	1		2		1	2
7:00	0	83	0	0	47	10	70	0	1	0	0	0	628	271	0	1		3		1	3
7:15	0	68	0	0	47	23	108	0	1	0	0	0	652	235	0	1		4		1	4
7:30	0	68	0	0	73	43	61	0	1	0	0	0	681	161	0						
7:45	0	55	0	0	94	17	28	0	1	0	0	0	652	130	0						
8:00	0	32	0	0	89	43	34	0	1	0	0	0	669	110	0						
8:15	0	74	0	0	70	23	34	0	1	0	0	0	636	95	0						
8:30	0	66	0	0	49	40	30	0	1	0	0	0	631	78	0						
8:45	0	62	0	0	91	30	8	0	1	0	0	0	611	69	0						
9:00	0	42	0	0	66	23	19	0	1	0	0	0	561	78	0						
9:15	0	72	0	0	87	3	17	0	1	0	0	0	547	78	0						
9:30	0	45	0	0	70	20	21	0	1	0	0	0	539	69	0						
9:45	0	59	0	0	61	13	17	0	1	0	0	0	545	71	0						
10:00	0	62	0	0	42	13	19	0	1	0	0	0	560	75	0						
10:15	0	51	0	0	77	26	8	0	1	0	0	0	581	79	0						
10:30	0	59	0	0	59	23	23	0	1	0	0	0	543	88	0						
10:45	0	64	0	0	61	23	21	0	1	0	0	0	542	73	0						
11:00	0	62	0	0	56	20	23	0	1	0	0	0	502	69	0						
11:15	0	53	0	0	40	23	17	0	1	0	0	0	536	61	0						
11:30	0	53	0	0	70	17	8	0	1	0	0	0	541	82	0						
11:45	0	42	0	0	49	17	17	0	1	0	0	0	550	121	0						
12:00	1	67	0	0	69	35	16	0	0	0	0	0	587	143	0						
12:15	1	36	0	0	69	15	39	0	0	0	0	0	570	151	0						
12:30	1	55	0	0	66	27	47	0	1	0	0	0	609	151	0						
12:45	1	33	0	0	72	39	39	0	1	0	0	0	603	138	0						
13:00	1	57	0	0	58	39	24	0	0	0	0	0	636	137	0						
13:15	1	67	0	0	61	31	39	0	0	0	0	0	690	160	0						
13:30	1	64	0	0	63	15	35	0	0	0	0	0	748	156	0						
13:45	1	69	0	0	66	42	39	0	0	0	0	0	832	164	0	1		1		1	1
14:00	1	81	0	0	69	58	47	0	0	0	0	0	843	149	0	1		2		1	2
14:15	2	81	0	0	77	58	35	0	0	0	0	0	867	137	0	1		3		1	3
14:30	1	91	0	0	96	39	43	0	0	0	0	0	891	137	0	1		4		1	4
14:45	1	76	0	0	77	35	24	0	0	0	0	0	945	126	0	1		1		1	1
15:00	1	64	0	0	102	66	35	0	0	0	0	0	940	137	0	1		2		1	2
15:15	1	93	0	0	94	54	35	0	0	0	0	0	944	134	0	1		3		1	3
15:30	1	124	0	0	63	93	32	0	0	0	0	0	907	127	0	1		4		1	4
15:45	1	83	0	0	61	39	35	0	0	0	0	0	796	115	0						
16:00	1	107	0	0	83	46	32	0	0	0	0	0	859	119	0						
16:15	1	60	0	0	74	70	28	0	0	0	0	0	857	119	0						
16:30	1	57	0	0	77	35	20	0	0	0	0	0	889	150	0	1		1		1	1
16:45	1	81	0	0	88	77	39	0	0	0	0	0	904	154	0	1		2		1	2
17:00	1	55	0	0	102	77	32	0	0	0	0	0	869	147	0	1		3		1	3
17:15	1	64	0	0	91	81	59	0	0	0	0	0	634	115	0			4		0	4
17:30	1	62	0	0	52	70	24	0	0	0	0	0	397	56	0						
17:45	1	69	0	0	69	73	32	0	0	0	0	0	212	32	0						
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						

Hours Where Condition Met: 4

Signal Warranted? Yes


4-Hour Warrant (100%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
563, 294
832, 164
889, 150
945, 126
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2


4-Hour Warrant (70%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
563, 294
832, 164
889, 150
945, 126
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2

APPENDIX D

TRAFFIC SIGNAL WARRANT

Kula Highway/Lauie Drive
Base Year Conditions (With Refuge Lane)

Weekday Kula Highway/Lauie Drive 8-Hour Signal Warrant

Tuesday, February 13, 2024

Condition A - Minimum volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	500	400	350	280	150	120	105	84
2+	1	600	480	420	336	150	120	105	84
2+	2+	600	480	420	336	200	160	140	112
1	2+	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	750	600	525	420	75	60	53	42
2+	1	900	720	630	504	75	60	53	42
2+	2+	900	720	630	504	100	80	70	56
1	2+	750	600	525	420	100	80	70	56

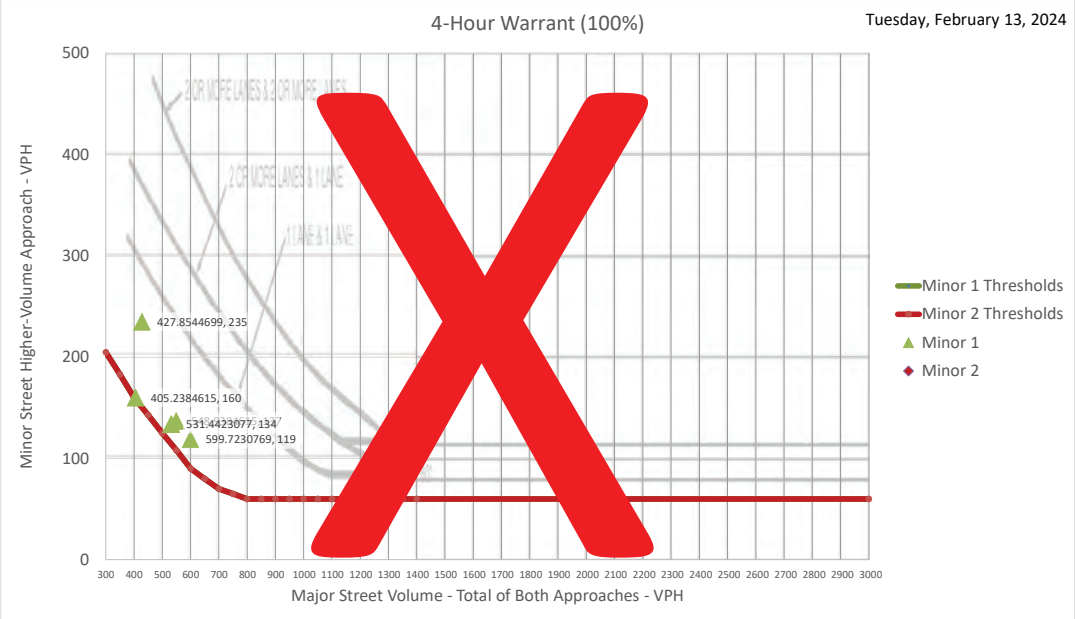
	Kula Highway						Lauie Drive			0			70 % Warrant			Minor 1 (EB)			Minor 1 (WB)			Combination		
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold			350	525	420	350	525	420			
	1						1			1			Minor Threshold			105	53	84	105	53	84			
							RT Reduction:		0%	RT Reduction:		0%													
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	A	B	A+B	A	B	A+B	A	B	A+B
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:15	0	0	0	0	0	0	0	0	0	0	0	0	5.65003465	37	0	-	-	-	-	-	-			
5:30	0	0	0	0	0	0	0	0	0	0	0	0	30.03880804	80	0	-	-	-	-	-	-			
5:45	0	0	0	0	0	0	0	0	0	0	0	0	112.98614	123	0	-	-	-	-	-	-			
6:00	0	0	0	0	2.3423	3.3077	36	0	1	0	0	0	216.6029106	194	0	-	-	-	-	-	-			
6:15	0	0	0	0	21.081	3.3077	42	0	1	0	0	0	267.7227997	228	0	-	-	-	-	-	-			
6:30	0	0	0	0	79.64	3.3077	42	0	1	0	0	0	313.3347193	294	0	-	-	-	-	-	-			
6:45	0	0	0	0	93.694	9.9231	70	0	1	0	0	0	346	313	0	-	-	-	-	-	-			
7:00	0	0	0	0	46.847	9.9231	70	0	1	0	0	0	352.6153846	271	0	1	-	-	-	-	-	1		
7:15	0	0	0	0	46.847	23.154	108	0	1	0	0	0	427.8544699	235	0	1	-	1	-	-	-	2		1
7:30	0	0	0	0	72.613	43	61	0	1	0	0	0	451.2778933	161	0	1	-	1	-	-	-	3		2
7:45	0	0	0	0	93.694	16.538	28	0	1	0	0	0	424.5467775	130	0	1	-	1	-	-	-	4		3
8:00	0	0	0	0	89.009	43	34	0	1	0	0	0	435.4352044	110	0	1	-	1	-	-	-	1		4
8:15	0	0	0	0	70.27	23.154	34	0	1	0	0	0	392.1656272	95	0	-	-	-	-	-	-	2		
8:30	0	0	0	0	49.189	39.692	30	0	1	0	0	0	388.7158697	78	0	-	-	-	-	-	-	3		
8:45	0	0	0	0	91.351	29.769	8	0	1	0	0	0	389.950797	69	0	-	-	-	-	-	-	4		
9:00	0	0	0	0	65.586	23.154	19	0	1	0	0	0	342.961885	78	0	-	-	-	-	-	-			
9:15	0	0	0	0	86.667	3.3077	17	0	1	0	0	0	309.6153846	78	0	-	-	-	-	-	-			
9:30	0	0	0	0	70.27	19.846	21	0	1	0	0	0	323.3998614	69	0	-	-	-	-	-	-			
9:45	0	0	0	0	60.901	13.231	17	0	1	0	0	0	314.995842	71	0	-	-	-	-	-	-			
10:00	0	0	0	0	42.162	13.231	19	0	1	0	0	0	324.9189189	75	0	-	-	-	-	-	-			
10:15	0	0	0	0	77.297	26.462	8	0	1	0	0	0	345.5883576	79	0	-	-	-	-	-	-			
10:30	0	0	0	0	58.559	23.154	23	0	1	0	0	0	304.8031878	88	0	-	-	-	-	-	-			
10:45	0	0	0	0	60.901	23.154	21	0	1	0	0	0	309.8995149	73	0	-	-	-	-	-	-			
11:00	0	0	0	0	56.216	19.846	23	0	1	0	0	0	291.5724186	69	0	-	-	-	-	-	-			
11:15	0	0	0	0	39.82	23.154	17	0	1	0	0	0	319.0138947	61	0	-	-	-	-	-	-			
11:30	0	0	0	0	70.27	16.538	8	0	1	0	0	0	340.2363825	82	0	-	-	-	-	-	-			
11:45	0	0	0	0	49.189	16.538	17	0	1	0	0	0	346.45842	121	0	-	-	-	-	-	-			
12:00	0	0	0	0	68.75	34.754	16	0	0	0	0	0	390.8461538	143	0	1	-	-	-	-	-	1		
12:15	0	0	0	0	68.75	15.446	39	0	0	0	0	0	383.7076923	151	0	1	-	-	-	-	-	2		
12:30	0	0	0	0	66	27.031	47	0	1	0	0	0	390.9038462	151	0	1	-	-	-	-	-	3		
12:45	0	0	0	0	71.5	38.615	39	0	1	0	0	0	376.5692308	138	0	1	-	-	-	-	-	4		
13:00	0	0	0	0	57.75	38.615	24	0	0	0	0	0	374.9307692	137	0	1	-	-	-	-	-	1		
13:15	0	0	0	0	60.5	30.892	39	0	0	0	0	0	405.2384615	160	0	1	-	-	-	-	-	2		
13:30	0	0	0	0	63.25	15.446	35	0	0	0	0	0	448.7692308	156	0	1	-	1	-	-	-	3		1
13:45	0	0	0	0	66	42.477	39	0	0	0	0	0	504.9384615	164	0	1	-	1	-	-	-	4		2
14:00	0	0	0	0	68.75	57.923	47	0	0	0	0	0	508.2153846	149	0	1	-	1	-	-	-	1		3
14:15	0	0	0	0	77	57.923	35	0	0	0	0	0	548.9384615	137	0	1	1	1	-	-	-	2	1	4
14:30	0	0	0	0	96.25	38.615	43	0	0	0	0	0	561.5769231	137	0	1	1	1	-	-	-	3	2	1
14:45	0	0	0	0	77	34.754	24	0	0	0	0	0	582.6384615	126	0	1	1	1	-	-	-	4	3	2
15:00	0	0	0	0	101.75	65.646	35	0	0	0	0	0	570	137	0	1	1	1	-	-	-	1	4	3
15:15	0	0	0	0	93.5	54.062	35	0	0	0	0	0	531.4423077	134	0	1	1	1	-	-	-	2	1	4
15:30	0	0	0	0	63.25	92.677	32	0	0	0	0	0	527.6384615	127	0	1	1	1	-	-	-	3	2	1
15:45	0	0	0	0	60.5	38.615	35	0	0	0	0	0	483.4653846	115	0	1	-	1	-	-	-	4	3	2
16:00	0	0	0	0	82.5	46.338	32	0	0	0	0	0	549.5807692	119	0	1	1	1	-	-	-	1	4	3
16:15	0	0	0	0	74.25	69.508	28	0	0	0	0	0	599.7230769	119	0	1	1	1	-	-	-	2	1	4
16:30	0	0	0	0	77	34.754	20	0	0	0	0	0	627.8076923	150	0	1	1	1	-	-	-	3	2	1
16:45	0	0	0	0	88	77.231	39	0	0	0	0	0	637.8115385	154	0	1	1	1	-	-	-	4	3	2
17:00	0	0	0	0	101.75	77.231	32	0	0	0	0	0	614.7	147	0	1	1	1	-	-	-	1	4	3
17:15	0	0	0	0	90.75	81.092	59	0	0	0	0	0	435.7192308	115	0	1	-	1	-	-	-	2		4
17:30	0	0	0	0	52.25	69.508	24	0	0	0	0	0	263.8769231	56	0	-	-	-	-	-	-	3		
17:45	0	0	0	0	68.75	73.369	32	0	0	0	0	0	142.1192308	32	0	-	-	-	-	-	-	4		
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
															Hours where condition met:						8	3	5
															Signal Warranted?						Yes		
															Notes								

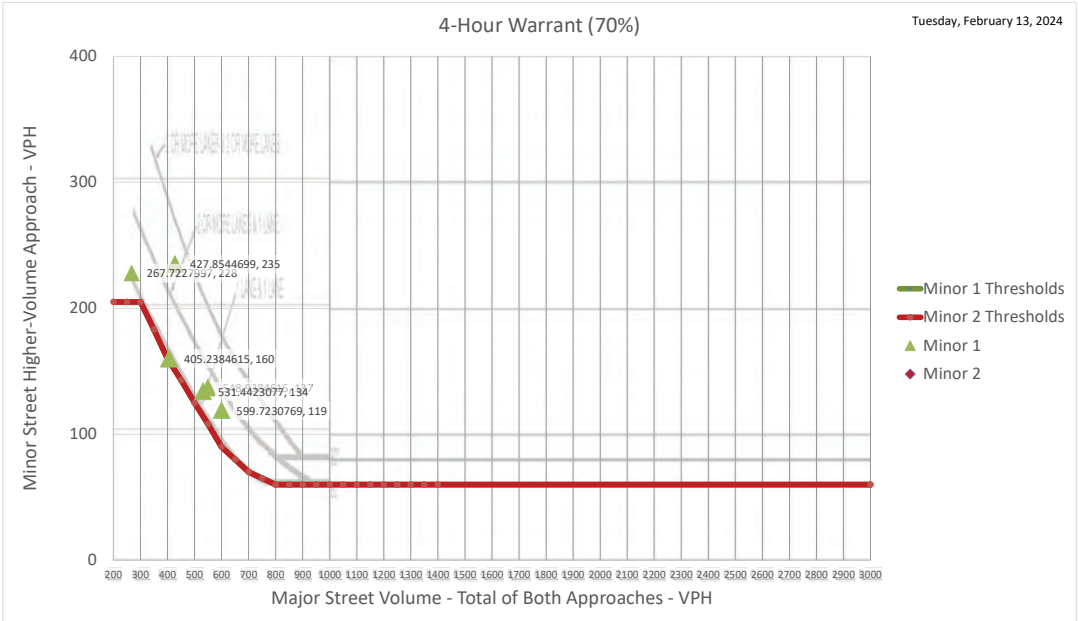
Weekday Kula Highway/Lauie Drive 4-Hour Signal Warrant

Tuesday, February 13, 2024

	Kula Highway						Lauie Drive			0			70 % Warrant									
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold									
	1						1			1												
							RT Reduction:		0%	RT Reduction:		0%										
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
5:15	0	0	0	0	0	0	0	0	0	0	0	0	5.65003465	37	0			0	0	0	0
5:30	0	0	0	0	0	0	0	0	0	0	0	0	30.03880804	80	0			0	0	0	0
5:45	0	0	0	0	0	0	0	0	0	0	0	0	112.98614	123	0			0	0	0	0
6:00	0	0	0	0	2.3423	3.3077	36	0	1	0	0	0	216.6029106	194	0			0	0	0	0
6:15	0	0	0	0	21.081	3.3077	42	0	1	0	0	0	267.7227997	228	0	1		1	0	1	1
6:30	0	0	0	0	79.64	3.3077	42	0	1	0	0	0	313.3347193	294	0	1		2	0	1	2
6:45	0	0	0	0	93.694	9.9231	70	0	1	0	0	0	346	313	0	1		3	0	1	3
7:00	0	0	0	0	46.847	9.9231	70	0	1	0	0	0	352.6153846	271	0	1		4	0	1	4
7:15	0	0	0	0	46.847	23.154	108	0	1	0	0	0	427.8544699	235	0	1		1	0	1	1
7:30	0	0	0	0	72.613	43	61	0	1	0	0	0	451.2778933	161	0	1		2	0	1	2
7:45	0	0	0	0	93.694	16.538	28	0	1	0	0	0	424.5467775	130	0			3	0	0	3
8:00	0	0	0	0	89.009	43	34	0	1	0	0	0	435.4352044	110	0			4	0	0	4
8:15	0	0	0	0	70.27	23.154	34	0	1	0	0	0	392.1656272	95	0			0	0	0	0
8:30	0	0	0	0	49.189	39.692	30	0	1	0	0	0	388.7158697	78	0			0	0	0	0
8:45	0	0	0	0	91.351	29.769	8	0	1	0	0	0	389.950797	69	0			0	0	0	0
9:00	0	0	0	0	65.586	23.154	19	0	1	0	0	0	342.961885	78	0			0	0	0	0
9:15	0	0	0	0	86.667	3.3077	17	0	1	0	0	0	309.6153846	78	0			0	0	0	0
9:30	0	0	0	0	70.27	19.846	21	0	1	0	0	0	323.3998614	69	0			0	0	0	0
9:45	0	0	0	0	60.901	13.231	17	0	1	0	0	0	314.995842	71	0			0	0	0	0
10:00	0	0	0	0	42.162	13.231	19	0	1	0	0	0	324.9189189	75	0			0	0	0	0
10:15	0	0	0	0	77.297	26.462	8	0	1	0	0	0	345.5883576	79	0			0	0	0	0
10:30	0	0	0	0	58.559	23.154	23	0	1	0	0	0	304.8031878	88	0			0	0	0	0
10:45	0	0	0	0	60.901	23.154	21	0	1	0	0	0	309.8995149	73	0			0	0	0	0
11:00	0	0	0	0	56.216	19.846	23	0	1	0	0	0	291.5724186	69	0			0	0	0	0
11:15	0	0	0	0	39.82	23.154	17	0	1	0	0	0	319.0138947	61	0			0	0	0	0
11:30	0	0	0	0	70.27	16.538	8	0	1	0	0	0	340.2363825	82	0			0	0	0	0
11:45	0	0	0	0	49.189	16.538	17	0	1	0	0	0	346.45842	121	0			0	0	0	0
12:00	0	0	0	0	68.75	34.754	16	0	0	0	0	0	390.8461538	143	0			0	0	0	0
12:15	0	0	0	0	68.75	15.446	39	0	0	0	0	0	383.7076923	151	0			0	0	0	0
12:30	0	0	0	0	66	27.031	47	0	1	0	0	0	390.9038462	151	0			0	0	0	0
12:45	0	0	0	0	71.5	38.615	39	0	1	0	0	0	376.5692308	138	0			0	0	0	0
13:00	0	0	0	0	57.75	38.615	24	0	0	0	0	0	374.9307692	137	0			0	0	0	0
13:15	0	0	0	0	60.5	30.892	39	0	0	0	0	0	405.2384615	160	0	1		1	0	1	1
13:30	0	0	0	0	63.25	15.446	35	0	0	0	0	0	448.7692308	156	0	1		2	0	1	2
13:45	0	0	0	0	66	42.477	39	0	0	0	0	0	504.9384615	164	0	1		3	0	1	3
14:00	0	0	0	0	68.75	57.923	47	0	0	0	0	0	508.2153846	149	0	1		4	0	1	4
14:15	0	0	0	0	77	57.923	35	0	0	0	0	0	548.9384615	137	0	1		1	0	1	1
14:30	0	0	0	0	96.25	38.615	43	0	0	0	0	0	561.5769231	137	0	1		2	0	1	2
14:45	0	0	0	0	77	34.754	24	0	0	0	0	0	582.6384615	126	0	1		3	0	1	3
15:00	0	0	0	0	101.75	65.646	35	0	0	0	0	0	570	137	0	1		4	0	1	4
15:15	0	0	0	0	93.5	54.062	35	0	0	0	0	0	531.4423077	134	0	1		1	0	1	1
15:30	0	0	0	0	63.25	92.677	32	0	0	0	0	0	527.6384615	127	0	1		2	0	1	2
15:45	0	0	0	0	60.5	38.615	35	0	0	0	0	0	483.4653846	115	0			3	0		3
16:00	0	0	0	0	82.5	46.338	32	0	0	0	0	0	549.5807692	119	0	1		4	0	1	4
16:15	0	0	0	0	74.25	69.508	28	0	0	0	0	0	599.7230769	119	0	1		1	0	1	1
16:30	0	0	0	0	77	34.754	20	0	0	0	0	0	627.8076923	150	0	1		2	0	1	2
16:45	0	0	0	0	88	77.231	39	0	0	0	0	0	637.8115385	154	0	1		3	0	1	3
17:00	0	0	0	0	101.75	77.231	32	0	0	0	0	0	614.7	147	0	1		4	0	1	4
17:15	0	0	0	0	90.75	81.092	59	0	0	0	0	0	435.7192308	115	0			0	0	0	0
17:30	0	0	0	0	52.25	69.508	24	0	0	0	0	0	263.8769231	56	0			0	0	0	0
17:45	0	0	0	0	68.75	73.369	32	0	0	0	0	0	142.1192308	32	0			0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0

Hours Where Condition Met:	6
Signal Warranted?	Yes


4-Hour Warrant (100%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
427.8544699, 235
405.2384615, 160
531.4423077, 134
599.7230769, 119
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2


4-Hour Warrant (70%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
427.8544699, 235
405.2384615, 160
531.4423077, 134
599.7230769, 119
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2

Weekday Kula Highway/Lauie Drive 8-Hour Signal Warrant

Tuesday, February 13, 2024

Condition A - Minimum volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	500	400	350	280	150	120	105	84
2+	1	600	480	420	336	150	120	105	84
2+	2+	600	480	420	336	200	160	140	112
1	2+	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	750	600	525	420	75	60	53	42
2+	1	900	720	630	504	75	60	53	42
2+	2+	900	720	630	504	100	80	70	56
1	2+	750	600	525	420	100	80	70	56

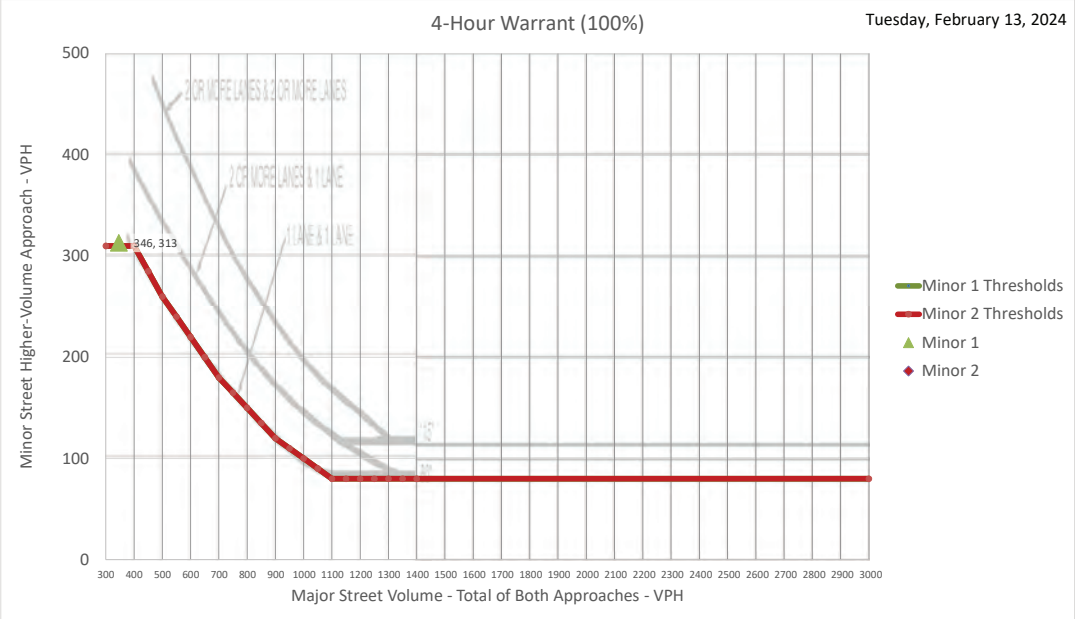
	Kula Highway						Lauie Drive			0			100 % Warrant			Minor 1 (EB)			Minor 1 (WB)			Combination		
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold			500	750	600	500	750	600			
	1						1			1			Minor Threshold			150	75	120	150	75	120			
							RT Reduction:		0%	RT Reduction:		0%												
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	A	B	A+B	A	B	A+B	A	B	A+B
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:15	0	0	0	0	0	0	0	0	0	0	0	0	5.65003465	37	0	-	-	-	-	-	-			
5:30	0	0	0	0	0	0	0	0	0	0	0	0	30.03880804	80	0	-	-	-	-	-	-			
5:45	0	0	0	0	0	0	0	0	0	0	0	0	112.98614	123	0	-	-	-	-	-	-			
6:00	0	0	0	0	2.3423	3.3077	36	0	1	0	0	0	216.6029106	194	0	-	-	-	-	-	-			
6:15	0	0	0	0	21.081	3.3077	42	0	1	0	0	0	267.7227997	228	0	-	-	-	-	-	-			
6:30	0	0	0	0	79.64	3.3077	42	0	1	0	0	0	313.3347193	294	0	-	-	-	-	-	-			
6:45	0	0	0	0	93.694	9.9231	70	0	1	0	0	0	346	313	0	-	-	-	-	-	-			
7:00	0	0	0	0	46.847	9.9231	70	0	1	0	0	0	352.6153846	271	0	-	-	-	-	-	-			
7:15	0	0	0	0	46.847	23.154	108	0	1	0	0	0	427.8544699	235	0	-	-	-	-	-	-			
7:30	0	0	0	0	72.613	43	61	0	1	0	0	0	451.2778933	161	0	-	-	-	-	-	-			
7:45	0	0	0	0	93.694	16.538	28	0	1	0	0	0	424.5467775	130	0	-	-	-	-	-	-			
8:00	0	0	0	0	89.009	43	34	0	1	0	0	0	435.4352044	110	0	-	-	-	-	-	-			
8:15	0	0	0	0	70.27	23.154	34	0	1	0	0	0	392.1656272	95	0	-	-	-	-	-	-			
8:30	0	0	0	0	49.189	39.692	30	0	1	0	0	0	388.7158697	78	0	-	-	-	-	-	-			
8:45	0	0	0	0	91.351	29.769	8	0	1	0	0	0	389.950797	69	0	-	-	-	-	-	-			
9:00	0	0	0	0	65.586	23.154	19	0	1	0	0	0	342.961885	78	0	-	-	-	-	-	-			
9:15	0	0	0	0	86.667	3.3077	17	0	1	0	0	0	309.6153846	78	0	-	-	-	-	-	-			
9:30	0	0	0	0	70.27	19.846	21	0	1	0	0	0	323.3998614	69	0	-	-	-	-	-	-			
9:45	0	0	0	0	60.901	13.231	17	0	1	0	0	0	314.995842	71	0	-	-	-	-	-	-			
10:00	0	0	0	0	42.162	13.231	19	0	1	0	0	0	324.9189189	75	0	-	-	-	-	-	-			
10:15	0	0	0	0	77.297	26.462	8	0	1	0	0	0	345.5883576	79	0	-	-	-	-	-	-			
10:30	0	0	0	0	58.559	23.154	23	0	1	0	0	0	304.8031878	88	0	-	-	-	-	-	-			
10:45	0	0	0	0	60.901	23.154	21	0	1	0	0	0	309.8995149	73	0	-	-	-	-	-	-			
11:00	0	0	0	0	56.216	19.846	23	0	1	0	0	0	291.5724186	69	0	-	-	-	-	-	-			
11:15	0	0	0	0	39.82	23.154	17	0	1	0	0	0	319.0138947	61	0	-	-	-	-	-	-			
11:30	0	0	0	0	70.27	16.538	8	0	1	0	0	0	340.2363825	82	0	-	-	-	-	-	-			
11:45	0	0	0	0	49.189	16.538	17	0	1	0	0	0	346.45842	121	0	-	-	-	-	-	-			
12:00	0	0	0	0	68.75	34.754	16	0	0	0	0	0	390.8461538	143	0	-	-	-	-	-	-			
12:15	0	0	0	0	68.75	15.446	39	0	0	0	0	0	383.7076923	151	0	-	-	-	-	-	-			
12:30	0	0	0	0	66	27.031	47	0	1	0	0	0	390.9038462	151	0	-	-	-	-	-	-			
12:45	0	0	0	0	71.5	38.615	39	0	1	0	0	0	376.5692308	138	0	-	-	-	-	-	-			
13:00	0	0	0	0	57.75	38.615	24	0	0	0	0	0	374.9307692	137	0	-	-	-	-	-	-			
13:15	0	0	0	0	60.5	30.892	39	0	0	0	0	0	405.2384615	160	0	-	-	-	-	-	-			
13:30	0	0	0	0	63.25	15.446	35	0	0	0	0	0	448.7692308	156	0	-	-	-	-	-	-			
13:45	0	0	0	0	66	42.477	39	0	0	0	0	0	504.9384615	164	0	1	-	-	-	-	-	1		
14:00	0	0	0	0	68.75	57.923	47	0	0	0	0	0	508.2153846	149	0	-	-	-	-	-	-	2		
14:15	0	0	0	0	77	57.923	35	0	0	0	0	0	548.9384615	137	0	-	-	-	-	-	-	3		
14:30	0	0	0	0	96.25	38.615	43	0	0	0	0	0	561.5769231	137	0	-	-	-	-	-	-	4		
14:45	0	0	0	0	77	34.754	24	0	0	0	0	0	582.6384615	126	0	-	-	-	-	-	-			
15:00	0	0	0	0	101.75	65.646	35	0	0	0	0	0	570	137	0	-	-	-	-	-	-			
15:15	0	0	0	0	93.5	54.062	35	0	0	0	0	0	531.4423077	134	0	-	-	-	-	-	-			
15:30	0	0	0	0	63.25	92.677	32	0	0	0	0	0	527.6384615	127	0	-	-	-	-	-	-			
15:45	0	0	0	0	60.5	38.615	35	0	0	0	0	0	483.4653846	115	0	-	-	-	-	-	-			
16:00	0	0	0	0	82.5	46.338	32	0	0	0	0	0	549.5807692	119	0	-	-	-	-	-	-			
16:15	0	0	0	0	74.25	69.508	28	0	0	0	0	0	599.7230769	119	0	-	-	-	-	-	-			
16:30	0	0	0	0	77	34.754	20	0	0	0	0	0	627.8076923	150	0	1	-	1	-	-	-	1		1
16:45	0	0	0	0	88	77.231	39	0	0	0	0	0	637.8115385	154	0	1	-	1	-	-	-	2		2
17:00	0	0	0	0	101.75	77.231	32	0	0	0	0	0	614.7	147	0	-	-	1	-	-	-	3		3
17:15	0	0	0	0	90.75	81.092	59	0	0	0	0	0	435.7192308	115	0	-	-	-	-	-	-	4		4
17:30	0	0	0	0	52.25	69.508	24	0	0	0	0	0	263.8769231	56	0	-	-	-	-	-	-			
17:45	0	0	0	0	68.75	73.369	32	0	0	0	0	0	142.1192308	32	0	-	-	-	-	-	-			
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
																					Hours where condition met:	2	0	1
																					Signal Warranted?	No		
																					Notes			

Weekday Kula Highway/Lauie Drive 4-Hour Signal Warrant

Tuesday, February 13, 2024

	Kula Highway						Lauie Drive			0			100 % Warrant									
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold									
	1						1			1												
							RT Reduction:		0%	RT Reduction:		0%										
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
5:15	0	0	0	0	0	0	0	0	0	0	0	0	5.65003465	37	0			0	0	0	0
5:30	0	0	0	0	0	0	0	0	0	0	0	0	30.03880804	80	0			0	0	0	0
5:45	0	0	0	0	0	0	0	0	0	0	0	0	112.98614	123	0			0	0	0	0
6:00	0	0	0	0	2.3423	3.3077	36	0	1	0	0	0	216.6029106	194	0			0	0	0	0
6:15	0	0	0	0	21.081	3.3077	42	0	1	0	0	0	267.7227997	228	0			0	0	0	0
6:30	0	0	0	0	79.64	3.3077	42	0	1	0	0	0	313.3347193	294	0			0	0	0	0
6:45	0	0	0	0	93.694	9.9231	70	0	1	0	0	0	346	313	0	1		1	0	1	1
7:00	0	0	0	0	46.847	9.9231	70	0	1	0	0	0	352.6153846	271	0			2	0	2	2
7:15	0	0	0	0	46.847	23.154	108	0	1	0	0	0	427.8544699	235	0			3	0	3	3
7:30	0	0	0	0	72.613	43	61	0	1	0	0	0	451.2778933	161	0			4	0	4	4
7:45	0	0	0	0	93.694	16.538	28	0	1	0	0	0	424.5467775	130	0			0	0	0	0
8:00	0	0	0	0	89.009	43	34	0	1	0	0	0	435.4352044	110	0			0	0	0	0
8:15	0	0	0	0	70.27	23.154	34	0	1	0	0	0	392.1656272	95	0			0	0	0	0
8:30	0	0	0	0	49.189	39.692	30	0	1	0	0	0	388.7158697	78	0			0	0	0	0
8:45	0	0	0	0	91.351	29.769	8	0	1	0	0	0	389.950797	69	0			0	0	0	0
9:00	0	0	0	0	65.586	23.154	19	0	1	0	0	0	342.961885	78	0			0	0	0	0
9:15	0	0	0	0	86.667	3.3077	17	0	1	0	0	0	309.6153846	78	0			0	0	0	0
9:30	0	0	0	0	70.27	19.846	21	0	1	0	0	0	323.3998614	69	0			0	0	0	0
9:45	0	0	0	0	60.901	13.231	17	0	1	0	0	0	314.995842	71	0			0	0	0	0
10:00	0	0	0	0	42.162	13.231	19	0	1	0	0	0	324.9189189	75	0			0	0	0	0
10:15	0	0	0	0	77.297	26.462	8	0	1	0	0	0	345.5883576	79	0			0	0	0	0
10:30	0	0	0	0	58.559	23.154	23	0	1	0	0	0	304.8031878	88	0			0	0	0	0
10:45	0	0	0	0	60.901	23.154	21	0	1	0	0	0	309.8995149	73	0			0	0	0	0
11:00	0	0	0	0	56.216	19.846	23	0	1	0	0	0	291.5724186	69	0			0	0	0	0
11:15	0	0	0	0	39.82	23.154	17	0	1	0	0	0	319.0138947	61	0			0	0	0	0
11:30	0	0	0	0	70.27	16.538	8	0	1	0	0	0	340.2363825	82	0			0	0	0	0
11:45	0	0	0	0	49.189	16.538	17	0	1	0	0	0	346.45842	121	0			0	0	0	0
12:00	0	0	0	0	68.75	34.754	16	0	0	0	0	0	390.8461538	143	0			0	0	0	0
12:15	0	0	0	0	68.75	15.446	39	0	0	0	0	0	383.7076923	151	0			0	0	0	0
12:30	0	0	0	0	66	27.031	47	0	1	0	0	0	390.9038462	151	0			0	0	0	0
12:45	0	0	0	0	71.5	38.615	39	0	1	0	0	0	376.5692308	138	0			0	0	0	0
13:00	0	0	0	0	57.75	38.615	24	0	0	0	0	0	374.9307692	137	0			0	0	0	0
13:15	0	0	0	0	60.5	30.892	39	0	0	0	0	0	405.2384615	160	0			0	0	0	0
13:30	0	0	0	0	63.25	15.446	35	0	0	0	0	0	448.7692308	156	0			0	0	0	0
13:45	0	0	0	0	66	42.477	39	0	0	0	0	0	504.9384615	164	0			0	0	0	0
14:00	0	0	0	0	68.75	57.923	47	0	0	0	0	0	508.2153846	149	0			0	0	0	0
14:15	0	0	0	0	77	57.923	35	0	0	0	0	0	548.9384615	137	0			0	0	0	0
14:30	0	0	0	0	96.25	38.615	43	0	0	0	0	0	561.5769231	137	0			0	0	0	0
14:45	0	0	0	0	77	34.754	24	0	0	0	0	0	582.6384615	126	0			0	0	0	0
15:00	0	0	0	0	101.75	65.646	35	0	0	0	0	0	570	137	0			0	0	0	0
15:15	0	0	0	0	93.5	54.062	35	0	0	0	0	0	531.4423077	134	0			0	0	0	0
15:30	0	0	0	0	63.25	92.677	32	0	0	0	0	0	527.6384615	127	0			0	0	0	0
15:45	0	0	0	0	60.5	38.615	35	0	0	0	0	0	483.4653846	115	0			0	0	0	0
16:00	0	0	0	0	82.5	46.338	32	0	0	0	0	0	549.5807692	119	0			0	0	0	0
16:15	0	0	0	0	74.25	69.508	28	0	0	0	0	0	599.7230769	119	0			0	0	0	0
16:30	0	0	0	0	77	34.754	20	0	0	0	0	0	627.8076923	150	0			0	0	0	0
16:45	0	0	0	0	88	77.231	39	0	0	0	0	0	637.8115385	154	0			0	0	0	0
17:00	0	0	0	0	101.75	77.231	32	0	0	0	0	0	614.7	147	0			0	0	0	0
17:15	0	0	0	0	90.75	81.092	59	0	0	0	0	0	435.7192308	115	0			0	0	0	0
17:30	0	0	0	0	52.25	69.508	24	0	0	0	0	0	263.8769231	56	0			0	0	0	0
17:45	0	0	0	0	68.75	73.369	32	0	0	0	0	0	142.1192308	32	0			0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0

Hours Where Condition Met:	1
Signal Warranted?	No


4-Hour Warrant (100%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
346, 313
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2


4-Hour Warrant (70%)
Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
346, 313
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2

APPENDIX D

TRAFFIC SIGNAL WARRANT

Kula Highway/Lauie Drive
Future Year Conditions (With Refuge)

Weekday Kula Highway/Lauie Drive 8-Hour Signal Warrant

Tuesday, February 13, 2024

Condition A - Minimum volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	500	400	350	280	150	120	105	84
2+	1	600	480	420	336	150	120	105	84
2+	2+	600	480	420	336	200	160	140	112
1	2+	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vechicles per hour on higher-volume minor-street approach (one direction only)			
Major	Minor	100% *	80%	70% **	56%	100% *	80%	70% **	56%
1	1	750	600	525	420	75	60	53	42
2+	1	900	720	630	504	75	60	53	42
2+	2+	900	720	630	504	100	80	70	56
1	2+	750	600	525	420	100	80	70	56

	Kula Highway						Lauie Drive			0			100 % Warrant			Minor 1 (EB)			Minor 1 (WB)			Combination		
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold			500	750	600	500	750	600			
	1						1			1			Minor Threshold			150	75	120	150	75	120			
							RT Reduction:		0%	RT Reduction:		0%												
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	A	B	A+B	A	B	A+B	A	B	A+B
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
1:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
2:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
3:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
4:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
5:15	0	0	0	0	0	0	0	0	0	0	0	0	10.03465003	53	0	-	-	-	-	-	-			
5:30	0	0	0	0	0	0	0	0	0	0	0	0	38.80803881	116	0	-	-	-	-	-	-			
5:45	0	0	0	0	0	0	0	0	0	0	0	0	126.1399861	179	0	-	-	-	-	-	-			
6:00	0	0	0	0	2.3423	7.6923	51	0	2	0	0	0	242.9106029	281	0	-	-	-	-	-	-			
6:15	0	0	0	0	21.081	7.6923	61	0	2	0	0	0	302.7997228	330	0	-	-	-	-	-	-			
6:30	0	0	0	0	79.64	7.6923	61	0	2	0	0	0	374.7193347	423	0	-	-	-	-	-	-			
6:45	0	0	0	0	93.694	23.077	100	0	2	0	0	0	460	450	0	-	-	-	-	-	-			
7:00	0	0	0	0	46.847	23.077	100	0	2	0	0	0	475.3846154	389	0	-	-	-	-	-	-			
7:15	0	0	0	0	46.847	53.846	154	0	2	0	0	0	594.4698545	339	0	1	-	-	-	-	-	1		
7:30	0	0	0	0	72.613	100	88	0	2	0	0	0	617.8932779	233	0	1	-	1	-	-	-	2		1
7:45	0	0	0	0	93.694	38.462	39	0	2	0	0	0	586.7775468	187	0	1	-	-	-	-	-	3		2
8:00	0	0	0	0	89.009	100	48	0	4	0	0	0	615.2044352	160	0	1	-	1	-	-	-	4		3
8:15	0	0	0	0	70.27	53.846	48	0	2	0	0	0	545.6271656	137	0	-	-	-	-	-	-			4
8:30	0	0	0	0	49.189	92.308	42	0	2	0	0	0	515.8697159	113	0	-	-	-	-	-	-			
8:45	0	0	0	0	91.351	69.231	12	0	2	0	0	0	490.7969508	101	0	-	-	-	-	-	-			
9:00	0	0	0	0	65.586	53.846	27	0	2	0	0	0	421.8849619	113	0	-	-	-	-	-	-			
9:15	0	0	0	0	86.667	7.6923	24	0	2	0	0	0	375.3846154	113	0	-	-	-	-	-	-			
9:30	0	0	0	0	70.27	46.154	30	0	2	0	0	0	419.8613999	101	0	-	-	-	-	-	-			
9:45	0	0	0	0	60.901	30.769	24	0	2	0	0	0	415.8419958	104	0	-	-	-	-	-	-			
10:00	0	0	0	0	42.162	30.769	27	0	2	0	0	0	438.9189189	110	0	-	-	-	-	-	-			
10:15	0	0	0	0	77.297	61.538	12	0	2	0	0	0	468.3575884	116	0	-	-	-	-	-	-			
10:30	0	0	0	0	58.559	53.846	33	0	2	0	0	0	423.1878032	128	0	-	-	-	-	-	-			
10:45	0	0	0	0	60.901	53.846	30	0	2	0	0	0	419.5148995	109	0	-	-	-	-	-	-			
11:00	0	0	0	0	56.216	46.154	33	0	2	0	0	0	392.4185724	103	0	-	-	-	-	-	-			
11:15	0	0	0	0	39.82	53.846	24	0	2	0	0	0	422.6292793	105	0	-	-	-	-	-	-			
11:30	0	0	0	0	70.27	38.462	12	0	4	0	0	0	426.0825364	168	0	-	-	-	-	-	-			
11:45	0	0	0	0	49.189	38.462	24	0	2	0	0	0	432.9968815	260	0	-	-	-	-	-	-			
12:00	0	0	0	0	68.75	63.831	35	0	2	0	0	0	487.7692308	324	0	-	-	-	-	-	-			
12:15	0	0	0	0	68.75	28.369	87	0	2	0	0	0	483.8615385	341	0	-	-	-	-	-	-			
12:30	0	0	0	0	66	49.646	105	0	3	0	0	0	503.9807692	341	0	1	-	-	-	-	-	1		
12:45	0	0	0	0	71.5	70.923	87	0	3	0	0	0	479.9538462	313	0	-	-	-	-	-	-	2		
13:00	0	0	0	0	57.75	70.923	52	0	2	0	0	0	481.5461538	312	0	-	-	-	-	-	-	3		
13:15	0	0	0	0	60.5	56.738	87	0	2	0	0	0	528.0076923	365	0	1	-	-	-	-	-	4		
13:30	0	0	0	0	63.25	28.369	78	0	2	0	0	0	594.1538462	356	0	1	-	-	-	-	-	1		
13:45	0	0	0	0	66	78.015	87	0	2	0	0	0	669.7076923	374	0	1	-	1	-	-	-	2		1
14:00	0	0	0	0	68.75	106.38	105	0	2	0	0	0	666.5230769	339	0	1	-	1	-	-	-	3		2
14:15	0	0	0	0	77	106.38	78	0	2	0	0	0	713.7076923	312	0	1	-	1	-	-	-	4		3
14:30	0	0	0	0	96.25	70.923	96	0	2	0	0	0	723.1153846	312	0	1	-	1	-	-	-	1		4
14:45	0	0	0	0	77	63.831	52	0	2	0	0	0	789.4076923	286	0	1	1	1	-	-	-	2	1	1
15:00	0	0	0	0	101.75	120.57	78	0	2	0	0	0	780	312	0	1	1	1	-	-	-	3	2	2
15:15	0	0	0	0	93.5	99.292	78	0	2	0	0	0	725.2884615	304	0	1	-	1	-	-	-	4	3	3
15:30	0	0	0	0	63.25	170.22	70	0	2	0	0	0	734.4076923	287	0	1	-	1	-	-	-	1	4	4
15:45	0	0	0	0	60.5	70.923	78	0	2	0	0	0	641.7730769	261	0	1	-	1	-	-	-	2	-	1
16:00	0	0	0	0	82.5	85.108	70	0	2	0	0	0	740.1961538	270	0	1	-	1	-	-	-	3	2	2
16:15	0	0	0	0	74.25	127.66	61	0	2	0	0	0	816.1846154	270	0	1	1	1	-	-	-	4	1	3
16:30	0	0	0	0	77	63.831	44	0	2	0	0	0	853.9615385	340	0	1	1	1	-	-	-	1	2	4
16:45	0	0	0	0	88	141.85	87	0	2	0	0	0	893.0423077	348	0	1	1	1	-	-	-	2	3	1
17:00	0	0	0	0	101.75	141.85	70	0	2	0	0	0	866.7	331	0	1	1	1	-	-	-	3	4	2
17:15	0	0	0	0	90.75	148.94	131	0	2	0	0	0	623.1038462	259	0	1	-	1	-	-	-	4	-	3
17:30	0	0	0	0	52.25	127.66	52	0	2	0	0	0	383.4153846	126	0	-	-	-	-	-	-			4
17:45	0	0	0	0	68.75	134.75	70	0	2	0	0	0	203.5038462	72	0	-	-	-	-	-	-			
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
19:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
20:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
21:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
22:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-	-			
																					Hours where condition met:	6	2	5
																					Signal Warranted?	No		
																					Notes			

Weekday Kula Highway/Lauie Drive 4-Hour Signal Warrant

Tuesday, February 13, 2024

	Kula Highway						Lauie Drive			0			100 % Warrant									
	Major Lanes						Minor 1 Lanes			Minor 2 Lanes			Major Threshold									
	1						1			1												
							RT Reduction:		0%	RT Reduction:		0%										
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Major Combined Hourly	Minor 1 Hourly	Minor 2 Hourly	Minor 1 Warrant Met	Minor 2 Warrant Met	Minor 1 Warrant Hour	Minor 2 Warrant Hour	Combo Warrant met	Combo Hour
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
0:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
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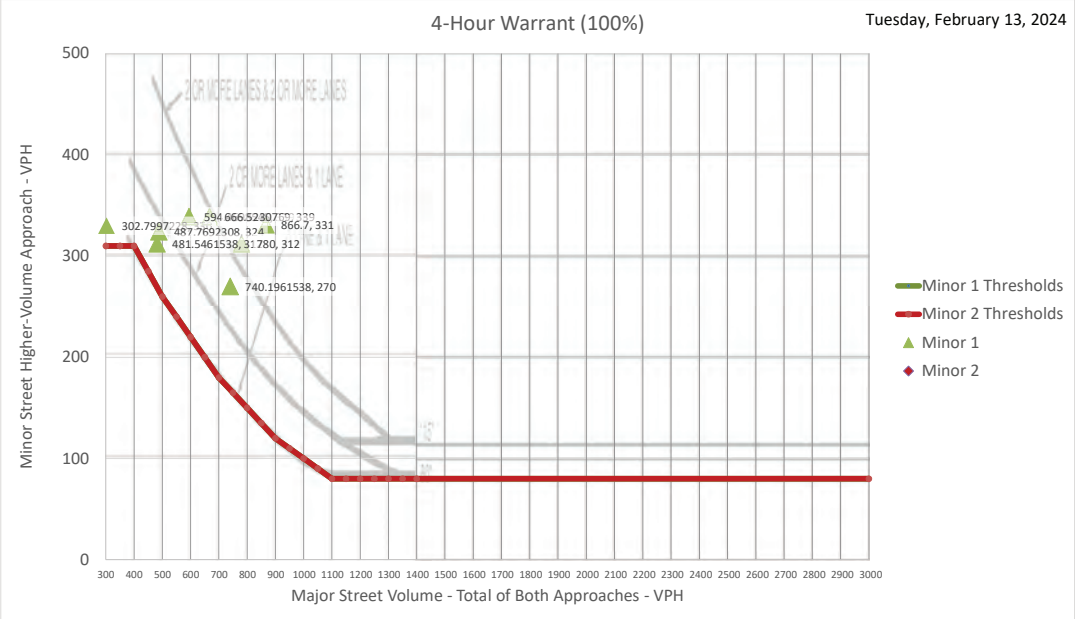
Hours Where Condition Met: 8

Signal Warranted? Yes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Tuesday, February 13, 2024
Minor Street Higher-Volume Approach - VPH
Major Street Volume - Total of Both Approaches - VPH
2 OR MORE LANES & 2 OR MORE LANES
2 OR MORE LANES & 1 LANE
1 LANE & 1 LANE
302.7997
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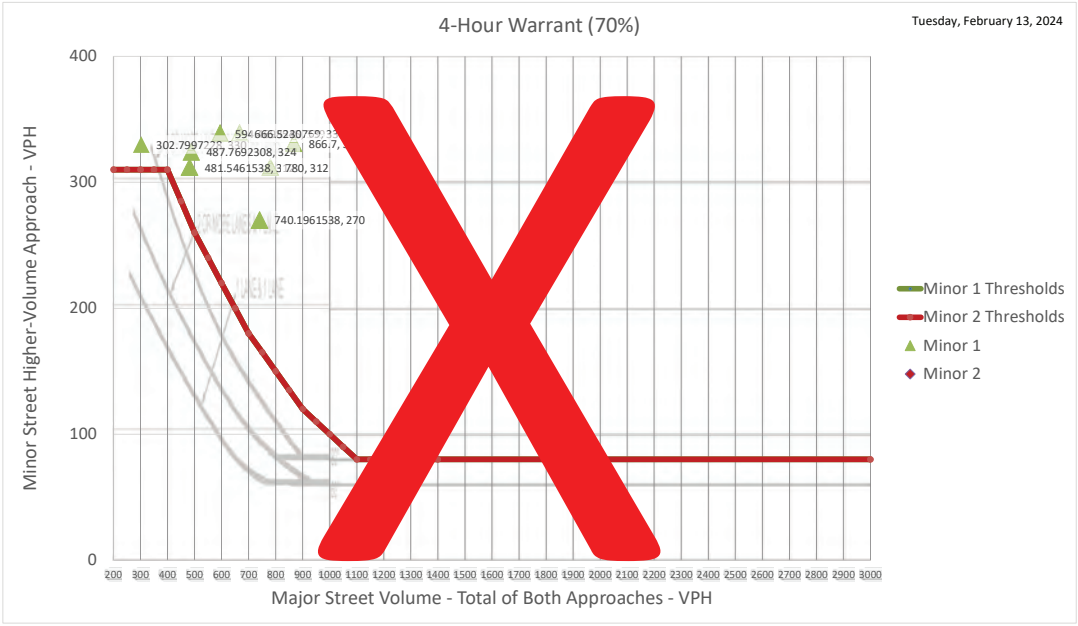
481.5461538, 312
866.7, 331
740.1961538, 270
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2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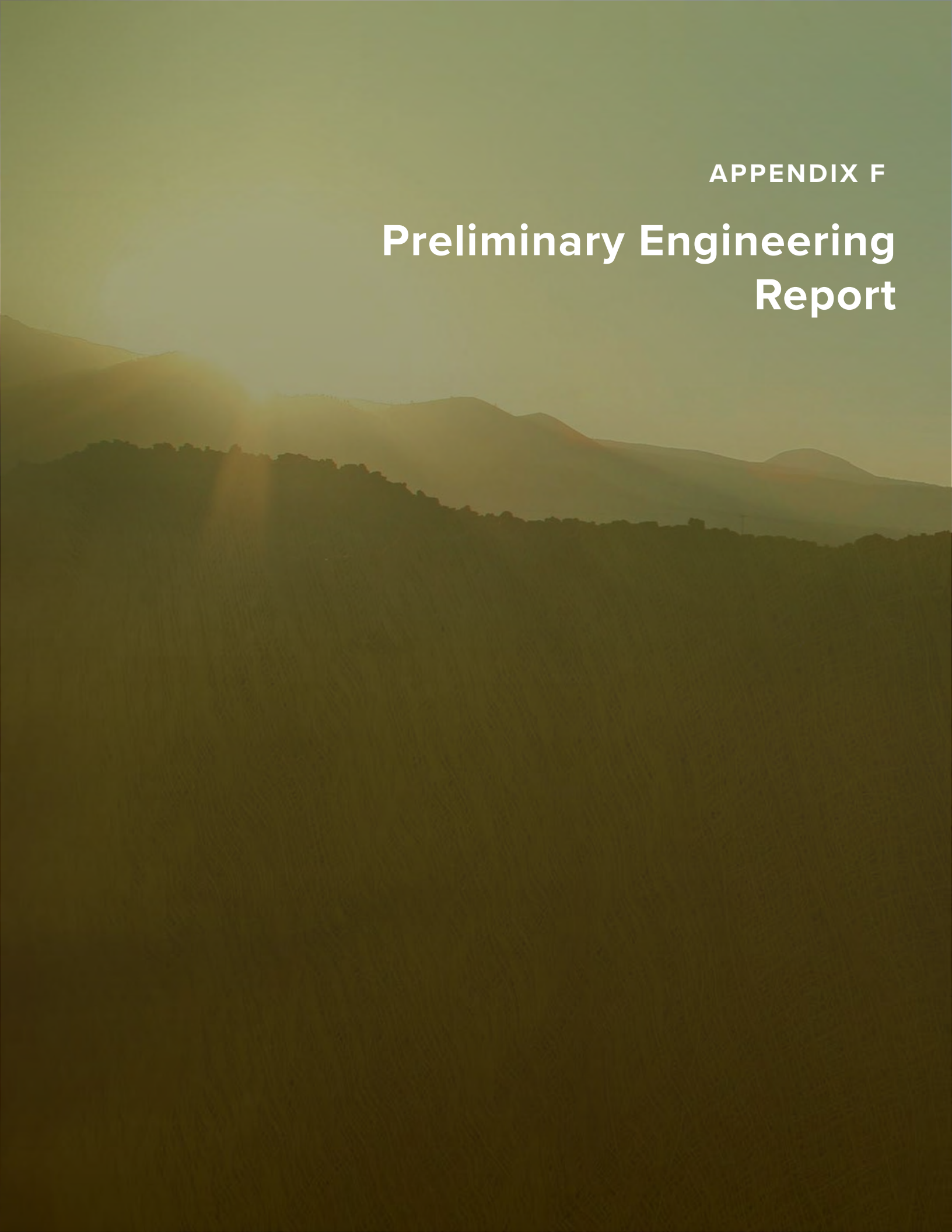
Minor 1 Thresholds
Minor 2 Thresholds
Minor 1
Minor 2



APPENDIX F

Preliminary Engineering Report

PRELIMINARY

ENGINEERING REPORT

FOR

PROPOSED DEVELOPMENT OF WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)

AT KULA, MAUI, HAWAII

TAX MAP KEY: (2) 2-2-02:14 (PORTION)
(2) 2-2-28:181 (PORTION)

PREPARED FOR:

PUEO DEVELOPMENT, LLC
45-709 KENEKE STREET
KANEOHE, HI 96744

PREPARED BY:

Tanaka
ENGINEERS, INC.
CIVIL ENGINEERING ● LAND SURVEYING ● CONSTRUCTION MANAGEMENT & INSPECTIONAL SERVICES

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII - 96793
JOB 24-005

SEPTEMBER 2024
REVISED: JANUARY 2025

TABLE OF CONTENTS

I. INTRODUCTION:

The purpose of this preliminary engineering report is to assess, discuss, evaluate and document the following physical and environmental attributes of the potential development sites; soils, slope, topography and terrain, flooding, drainage and site access. It will also assess and discuss the existing and anticipate the infrastructural requirements for the potential full build out of the development of the proposed land uses as shown on the conceptual site plan (Figure 6). This report is prepared in support of an environmental assessment for this project.

This report will also define the expected requirements for grading and Best Management Practices during site development.

II. PROJECT DESCRIPTION:

The proposed project (at potential full build out) will consist of single family residential (SF) lots, multi-family (MF) residential units; kupuna housing; community center; cultural center; agricultural center; solar farm; wastewater treatment facility (WWTF); greenways; drainage areas; roadways, etc. The breakdown is shown on Conceptual Site Plan (Figure 6). The total site area is approximately 150 acres.

A. Existing Infrastructure - This Report will review existing infrastructure on the general overall project area and surrounding area for roads and drainage system.

B. Water and Wastewater Systems - Determine projected onsite water demand and wastewater flow projections based on master plan program elements and land uses.

C. Ingress and Egress - Identify ingress and egress to each parcel and internal roadways to facilitate homestead usage and accessibility.

D. Budget Cost Estimate - Prepare a rough order of magnitude (ROM) cost estimate for the design and construction of necessary infrastructural improvements.

III. SITE LOCATION AND AREA:

The project site is located on Hawaiian Home Lands in Waiohuli, Maui, [portions of TMKs: (2) 2-2-028:181 and (2) 2-2-002:014] consisting of approximately 150 acres. The Waiohuli Hawaiian Homesteaders Association, Inc. (WHHA) project site is located on the leeward (southwest facing) site of Maui's Haleakala mountain slope. The site is makai and down gradient of the Kula Highway (State Road #37). It is adjacent to the rural single family DHHL residential development named Kula Residential Lots (See Figures 1 and 2).

IV. SOILS AND TOPOGRAPHY:

A. SOILS:

According to the Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii [2], soils at the project area are classified as Kamaole Very Stony Silt Loam, 3 to 15 percent (KGKC) slopes (See Figures 4A, 4B and 4C).

The Kamaole Series (KGKC) exists on the uplands where permeability is moderate. Runoff is slow to medium and erosion hazard is slight to moderate.

B. TOPOGRAPHY:

The existing topography of the project site is shown on Figure 5. The site slopes in a northwesterly direction (mauka to makai) at a slope between 8% to 12%. The ground elevation ranges from 2,100± feet to 1,450± feet above mean sea level.

V. ACCESS:

A. EXISTING:

The site is presently accessed from the existing Lau'ie Drive as shown on Figure 2. Lau'ie Drive connects to Kula Highway which is the main thoroughfare that connects, along with Haleakala Highway, Central Maui to the remainder of the island.

B. ANTICIPATED IMPROVEMENTS:

The roadway system within the proposed project (at potential full build out) will consist of a 50 foot road right-of-ways with 24 foot wide paved area and 13 foot wide grassed/paved shoulders on both sides. The shoulders will be graded to provide a swale with drainage system (grated drain inlets) to convey the storm runoff to drainage basins, eventually overflowing into the existing adjacent Waiohuli Gulch. The conceptual roadway system improvements on the extension of Lau'ie Drive is shown on Figure 6.

C. ESTIMATED COST FOR ROADWAY SYSTEM (AT POTENTIAL FULL BUILD-OUT):

The preliminary estimated cost to provide a complete roadway system which includes all work within the road right-of-way at potential full build-out is approximately $15,946,750 and itemized and shown in Exhibit “E”.

VI. WATER SYSTEM:

A. EXISTING:

There exists a County (DWS) water system in the vicinity of the project site as shown on Figure 7. It consists of a single 8-inch waterline at the end of the existing Lau’ie Drive. The existing water system is part of the Upper Kula Water System. We do not anticipate connection with this municipal water system and propose to develop a private water system to satisfy the domestic, irrigation and fire protection needs of the project.

B. ANTICIPATED WATER REQUIREMENTS:

Determination of anticipated water requirements for the proposed project at potential full build out is presented in Exhibit A. The expected water demands are as follows:

1.	Average Domestic Daily Demand	=	370,100 gals./day
2.	Maximum Daily Demand	=	555,150 gals./day
3.	Peak Hour Demand	=	1,110,300 gals./day
4.	Maximum Fire Flow Demand	=	2,000 gals./min.

C. ANTICIPATED WATER SYSTEM IMPROVEMENTS:

The size of the distribution lines are based upon simultaneous delivery of the needed fire flow and maximum daily demand. The anticipated fire flow plus the maximum daily demand for the proposed project is 2,386 gals./min. (gpm). This combined flow can be sufficiently delivered by the proposed water system improvements as shown on Figure 7.

Fire hydrants will be spaced according to the County of Maui (DWS) standards.

A groundwater resources feasability study for the Waiohuli Hawaiian Homesteads Association Community Economic Plan was prepared by Intera Incorporated, dated March 1, 2022. The report was prepared for Pueo Development, LLC.

The report focuses on the feasibility of developing onsite groundwater well(s) to supply water for the project site.

Based upon the ground water resources feasibility study for Waiohuli Hawaiian Homesteads Association Community Economic Plan, prepared by Intera Incorporated and the Standards and Rules of the Department of Water of the Country of Maui, the following are anticipated water system improvements.

1. Install a well with a pump to meet the required demand. Due to the possibility of pump failure, a second well will be required.
2. Provide a storage tank or reservoir to meet the maximum day demand and set the tank at an elevation to provide adequate pressure.

3. Installation of onsite waterline system with necessary service laterals, fire hydrants and transmission lines from the source to storage tanks.

4. Conceptual offsite water system with necessary storage tanks and transmission waterline as shown on Figure 7.

D. ESTIMATED COST FOR WATER SYSTEM (AT POTENTIAL FULL BUILD OUT):

The preliminary estimated cost to provide a complete water system at potential full build out is approximately $22,545,805 and itemized and shown on Exhibit "B".

VII. WASTEWATER SYSTEM:

A. EXISTING:

There is no County of Maui sewer system in this area.

B. ANTICIPATED WASTEWATER FLOW:

The total average wastewater flow for the proposed project as determined in Exhibit C is about 102,765 gallons per day (gpd) at potential full build out.

C. ANTICIPATED WASTEWATER SYSTEM IMPROVEMENTS:

The following options are being considered for the disposal of wastewater flows that will be generated by the potential full build out of the project.

Option 1:

Provide individual wastewater system (IWS) for each lot in accordance with the requirements of the State Department of Health's Administrative Rules Chapter 11-62, "Wastewater". Upon development of each potential

lot, the design wastewater flow and details of the IWS will be submitted to the State Department of Health, Wastewater Branch, for review and approval.

Option 2:

Collect onsite wastewater flows and convey via gravity sewerline to a new "Wastewater Treatment Facility" (WWTF) at the makai (downhill) site of the project site as shown on Figure 8.

Option 3:

Provide package wastewater treatment plans which are pre-manufactured facilities used to treat wastewater in small communities or on individual properties.

1. Package plants can be designed to treat flows as low as 0.002 MGD (million gallons per day) or as high as 0.5 MGD. These plants can be added in parallel as the wastewater flow increases.

D. ESTIMATED COST FOR WASTEWATER SYSTEM (AT POTENTIAL FULL BUILD OUT):

The preliminary estimated cost to construct a complete the preferred wastewater system (Option 2) at potential full build out is approximately $10,481,675 and itemized and shown on Exhibit "D".

VIII. DRAINAGE:

A. GENERAL:

This preliminary Drainage Study, in general, is based on the requirements, formulas, charts and tables of the Rules of the Design of Storm Drainage

Facilities of the County of Maui [1] hereinafter referred to as County Drainage Standards.

B. FLOODING HAZARD:

The site is located within Zone X as plotted on Map No. 1500030595E of the Flood Insurance Rate Map for the County of Maui (see Figure 3). Zone X is designated as areas of minimal flooding or areas determined to be outside the 0.2% annual chance flood plain. Hence the proposed grading work is not subject to chapter 19.62, Flood Hazard Areas, of the Maui County Code

C. EXISTING DRAINAGE CONDITIONS:

There is minimal offsite storm runoff that affects the project area. Runoff from the adjacent lots and existing mauka single family lots are collected by drainage swales and grated drain inlets and then conveyed to existing gulches north and south of the project site.

Existing onsite runoff generally flows in an westerly direction (downhill) into Waiohuli Gulch.

D. PRELIMINARY STORM RUNOFF DISCHARGES:

Based on the preliminary calculations (Exhibit “F”), the project area, encompassing a 148.8 acres could generate the 50 year (1-hour) storm discharges as follows:

50-year runoff peak rate:

Existing = 132.6 cfs

Developed = 414.2 cfs

Increase = 281.6 cfs

E. ANTICIPATED DRAINAGE SYSTEM IMPROVEMENTS:

The Maui County Drainage Standards allows onsite retention of the additional runoff generated by the development when there is no existing drainage system or adequate outlet to connect the development's drainage system. Onsite impoundment of the storm runoff is proposed by means of surface retention basins. The storage capacity of the retention basins must be at least equal to the 50-year, 1-hour runoff volume increase in accordance with the Maui County Drainage Standards. (See Figure 10)

F. OPERATION AND MAINTENANCE PLAN:

The operation and maintenance of the onsite drainage system will be handled by the Community Association. The recommended operation and maintenance activities will include, but not limited to:

1. Inspection of the drainage facilities annually and after major storms. Repair damages, if any. Remove debris, if any, at grated drain inlets to permit unimpeded flow.
2. Periodic inspection of the drainage system. Remove debris and sediment build-up, as required, specifically inside grated drain inlets, if any, upstream of the retention basins.
3. Preventing grass and landscape cuttings from entering the drainage system.
4. Cleaning of parking areas as often as possible to minimize the entry of debris and sediments into the drainage system.

5. Maintaining healthy growth of grass lawns and landscaping to prevent soil erosion; thereby, reducing sediments that might enter the drainage system.

G. CONCLUSION:

The proposed development will increase the existing storm runoff due to addition of impervious surfaces such as building roofs, pavement and concrete. Despite the increase in runoff, the proposed development is not anticipated to create any adverse drainage effects on downstream properties and roadways. The recommended drainage improvements, as shown on Figure 10, call for the retention of runoff volume anticipated to be generated by the proposed development; thereby reducing the present storm runoff into the downstream properties. The proposed retention basins will also have the effect of reducing the potential for sediments contained in the runoff from entering neighboring properties and eventually the ocean.

H. ESTIMATED COST FOR DRAINAGE SYSTEM (AT POTENTIAL FULL BUILD OUT):

The preliminary estimated cost to construct a complete drainage system at potential full build out is approximately $2,497,685 and is itemized as shown on Exhibit “G”.

IX. GRADING REQUIREMENTS AND BEST MANAGEMENT PRACTICES:

A. GRADING REQUIREMENTS:

Ongoing grading for the proposed project will be in conformance with the applicable requirements of the Maui County’s Grading Ordinance No. 2684 or

Chapter 20.08 of the Maui County Code. A grubbing and grading permit must be obtained from the Development Services Administration (DSA) of the Department of Public Works. Associated submittals for the permit application are grading plan; soil erosion control plan or Best Management Practices Plan; drainage plan; and drainage report. Additionally, since the grading area is over one (1) acre, a National Pollutant Discharge Elimination System (NPDES) Permit must be obtained from the Clean Water Branch of the State Department of Health.

B. BEST MANAGEMENT PRACTICES (BMPs):

The proposed plan for temporary control of soil erosion and dust during grading operations will be shown with the attached construction plans. The BMPs will include the following:

1. Control dust by means of water trucks.
2. Graded areas shall be thoroughly watered after construction activity has ceased for the day and for weekends and holidays.
3. All exposed areas shall be grassed as soon as finished grading is completed.
4. Minimize time of grading operations.
5. Construction of temporary sediment basin(s) prior to mass grading of project site. Construct temporary swale to direct storm runoff to temporary basin(s).
6. Installation of dust control fence surrounding the project site, as required.

7. Installation of silt fence, gravel bag berms or other approved sediment trapping devices along the makai limits of the grading area and sediment pit.

8. Temporary control measures shall be in place and functional prior to grading and shall remain operational throughout the grading operations period or until permanent controls, such as grassing, are in place.

Best Management Practices shall be in compliance with Section 20.08.035 of the Maui County Code (Ord. No. 2684) and "Construction Best Management Practices (BMPs) for the County of Maui" of the Department of Public Works & Waste Management, May 2001.

X. SUMMARY OF ESTIMATED CONSTRUCTION COST:

1.	Roadway	= $15,946,750
2.	Water System	= $22,545,805
3.	Wastewater	= $10,481,675
4.	Drainage	= $ 2,497,685
		$51,471,915

XI. ELECTRICITY/TELEPHONE/CATV SYSTEMS:

A. EXISTING:

There are existing overhead electrical/telephone facilities that are strung across the mauka portion of Hawaiian Home Lands (Kula Residence Lots

Subdivision) along the eastern boundary of the project site. These existing facilities currently service adjacent and nearby existing developments.

B. FUTURE SERVICES:

It is anticipated that services for the future development will come off from nearby existing overhead facilities. It is also anticipated that onsite facilities may be installed underground.

XII. CONSTRUCTION PLAN APPROVALS:

Approval of construction plans and appropriate permits for the infrastructure improvements of the proposed project will be obtained from the Department of Public Works; Department of Environmental Management; Department of Water Supply; Fire Prevention Bureau; and State Department of Health, Wastewater and Clean Water Branches. The various infrastructures will be designed in compliance with the applicable requirements of these governmental agencies.

Electrical/telephone/CATV improvements will need to be approved by their respective utility company.

XIII. REFERENCES:

1. Rules for the Design of Storm Drainage Facilities in the County of Maui, Title MC-15, Department of Public Works and Waste Management, County of Maui, Chapter 4.

2. Construction Best Management Practices (BMPs) for the County of Maui, Department of Public Works and Waste Management, May 2001.

3. Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii, prepared by U. S. Department of Agriculture, Soil Conservation Service, August 1972.

4. Erosion and Sediment Control Guide for Hawaii, prepared by U. S. Department of Agriculture, Soil Conservation Service, March 1981.

5. Rainfall-Frequency Atlas of the Hawaiian Islands, Technical Paper No. 43, U. S. Department of Commerce, Weather Bureau, 1962.

6. Flood Insurance Rate Maps for the County of Maui, June 1981.

7. Water System Standards, Department of Water Supply, County of Maui, 2002.

8. Sewerage Master Plan for the County of Maui, October 1971.

9. Waiohuli Well Development Groundwater Resources Feasibility Study for the Waiohuli Hawaiian Homesteaders Associate Community Economic Plan, prepared by Intera, Inc., 74 Kihapai Street, Kailua, Hawaii - 96734, dated December 2022.

EXHIBITS

EXHIBIT "A"
WE DO - ANTICIPTATED DOMESTIC WATER CONSUMPTION
WATER SYSTEM STANDARDS, STATE OF HAWAII 2002

Single Family	100 Units	x	600 gal./unit	=	60,000 gal./day
	40 Ac.	x	3,000 gal./acre	=	120,000 gal./day*
Multi-Family Residential	80 Units	x	560 gal./unit	=	44,800 gal./day*
	5 Acs.	x	5,000 gal./acre	=	25,000 gal./day
Kupuna Housing:	165 Units	x	560 gal./unit	=	92,400 gal./day*
	10.1 Ac.	x	5,000 gal./acre	=	50,500 gal./day
Community Based Health Center:	1.6 Acs.	x	6,000 gal./acre	=	9,600 gal./day
Cultural Center:	1.7 Acs.	x	6,000 gal./acre	=	10,200 gal./day
Community Development Team Headquarters:	0.9 Acs.	x	6,000 gal./acre	=	5,400 gal./day
Agriculture Development Center:	0.7 Acs.	x	6,000 gal./acre	=	4,200 gal./day
Utility Management Center:	0.7 Acs.	x	6,000 gal./acre	=	4,200 gal./day
Native Dryland Forest Restoration	7.3 Acs.	x	1,700 gal./acre	=	12,410 gal./day
Solar Farm:	26.4 Acs.	x	1,700 gal./acre	=	44,880 gal./day
Wastewater Treatment Facility:	1.6 Acs.	x	6,000 gal./acre	=	9,600 gal./day
Trailhead Park:	1 Acs.	x	1,700 gal./acre	=	1,700 gal./day
Greenway Trail:	6.3 Acs.	x	1,700 gal./acre	=	10,710 gal./day
Drainage Area:	36.1 Acs.	x	0 gal./acre	=	0 gal./day
Roadways:	10.6 Acs.	x	0 gal./acre	=	0 gal./day
	150 Acres Total				
*Greater Demand Used			Total Avg. Demand	=	370,100 gal./day
Max. Daily Demand	= 370,100	x	1.5	=	555,150 gal./day
Peak Hour Demand	= 370,100	x	3	=	1,110,300 gal./day

EXHIBIT “B”

WATER SYSTEM

(Itemized Preliminary Estimated Costs)

Item No.		Approx. Quantity	Unit	Unit Price	Total
1.	8" D.I. Waterline (CL 52)	8,100	l.f.	$235	$1,903,500
2.	12" D.I. Waterline (CL 52)	5,850	l.f.	$300	$1,755,000
3.	Fire Hydrant	27	Ea.	$10,000	$270,000
4.	DCDA w/M.H.	7	Ea.	$65,000	$455,000
5.	PRV w/M.H.	2	Ea.	$30,000	$60,000
6.	8" G.V. w/SVB	21	Ea.	$2,200	$46,200
7.	Single Service Lateral w/Meter Box	12	Ea.	$3,500	$42,000
8.	Double Service Lateral w/Meter Box	40	Ea.	$5,500	$220,000
9.	Commercial Service Lateral w/M.H..	10	Ea.	$15,000	$150,000
10.	Air Relief Valve w/M.H.	6	Ea.	$15,000	$90,000
11.	6" D.I. Pipe CL 52	1,000	L.F.	$210	$210,000
12.	Reaction Blocks	90	Ea.	$500	$45,000
13.	6" Gate Valve w/SVB	27	Ea.	$2,000	$54,000
14.	Storage Tank w/Trans. Line (0.5 MG)		L.S.		$5,000,000
		Subtotal =			$10,300,700
		15% Contingency =			$1,545,105
		Subtotal =			$11,845,805
15.	Water Well Development				
	(Cost Estimate per Intera Well Development Study - 3/1/22)				
	a. Water Well (2 Wells)		L.S.	$4,600,000	
	b. Well Pump, Controller, Electrical , etc.		L.S.	$2,400,000	
	c. Water System		L.S.	$3,700,000	
		Subtotal =			$10,700,000
		Total Estimated Cost =			$22,545,805

EXHIBIT "C"
WE DO - ANTICIPTATED DAILY WASTEWATER FLOW
COUNTY OF MAUI, WASTEWATER RECLAMATION DIVISION

Single Family		100	Units	x	350	Gal./Unit	=	35,000
Multi-Family Residential:		80	Units	x	255	Gal./Unit	=	20,400
Kupuna Housing:		165	Units	x	255	Gal./Unit	=	42,075
Community Based Health Center:	Estimate	15	Beds	x	200	Gal./Unit	=	3,000
Cultural Center:	Estimate	50	Person/Day	x	20	Gal./Unit	=	1,000
Community Development Team Headquarters:	Estimate	15	Persons	x	20	Gal./Unit	=	300
Agriculture Development Center:	Estimate	12	Persons	x	20	Gal./Unit	=	240
Utility Management Center:	Estimate	20	Employees	x	25	Gal./Unit	=	500
Native Dryland Forest Restoration		7.3	Acs.	x	0		=	0
Solar Farm:		26.4	Acs.	x	0		=	0
Wastewater Treatment Facility:	Estimate	10	Employees	x	25	Gal./Unit	=	250
Trailhead Park:		1	Acs.	x	0		=	0
Greenway Trail:		6.3	Acs.	x	0		=	0
Drainage Area:		36.1	Acs.	x	0		=	0
Roadways:		10.6	Acs.	x	0		=	0

Total Average Wastewater Flow = 102,765 Gal./Day

County of Maui
Wastewater Reclamation Division

2200 Main Street Suite 610 • Wailuku, HI 96793 • (808) 270-7417 • 270-7425 fax

Wastewater Flow Standards

The following wastewater flow contributions are to be utilized for projecting wastewater flows for the following types of uses, unless other supporting data is provided to show differently.

Type of use	Unit	Contribution (Gal/Unit/Day)
Apartment/Condo	Unit	255
Bar	Seat	15
Church, large	Seat	6
Church, small	Seat	4
Cottage or Ohana (600 S.F. max)	Unit	180
Day-care Center	Child	10
Factory	Employee	30
Golf Clubhouse	Golf Rounds	25
Hotel, resort with laundry	Room	350
Hotel, average with laundry	Room	300
Hotel, average without laundry	Room	250
Hospital	Bed	200
Industrial Shop	Employee	25
Laundry (coin operated)	Machine	300
Office	Employee	20
Residence, subdivision	Home	350
Restaurant, average	Seat	80
Restaurant, fast food	Seat	100
Rest Home	Patient	100
Retail Store	Employee	15
School, elementary	Student	15
School, high	Student	25
Storage, w/ offices	Employee	15
Storage w/ offices and showers	Employee	30
Store Customer bathroom usage	Use	5
Theater	Seat	5

The following standards will be used as necessary to compute the number of units required to make wastewater calculations:

Residential Occupancy	4 persons per unit
Apartment/Condo Occupancy	2.5 persons per unit
Hotel Occupancy	2.25 persons per unit
Hotel Employees	1 per hotel room
Office Employees	1 per 200 square feet of floor area
Retail Warehouse Employees	1 per 350 square feet of floor area
Storage/ Industrial Employees	1 per 500 square feet of floor area

EXHIBIT “D”

WASTEWATER SYSTEM

(Itemized Preliminary Estimated Costs)

Item No.		Approx. Quantity	Unit	Unit Price	Total
1.	8" PVC Sewerline	7,600	l.f.	$220	$1,672,000
2.	SMH	30	Ea.	$10,000	$300,000
3.	Sewer Service Lateral	101	Ea.	$7,500	$757,500
4.	6" PVC Sewerline	1,300	l.f.	$200	$260,000
5.	WWTF (105,000 gal./day)		L.S.		$6,125,000
	a. Package Treatment Plant for Onsite Installation			$2,625,000	
	b. Pump, Controller, Electrical, etc.			$1,500,000	
	c. Effluent Disposal - Irrigation, Underground Percolation; Leach Field, etc.			$2,000,000	
			Subtotal =		$9,114,500
			15% Contingency =		$1,367,175
			Total Estimated Cost =		$10,481,675

EXHIBIT “E”

ROADWAY SYSTEM (RIGHT-OF-WAY)

(Itemized Preliminary Estimated Cost)

Item No.		Approx. Quantity	Unit	Unit Price	Total
1.	BMP (150 Acres)		L.S.		$225,000
2.	Clear and Grub	10.6	Ac.	$10,000	$106,000
3.	Excavation and Embankment	165,000	c.y.	$50	$8,250,000
4.	Grading - 50' ROW	50,000	s.y.	$9	$450,000
5.	Grass Shoulder	234,000	s.f.	$1	$117,000
6.	2" A.C. (HMA Pavement Mix IV)	2,775	Tons	$450	$1,248,750
7.	6" Aggregate Base Course	4,000	c.y.	$425	$1,700,000
8.	Striping - Signs - Reflectors, etc.		L.S.		$120,000
9.	R.O.W. Landscaping		L.S.		$300,000
10.	Mobilization (6%)		L.S.		$1,250,000
11.	Archaeological Monitoring (9,000' ±)				$100,000
	Subtotal =				$13,866,750
	15% Contingency =				$2,080,000
	Total Estimated Cost =				$15,946,750

EXHIBIT "F"

PRELIMINARY DRAINAGE CALCULATIONS

I. REFERENCE:

"Rules for the Design of Storm Drainage Facilities in the County of Maui" [1], referred to as Maui County Drainage Standards.

II. METHODOLOGY:

A. Rational Method:

For Potential Full Build Out drainage areas that have areas less than 100 acres, the peak discharge based on a 50-year (1-hour storm) will be determined by the Rational Method, Q = CIA, in which:

Q = flow rate in cubic feet per second (cfs)

C = runoff coefficient for the drainage area

I = rainfall intensity in inches per hour for a duration equal to the time of concentration

A = drainage areas in acres

The factors used in the application of the formula were taken from applicable tables and charts of the Maui Storm Drainage Standards.

1. Rainfall Value:

50-year, 1-hour rainfall = 3.0" (Plate 4)

2. Runoff Coefficient, C: The runoff coefficients for the project area are as follows:

Existing Condition: C = 0.30 (Unimproved Areas) (Table 2)

Developed Condition: See Hydrology Charts (attached)

3. Time of Concentration, Tc: As determined from Plate 1.

See attached Hydrology Charts

4. Rainfall Intensity, I: As determined from Plate 2

See attached Hydrology Charts

III. PRELIMINARY STORM RUNOFF DISCHARGES:

Based on the preliminary calculations (Exhibit "C"), the project area, encompassing a total of 148.8 acres could generate the 50-year (1-hour) storm discharges as follows:

50-Year Peak Runoff Rate:

Existing = 132.6 c.f.s. (See attached Existing Condition Hydrology Chart)

Developed = 414.2 c.f.s. (See attached Potential Full Build Out Hydrology Chart)

Thus:

Increase = 414.2 - 132.6

= 281.6 c.f.s.

EXHIBIT “G”

DRAINAGE SYSTEM

(Itemized Preliminary Estimated Costs)

Item No.		Approx. Quantity	Unit	Unit Price	Total
1.	24" HDPE Drain Pipe	5,580	l.f.	$205.00	$1,143,900.00
2.	Grade/Landscape Greenway Drainage Swales	7,200	l.f.	$60.00	$432,000.00
3.	Drainage Basin Lot Grading/Grassing	6	ea.	$25,000.00	$150,000.00
4.	Grated Drain Inlets	38	ea.	$10,000.00	$380,000.00
5.	Flared End Section Outlets	6	ea.	$5,000.00	$30,000.00
6.	Drain Manholes	3	ea.	$12,000.00	$36,000.00
		Subtotal =			$2,171,900.00
		15% Contingency =			$325,785.00
		Total Estimated Cost =			$2,497,685.00

EXHIBIT "H"

PROJECT: Waiohuli Economic Development Opportunities (WE DO)

LOCATION: Waiohuli, Kula, Hawaii

HYDROLOGY
(EXISTING CONDITION)
(See Figure 9 for Drainage Areas)

DATE January 2025

T.M.K. (2) 2-2-02:14 (Por.)
(2) 2-2-28:181 (Por.)

Drainage Area Designation	Inlet Structure/ Designation	Area (Acres)	Length of Overland Flow (feet)	Average Slope %	Character of Ground	Tc (min.)	C	TM (years)	1-Hour Rainfall (inches)	I (in./hr.)	Q = AIC (c.f.s.)	Remarks
1		79.9	5,380	9.4	Ave. Grass	59.0	0.30	50	3.0	2.5	59.9	
2		38.0	4,710	11.6	Ave. Grass	52.0	0.30	50	3.0	2.75	31.4	
3		30.9	1,800	11.7	Ave. Grass	27.5	0.30	50	30	4.45	41.3	
		148.8									132.6	Total Existing Runoff

JOB NO.: 24-005

R. T. TANAKA ENGINEERS, INC.
ENGINEERS - SURVEYORS

SHEET 1 OF 1

EXHIBIT "I"

PROJECT: Waiohuli Economic Development Opportunities (WE DO)

LOCATION: Waiohuli, Kula, Maui, Hawaii

HYDROLOGY
POTENTIAL FULL-BUILD OUT
(See Figure 10 for Drainage Areas)

DATE January 2025

T.M.K. (2) 2-2-2:14 (Por.) (2) 2-2-28:181 (Por.)

Drainage Area Designation	Inlet Structure/ Designation	Area (Acres)	Length of Overland Flow (feet)	Average Slope %	Character of Ground	Tc (min.)	C	TM (years)	1-Hour Rainfall (inches)	I (in./hr.)	Q = AIC (c.f.s.)	Remarks
1	GDI #1	0.07	121.3 (P)	8.2	Ave.Grass/ Paved	10.5 + 2.2 = 12.7	0.95	50	3.0	5.75	0.38	
2	GDI #4	0.29	421.8 (P)	9.5	Paved	5.0	0.95	50	3.0	7.7	2.12	
3	GDI #6	0.30	405.7 (P)	12.3	Paved	4.5	0.95	50	3.0	7.8	2.22	
4	GDI #8	0.22	356.5 (P)	14.0	Paved	4.0	0.95	50	3.0	7.9	1.65	
5	GDI #10	0.39	253.2 (G) 286.8(P)	10.3 11.5	Ave. Grass/ Paved	13.0 + 3.8 = 16.8	0.95	50	3.0	5.3	1.96	
6	GDI #12	0.19	295.8 (P)	4.1	Paved	5.0	0.95	50	3.0	7.7	1.39	
7	GDI #20	0.16	256.1 (P)	7.8	Paved	4.0	0.95	50	3.0	7.9	1.20	
8	GDI #18	0.25	433.3 (P)	9.0	Paved	5.2	0.95	50	3.0	7.65	1.82	
9	GDI #15	0.08	118.0 (P)	4.2	Paved	3.0	0.95	50	3.0	8.25	0.63	
10	GDI #21	0.18	294.3 (P)	9.9	Paved	4.0	0.95	50	3.0	7.9	1.35	
11	GDI #24	0.20	345.2 (P)	10.1	Paved	4.4	0.95	50	3.0	7.85	1.49	
12	GDI #26	0.17	286.0 (P)	12.2	Paved	3.8	0.95	50	3.0	8.1	1.31	
13	GDI #26	0.14	250.8 (P)	3.2	Paved	5.2	0.95	50	3.0	7.65	1.02	
14	GDI #30	0.20	329.3 (P)	8.5	Paved	4.4	0.95	50	3.0	7.85	1.49	
15	GDI #28	0.18	306.9 (P)	12.1	Paved	3.9	0.95	50	3.0	8.0	1.37	

EXHIBIT "I"

PROJECT: Waiohuli Economic Development Opportunities (WE DO)
LOCATION: Waiohuli, Kula, Maui, Hawaii

HYDROLOGY
POTENTIAL FULL-BUILD OUT
(See Figure 10 for Drainage Areas)

DATE January 2025
T.M.K. (2) 2-2-2:14 (Por.) (2) 2-2-28:181 (Por.)

Drainage Area Designation	Inlet Structure/ Designation	Area (Acres)	Length of Overland Flow (feet)	Average Slope %	Character of Ground	Tc (min.)	C	TM (years)	1-Hour Rainfall (inches)	I (in./hr.)	Q = AIC (c.f.s.)	Remarks
16	GDI #32	0.18	303.6 (P)	11.2	Paved	3.9	0.95	50	3.0	8.0	1.37	
17	GDI #33	0.28	474.2 (P)	2.1	Paved	7.2	0.95	50	3.0	6.95	1.85	
18	GDI #35	0.24	387.4 (P)	6.2	Paved	5.5	0.95	50	3.0	7.5	1.71	
19	GDI #37	0.28	471.3 (P)	11.7	Paved	5.0	0.95	50	3.0	7.7	2.05	
20	GDI #2	1.27	380.4 (P) 190.9 (P)	7.9 3.7	Ave. Grass/ Paved	15.6 + 4.4 = 20.0	0.85	50	3.0	4.95	5.34	
21	GDI #3	1.85	387.1 (G) 333.3 (P)	7.0 6.0	Ave. Grass/ Paved	17.6 + 4.9 = 22.5	0.85	50	3.0	4.75	7.47	
22	GDI #5	1.86	384.5 (G) 381.5 (P)	12.0 13.1	Ave. Grass/ Paved	15.2 + 4.4 = 19.6	0.80	50	3.0	5.0	7.44	
23	GDI #7	5.24	1376.9 (G) 399.9 (P)	10.0 13.8	Ave. Grass/ Paved	10.6 + 4.5 = 15.1	0.80	50	3.0	5.55	23.27	
24	Drainage Lot	9.15	1305.2 (G)	9.6	Ave. Grass	24.5	0.80	50	3.0	4.55	33.31	
25	Drainageway	19.89	593.9 (G)	9.3	Ave. Grass	18.1	0.30	50	3.0	5.2	31.03	
26	Grass Drainage Ditch/Swale	5.22	754.7 (G)	13.4	Ave. Grass	19.2	0.85	50	3.0	5.1	22.63	
27	Drainageway	15.04	742.7 (G)	19.3	Ave. Grass	17.5	0.30	50	3.0	5.3	23.91	
28	Drainage Basin	12.20	4254.4 (G)	9.1	Ave. Grass	16.2	0.65	50	3.0	5.4	42.82	
29	GDI #19	3.12	458.2 (G) 272.6 (P)	12.0 8.0	Ave. Grass/Paved	16.2 + 4.2 = 20.4	0.65	50	3.0	4.9	9.94	
30	GDI #11	3.35	456.2 (G) 264.9 (P)	9.2 5.3	Ave. Grass/ Paved	16.8 + 4.8 = 21.6	0.65	50	3.0	4.85	10.56	

EXHIBIT "I"

PROJECT: Waiohuli Economic Development Opportunities (WE DO)

LOCATION: Waiohuli, Kula, Maui, Hawaii

HYDROLOGY
POTENTIAL FULL-BUILD OUT
(See Figure 10 for Drainage Areas)

DATE January 2025

T.M.K. (2) 2-2-2:14 (Por.) (2) 2-2-28:181 (Por.)

Drainage Area Designation	Inlet Structure/ Designation	Area (Acres)	Length of Overland Flow (feet)	Average Slope %	Character of Ground	Tc (min.)	C	TM (years)	1-Hour Rainfall (inches)	I (in./hr.)	Q = AIC (c.f.s.)	Remarks
31	GDI #9	0.37	245.5 (G) 262.4 (P)	11.4 10.7	Ave. Grass/ Paved	13.0 + 3.6 = 16.6	0.65	50	3.0	5.35	1.29	
32	GDI #13	2.30	710.0 (G) 526..0 (P)	9.2 8.4	Ave. Grass/ Paved	20.2 + 5.7 = 25.9	0.65	50	3.0	4.55	6.80	
33	GDI #14	2.02	442.7 (G) 631.7 (P)	11.3 7.1	Ave. Grass/ Paved	16.0 + 6.3 = 22.3	0.65	50	3.0	4.75	6.24	
34	GDI #16	1.20	442.3 (G) 115.6 (P)	11.3 6.9	Ave. Grass/ Paved	16.1 + 10.8 = 26.9	0.80	50	3.0	4.45	4.27	
35	GDI #17	2.91	532.0 (G) 403.3 (P)	9.4 8.7	Ave. Grass/ Paved	17.9 + 4.7 = 22.6	0.80	50	3.0	4.75	11.06	
36	Basin Lot	1.83	193.9 (G)	9.3	Ave. Grass	12.0	0.65	50	3.0	5.95	7.08	
37	GDI #29	0.69	346.0 (G) 332.3 (P)	8.4 8.7	Ave. Grass/ Paved	15.8 + 4.4 = 20.2	0.80	50	3.0	4.93	2.72	
38	GDI #27	0.77	241.4 (G) 281.4 (P)	12.8 11.0	Ave. Grass/ Paved	12.3 + 3.8 = 16.1	0.80	50	3.0	5.4	3.33	
39	GDI #25	2.69	589.8 (G) 240.3 (P)	10.0 2.1	Ave. Grass/ Paved	18.2 + 5.5 = 23.7	0.80	50	3.0	4.7	10.11	
40	GDI #25	3.19	659.4 (G) 266.7 (P)	10.3 6.4	Ave. Grass/ Paved	19.0 + 4.7 = 23.7	0.80	50	3.0	4.7	11.99	
41	GDI #23	2.63	541.3 (G) 293.9 (P)	8.1 6.8	Ave. Grass/ Paved	18.6 + 4.6 = 23.2	0.80	50	3.0	4.65	9.78	
42	GDI #22	0.58	254.2 (G) 281.6 (P)	7.5 8.5	Ave. Grass/ Paved	13.9 + 4.2 = 18.1	0.65	50	3.0	5.28	1.99	
43	Basin Lot	1.56	295.7 (G)	8.5	Ave. Grass	14.6	0.65	50	3.0	5.55	5.63	
44	GDI #36	4.22	855.1 (G) 455.9 (P)	9.7 5.9	Ave. Grass/ Paved	21.2 + 5.7 = 26.9	0.65	50	3.0	4.45	12.21	
45	GDI #34	3.99	584.8 (G) 447.0 (P)	7.7 6.7	Ave. Grass/ Paved	19.5 + 5.5 = 25.0	0.65	50	3.0	4.55	11.80	

EXHIBIT "I"

PROJECT: Waiohuli Economic Development Opportunities (WE DO)

LOCATION: Waiohuli, Kula, Maui, Hawaii

DATE January 2025

T.M.K. (2) 2-2-2:14 (Por.) (2) 2-2-28:181 (Por.)

HYDROLOGY
POTENTIAL FULL-BUILD OUT
(See Figure 10 for Drainage Areas)

Drainage Area Designation	Inlet Structure/ Designation	Area (Acres)	Length of Overland Flow (feet)	Average Slope %	Character of Ground	Tc (min.)	C	TM (years)	1-Hour Rainfall (inches)	I (in./hr.)	Q = AIC (c.f.s.)	Remarks
46	GDI #31	0.63	264.5 (G) 283.1 (P)	13.2 11.7	Ave. Grass/ Paved	13.0 + 3.7 = 16.7	0.65	50	3.0	5.25	2.15	
47	Basin Lot	0.94	263.1 (G)	11.4	Ave. Grass	13.0	0.85	50	3.0	5.8	4.63	
48	GDI #38	1.63	354.4 (G) 466.8 (P)	11.3 11.4	Ave. Grass/ Paved	14.8 + 5.0 = 19.8	0.65	50	3.0	5.0	5.30	
49	Basin Lot	1.29	352.0 (G)	10.8	Ave. Grass	16.4	0.65	50	3.0	5.38	4.51	
50	Drainageway	31.15	2343.3	12.0	Ave. Grass	33.5	0.35	50	3.0	4.15	45.25	
											414.24	Total

JOB NO.: 24-005

R. T. TANAKA ENGINEERS, INC.
ENGINEERS - SURVEYORS

SHEET 4 OF 4

Project: Waiohuli Economic Development Opportunities (WE DO)
Drainline: 1
Date: January 2025
Location: Waiohuli, Kula, Maui, Hawaii
Comp. By: N.D. Checked By: K.T.

Structure	Design Q	Size of Pipe	Approximate Slope of Pipe	Approximate Length of Segment	Approximate Velocity Full/Actual	Approximate Depth of Flow
	cfs	in.	ft./ft.	ft.	fps	ft.
Outlet #1						
	49.89	24"	0.08	30	23.0	1.32
GDI #7						
	24.97	24"	0.08	386	19.0	0.86
GDI #5						
	15.31	24"	0.08	397	16.8	0.66
DMH #4						
	5.72	24"	0.08	348	13.0	0.40
GDI #2						
	0.38	24"	0.04	68	4.5	0.13
DMH #1						
GDI #4						
	7.47	24"	0.04	18	10.8	0.54
GDI #3						
GDI #5						
	2.22	24"	0.04	18	7.4	0.30
GDI #6						
GDI #7						
	1.65	24"	0.04	19	6.8	0.26
GDI #8						

Project: Waiohuli Economic Development Opportunities (WE DO)
Drainline: 2
Date: January 2025
Location: Waiohuli, Kula, Maui, Hawaii
Comp. By: N.D. Checked By: K.T.

Structure	Design Q	Size of Pipe	Approximate Slope of Pipe	Approximate Length of Segment	Approximate Velocity Full/Actual	Approximate Depth of Flow
	cfs	in.	ft./ft.	ft.	fps	ft.
Outlet #2						
	36.89	24"	0.04	30	16.0	1.38
GDI #13						
	23.85	24"	0.08	261	19.0	0.86
DMH #1						
	23.85	24"	0.08	250	19.0	0.86
GDI #12						
	11.90	24"	0.08	294	15.0	0.58
GDI #10						
	9.94	24"	0.04	18	12.0	0.63
GDI #9						
GDI #12						
	10.56	24"	0.04	51	11.9	0.65
GDI #11						
GDI #13						
	6.24	24"	0.04	26	10.0	0.51
GDI #14						

EXHIBIT "J"

Project: Waiohuli Economic Development Opportunities (WE DO)
Drainline: 3
Date: January 2025
Location: Waiohuli, Kula, Maui, Hawaii
Comp. By: N.D. Checked By: K.T.

Structure	Design Q	Size of Pipe	Approximate Slope of Pipe	Approximate Length of Segment	Approximate Velocity Full/Actual	Approximate Depth of Flow
	cfs	in.	ft./ft.	ft.	fps	ft.
Outlet #3						
	14.61	24"	0.08	157	16.5	0.64
GDI #24						
	9.78	24"	0.04	18	11.5	0.63
GDI #23						
GDI #24						
	3.34	24"	0.08	329	11.0	0.32
GDI #22						
	1.35	24"	0.04	20	6.4	0.24
GDI #21						

Project: Waiohuli Economic Development Opportunities (WE DO)
Drainline: 4
Date: January 2025
Location: Waiohuli, Kula, Maui, Hawaii
Comp. By: N.D. Checked By: K.T.

Structure	Design Q	Size of Pipe	Approximate Slope of Pipe	Approximate Length of Segment	Approximate Velocity Full/Actual	Approximate Depth of Flow
	cfs	in.	ft./ft.	ft.	fps	ft.
Outlet #4						
	34.92	24"	0.04	30	16.0	1.30
GDI #38						
	39.62	24"	0.04	20	15.0	1.18
GDI #37						
	27.57	24"	0.04	23.4	19.2	1.12
DMH #3						
	27.57	24"	0.08	230	19.2	0.92
GDI #36						
	13.65	24"	0.08	209	16.0	0.62
DMH #2						
	13.65	24"	0.08	214	16.0	0.62
GDI #34						
	1.85	24"	0.04	18	7.2	0.28
GDI #33						
GDI #36						
	1.71	24"	0.04	18	6.8	0.26
GDI #35						

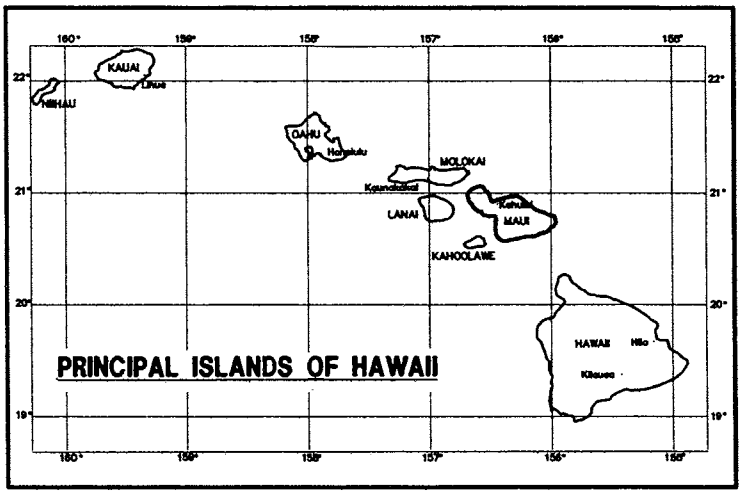
Project: Waiohuli Economic Development Opportunities (WE DO)
Drainline: 5
Date: January 2025
Location: Waiohuli, Kula, Maui, Hawaii
Comp. By: N.D. Checked By: K.T.

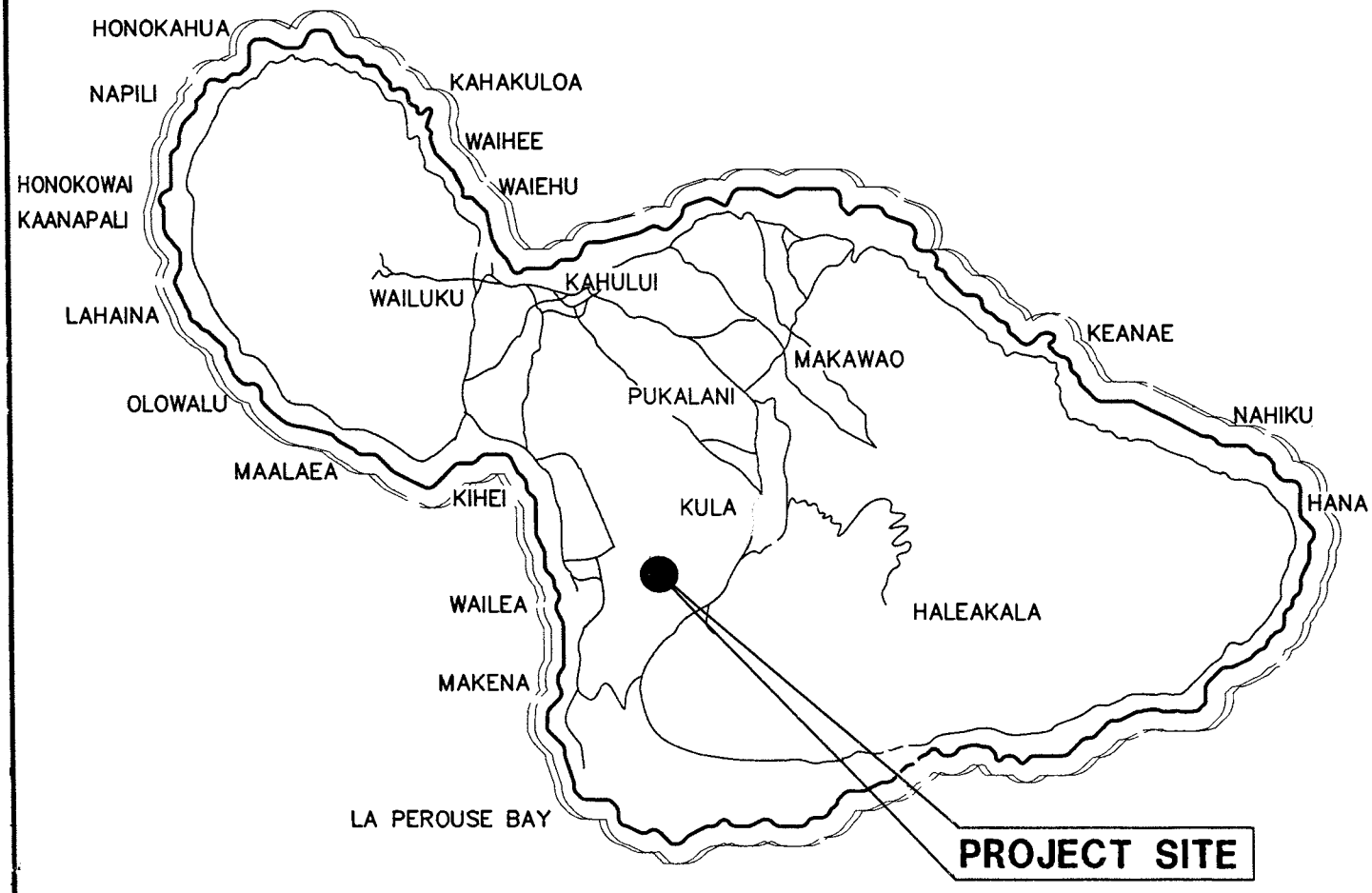
Structure	Design Q	Size of Pipe	Approximate Slope of Pipe	Approximate Length of Segment	Approximate Velocity Full/Actual	Approximate Depth of Flow
	cfs	in.	ft./ft.	ft.	fps	ft.
Outlet #5						
	24.87	24"	0.08	190	19.0	0.82
GDI #32						
	21.35	24"	0.08	294	18.5	0.78
GDI #28						
	4.21	24"	0.08	307	12.0	0.34
GDI #30						
	2.72	24"	0.04	18	7.9	0.33
GDI #29						
GDI #28						
	15.77	24"	0.04	32	13.2	0.80
GDI #27						
	12.44	24"	0.04	345	12.5	0.70
GDI #26						
	10.11	24"	0.04	20	12.0	0.68
GDI #25						
GDI #32						
	2.15	24"	0.04	18	7.3	0.29
GDI #31						

Project: Waiohuli Economic Development Opportunities (WE DO)
Drainline: 6
Date: January 2025
Location: Waiohuli, Kula, Maui, Hawaii
Comp. By: N.D. Checked By: K.T.

Structure	Design Q	Size of Pipe	Approximate Slope of Pipe	Approximate Length of Segment	Approximate Velocity Full/Actual	Approximate Depth of Flow
	cfs	in.	ft./ft.	ft.	fps	ft.
Outlet #6						
	28.92	24"	0.04	40	15.0	1.15
GDI #18						
	11.14	24"	0.08	422	12.0	0.68
GDI #19						
	1.20	24"	0.04	19	7.8	0.19
GDI #20						
GDI #18						
	15.96	24"	0.04	27	13.4	0.26
GDI #17						
	4.90	24"	0.04	326	9.6	0.45
GDI #16						
	0.63	24"	0.04	18	5.2	0.18
GDI #15						

FIGURES





N

LOCATION MAP

ISLAND OF MAUI

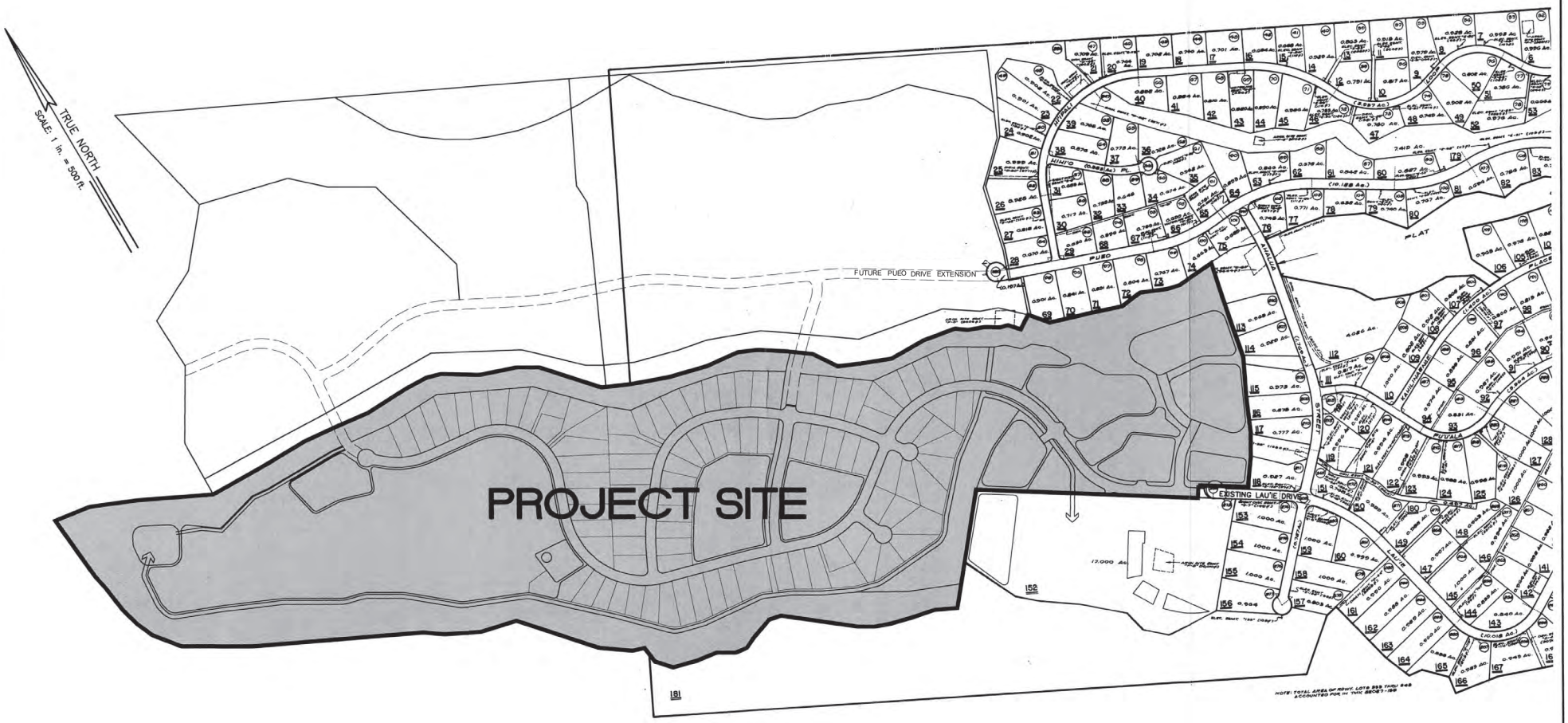
Tax Map Key (2) 2-2-04:14 (Por.) & (2) 2-2-28:181 (Por.)

FIGURE 1

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS - CIVIL & STRUCTURAL ENGINEERS

JOB NO. 24-005



VICINITY MAP

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)

"POTENTIAL FULL BUILDOUT" (TOTAL AREA= 150 ACRES ±)

500 250 0 500 1000

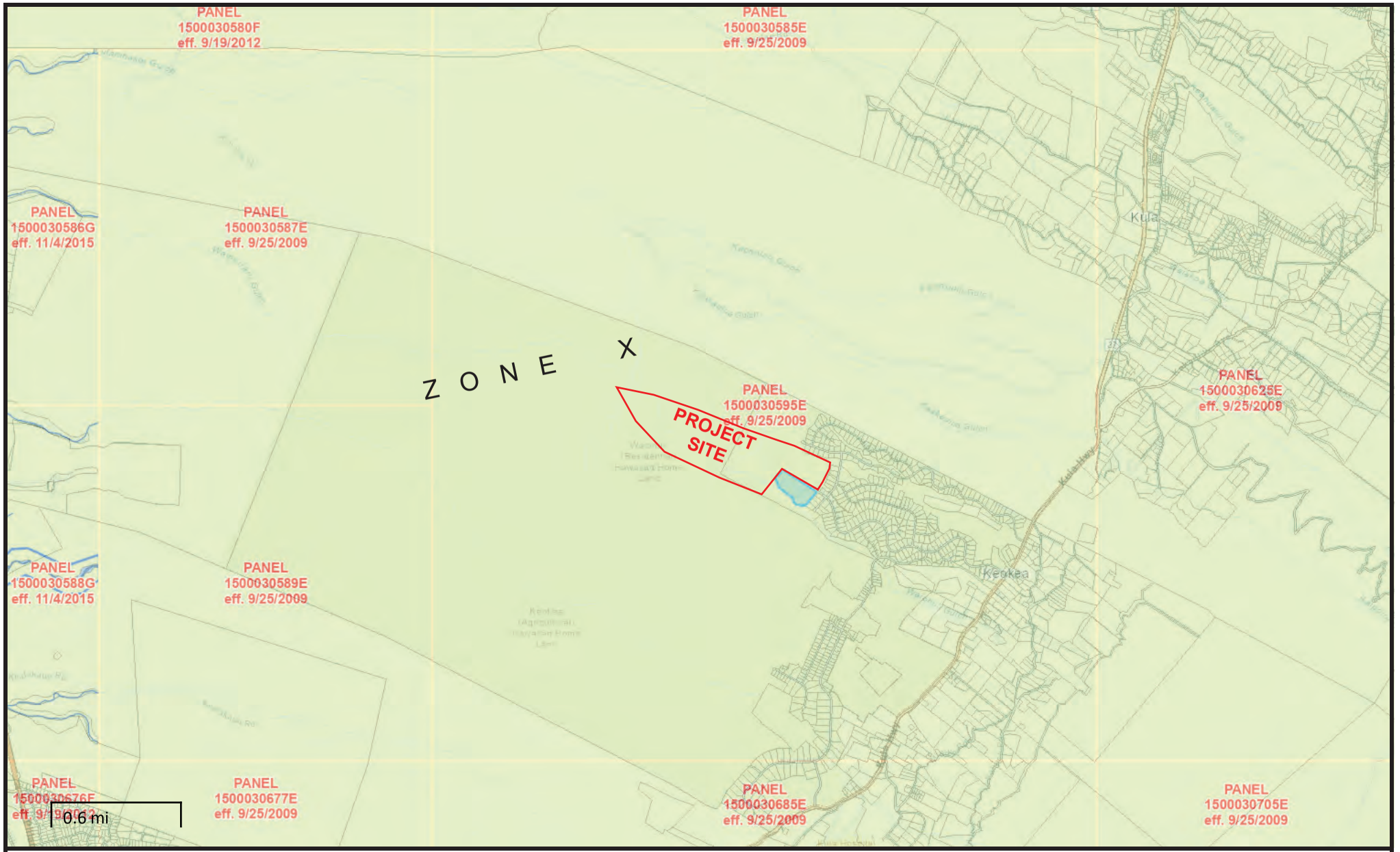
GRAPHIC SCALE IN FEET

FIGURE 2

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO: 24–005



Flood Hazard Map

Title: WE DO Property 150 Acres (+/-)

Notes:

Map generated on 08/07/2024

Map Legend

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

FIGURE 3

Soil Map—Island of Maui, Hawaii

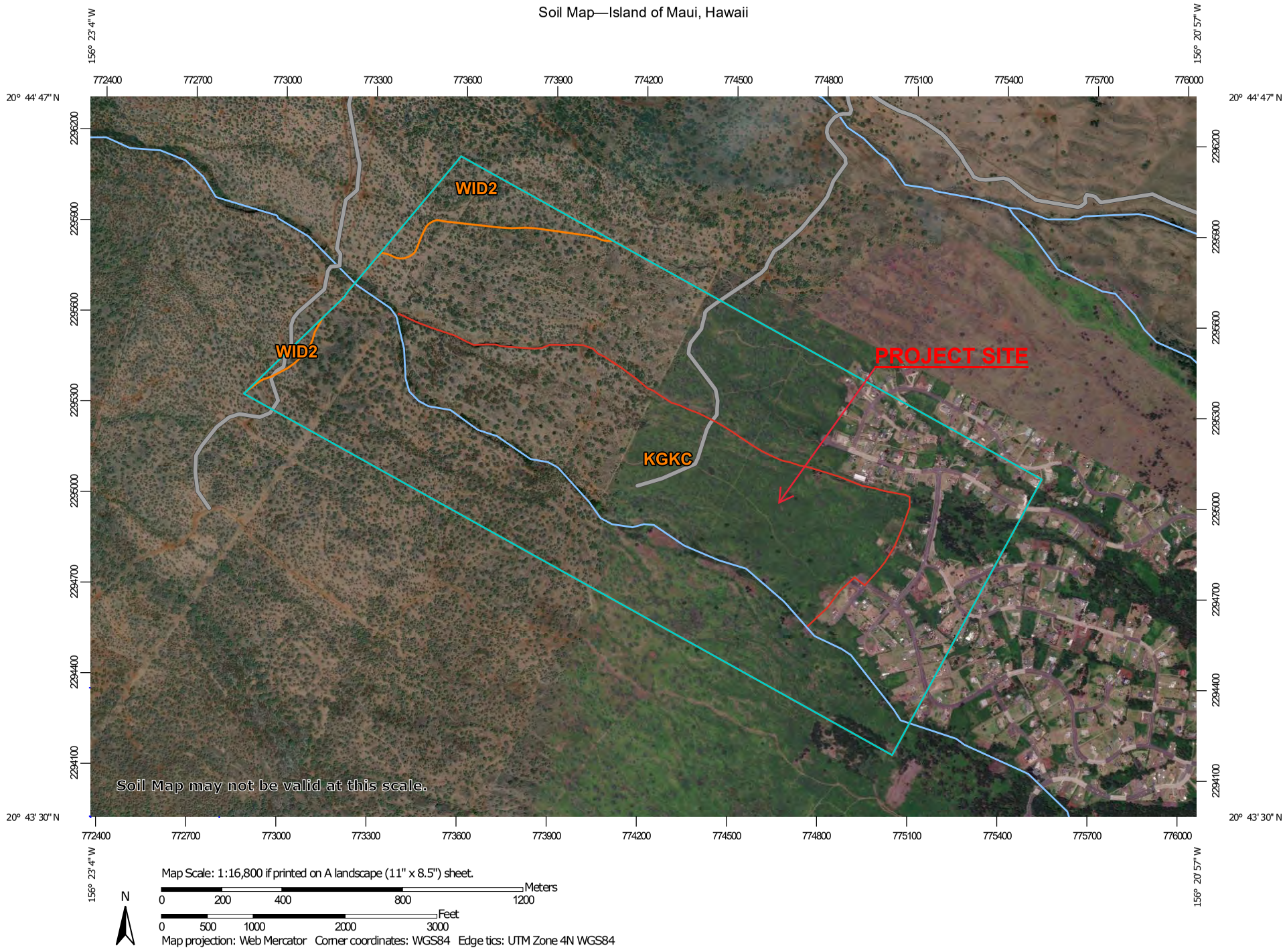


FIGURE 4A

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Island of Maui, Hawaii
Survey Area Data: Version 21, Sep 8, 2023

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

Date(s) aerial images were photographed: Jan 29, 2017—Oct 11, 2020

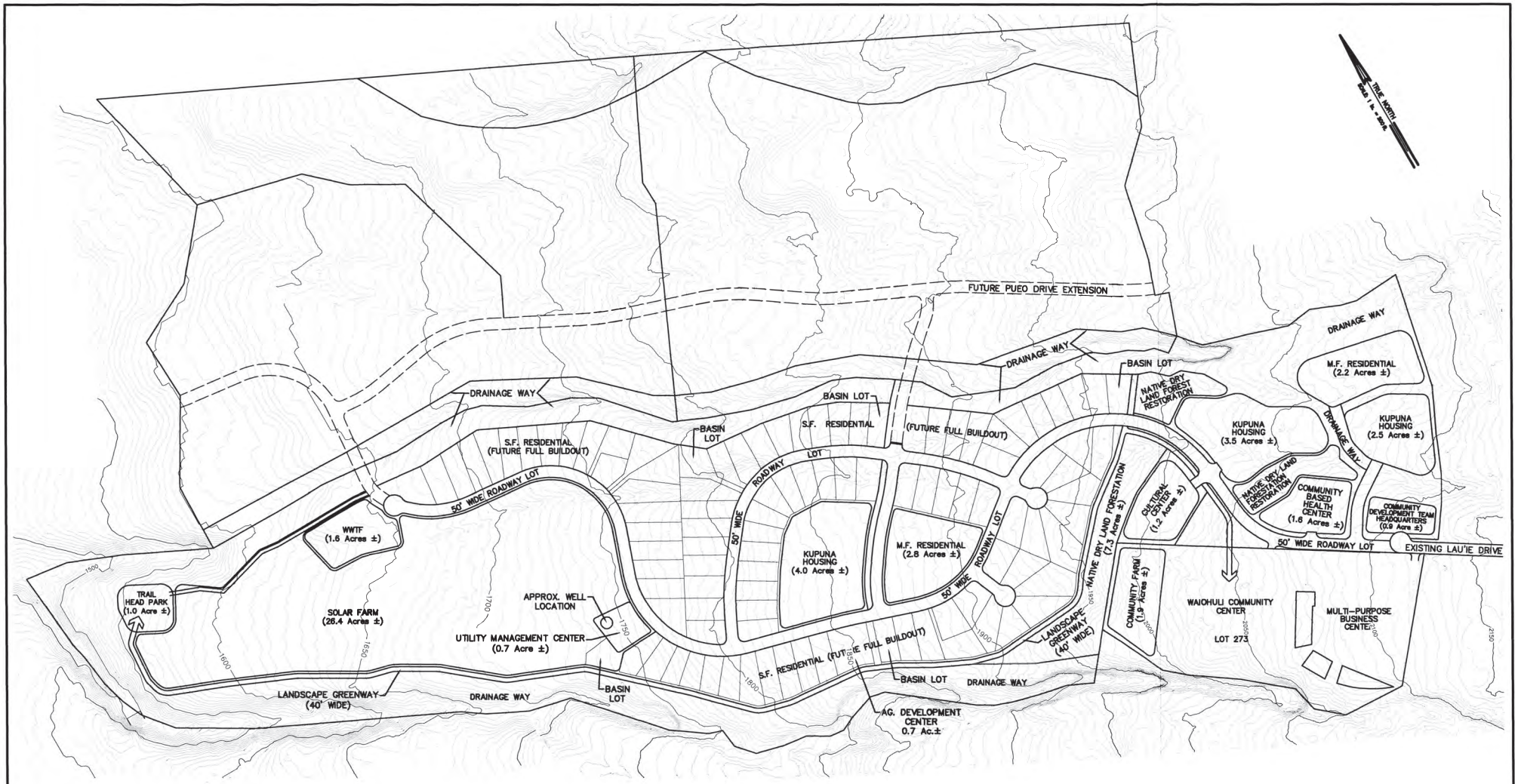
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

FIGURE 4B

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KGKC	Kamaole very stony silt loam, 3 to 15 percent slopes	575.1	96.2%
WID2	Waiakoa extremely stony silty clay loam, 3 to 25 percent slopes, eroded, MLRA 157	22.9	3.8%
Totals for Area of Interest		**598.0**	**100.0%**

FIGURE 4C



TOPOGRAPHIC MAP

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)

"POTENTIAL FULL BUILDOUT" (TOTAL AREA= 150 ACRES ±)

400 200 0 400 800
GRAPHIC SCALE IN FEET

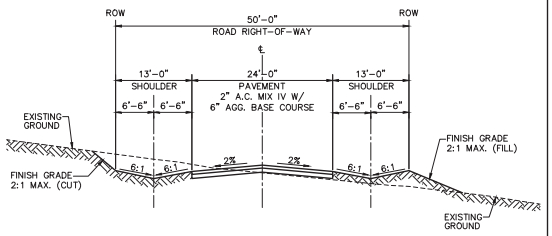
FIGURE 5

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO: 24–005

PROPOSED LAND USE	AREA (acreage)	DENSITY (du/ac)	ESTIMATED # OF UNITS
SINGLE FAMILY RESIDENTIAL (SF - 15,000+ SqFt LOT)	40	2.5	100
MULTI-FAMILY (MF) RESIDENTIAL	5	10 -16	50 - 80
KŪPUNA HOUSING	10.1	10 -16	100 - 165
COMMUNITY BASED HEALTH CENTER	1.6		
CULTURAL CENTER	1.7		
COMMUNITY DEVELOPMENT TEAM HEADQUARTERS	0.9		
AGRICULTURE DEVELOPMENT CENTER	0.7		
UTILITY MANAGEMENT CENTER (WITH WELL SITE)	0.7		
NATIVE DRYLAND FOREST RESTORATION	7.3		
SOLAR FARM	26.4		
WASTE WATER TREATMENT FACILITY (WWTF)	1.6		
TRAIL HEAD PARK	1.0		
GREENWAY TRAIL (40')	6.3		
DRAINAGE AREA	36.1		
ROADWAYS (50')	10.6		
SUBTOTAL	150		250 - 350



TYPICAL SECTION OF ROADWAY
NOT TO SCALE

CONCEPTUAL SITE PLAN

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)
"POTENTIAL FULL BUILDOUT" (TOTAL AREA= 150 ACRES ±)

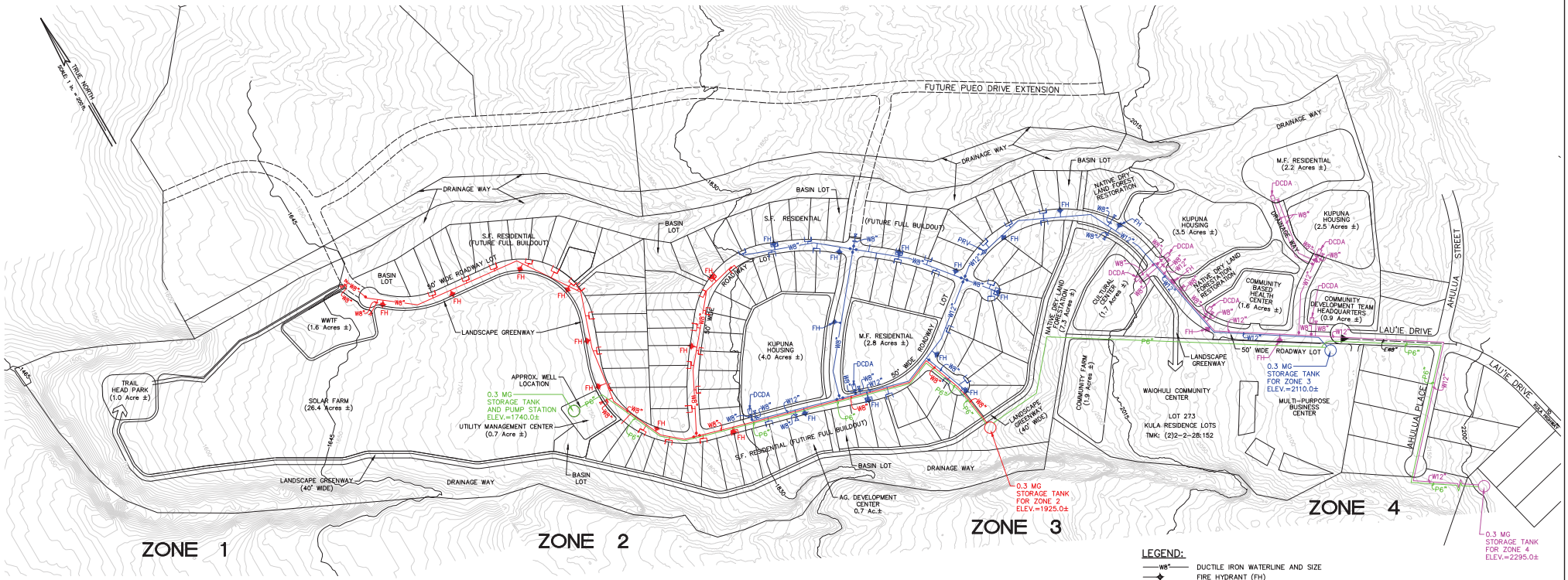
200 100 0 200 400
GRAPHIC SCALE IN FEET

FIGURE 6

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO: 24-005



LEGEND:

- W8" — DUCTILE IRON WATERLINE AND SIZE
- FH — FIRE HYDRANT
- DCDA — DOUBLE CHECK DETECTOR ASSEMBLY
- PRV — PRESSURE REDUCING VALVE WITH MANHOLE
- GV — GATE VALVE WITH S.V.B. & COVER
- SERVICE LATERAL (COMMERCIAL)
- EW8" — EXISTING WATERLINE AND SIZE
- ZONE 2 – SINGLE SERVICE LATERAL (RESIDENTIAL)
- ZONE 2 – DOUBLE SERVICE LATERAL (RESIDENTIAL)
- ZONE 3 – SINGLE SERVICE LATERAL (RESIDENTIAL)
- ZONE 3 – DOUBLE SERVICE LATERAL (RESIDENTIAL)
- ZONE 4 – SINGLE SERVICE LATERAL (RESIDENTIAL)
- ZONE 4 – DOUBLE SERVICE LATERAL (RESIDENTIAL)
- P6" — PUMP WATERLINE AND SIZE

CONCEPTUAL WATER SYSTEM SITE PLAN

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)

"POTENTIAL FULL BUILDOUT" (TOTAL AREA= 150 ACRES ±)

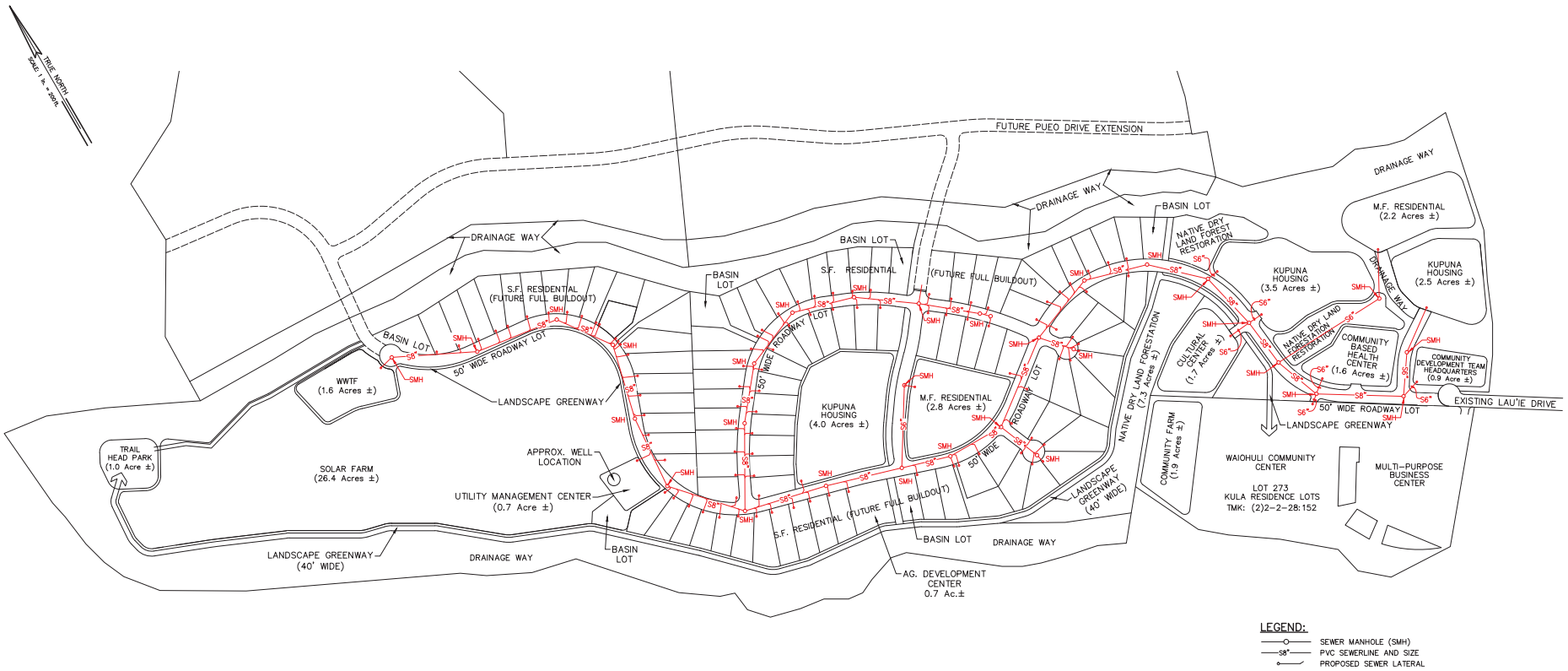
200 100 0 200 400
GRAPHIC SCALE IN FEET

FIGURE 7

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO: 24-005



CONCEPTUAL SEWER SYSTEM SITE PLAN

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)

"POTENTIAL FULL BUILDOUT" (TOTAL AREA= 150 ACRES ±)

200 100 0 200 400
GRAPHIC SCALE IN FEET

FIGURE 8

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO: 24-005

CONCEPTUAL DRAINAGE HYDROLOGY SITE PLAN

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)

"POTENTIAL FULL BUILDOUT" (TOTAL AREA= 150 ACRES ±)

200 100 0 200 400
GRAPHIC SCALE IN FEET

FIGURE 9

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO: 24-005

CONCEPTUAL DRAINAGE SYSTEM AND FINISHED HYDROLOGY SITE PLAN

WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES (WE DO)

"POTENTIAL FULL BUILDOUT" (TOTAL AREA= 150 ACRES ±)

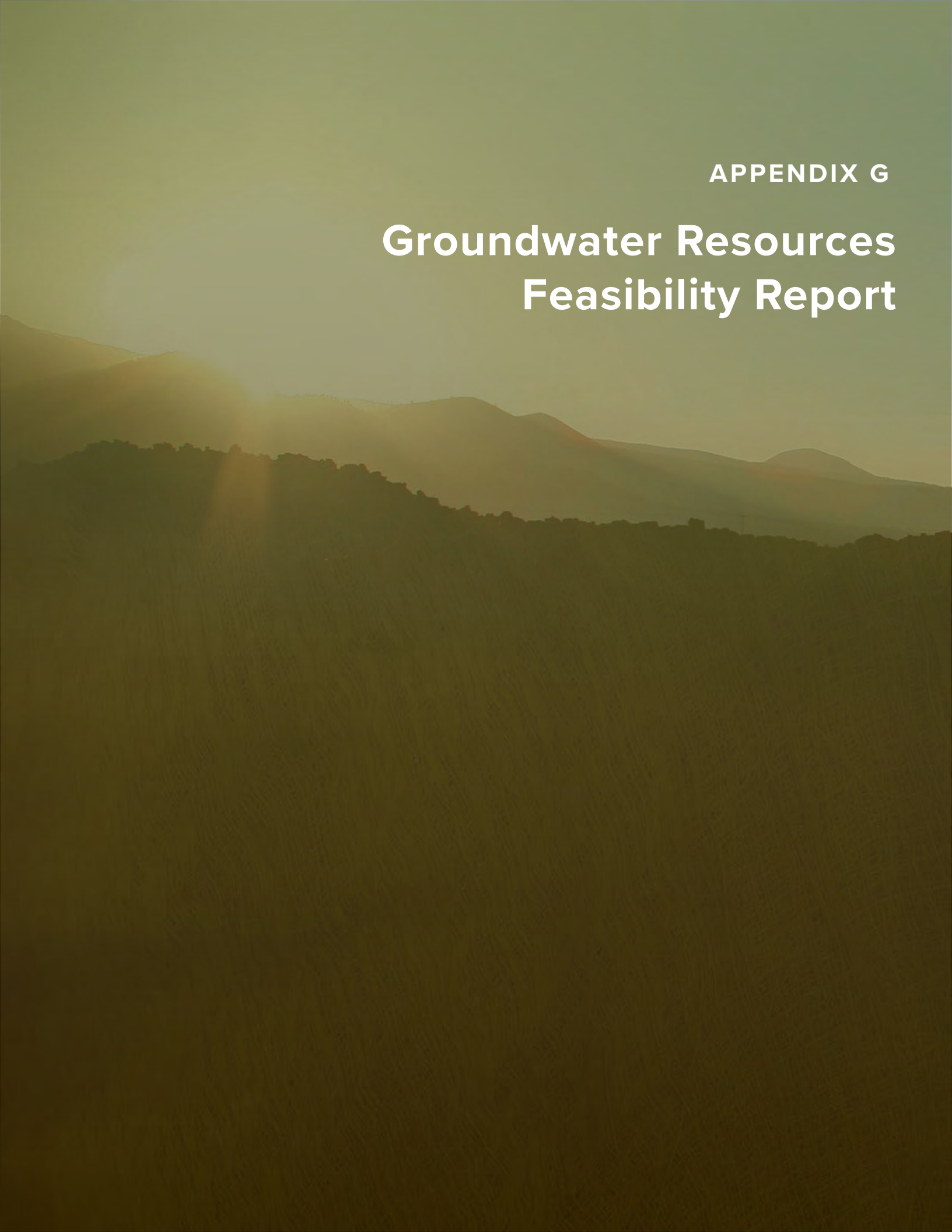
200 100 0 200 400
GRAPHIC SCALE IN FEET

FIGURE 10

871 KOLU STREET, SUITE 201
WAILUKU, MAUI, HAWAII 96793

R. T. TANAKA ENGINEERS, INC.
LAND SURVEYORS – CIVIL & STRUCTURAL ENGINEERS

JOB NO: 24-005



APPENDIX G

Groundwater Resources Feasibility Report

Waiohuli Well Development

Groundwater Resources Feasibility Study for the Waiohuli Hawaiian Homesteaders Association Community Economic Plan

Prepared for:

Pueo Development, LLC
45-709 Keneke Street
Kāneʻohe, HI 96744

Prepared by:

INTERA Incorporated
74 Kihapai Street
Kailua, HI 96734
808-382-6853

March 2022

Waiohuli Well Development
Groundwater Resources Feasibility Study for the Waiohuli Hawaiian Homesteaders Association Community Economic Plan

Report Date: March 1, 2022

Prepared for:
Pueo Development, LLC
45-709 Keneke Street
Kāneʻohe, HI 96744

Prepared by:
INTERA Incorporated
74 Kihapai Street
Kailua, HI 96734

This work was prepared by me or under my supervision

Kevin L. Gooding

Signature

December 31, 2022

Expiration date

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACROYNMS AND ABBREVIATIONS

bgs	below ground surface
CWRM	Commission on Water Resource Management (
CTD	Conductivity Temperature and Depth meter
DOH	Hawai‘i Department of Health
DPW	County of Maui Department of Public Works
DHHL	Department of Hawaiian Home Lands
EA	Environmental Assessment
F	Fahrenheit
feet	foot *or* feet
gpd	gallons per day
gpm	gallons per minute
HWCPIS	Hawai‘i Well Construction and Pump Installation Standards
INTERA	INTERA Incorporated
MDWS	Maui Department of Water Supply
mgd	million gallons per day
mg/L	milligrams per liter
MAV	moving average, as in 12-month moving average
msl	mean sea level
MCL	Maximum Contaminant Level
No.	number
NPDES	National Pollution Discharge Elimination System
OSDS	onsite sewage disposal systems
PWSS	Public Water System Supervision
Rd	Road
ROM	Rough Order of Magnitude
SHPD	State Historic Preservation Division (SHPD)
U.S.	United States
USGS	United States Geological Survey
WHHA	Waiohuli Hawaiian Homesteaders Association

1.0 INTRODUCTION

1.1 Background

The Waiohuli Hawaiian Homesteaders Association (WHHA) is in the initial phases of investigating the potential for a future development in Upcountry Maui (WHHA Site). The Department of Hawaiian Home Lands (DHHL) has issued WHHA a Right of Entry to approximately 150 acres of open space to conduct the necessary due diligence and feasibility analyses.

A conceptual plan is currently being developed in which the development of housing, infrastructure and support services would provide jobs for the Waiohuli Homestead community. Currently WHHA is considering approximately 350 to 650 housing units (single and multi-family), a community center, an immersion school, community farming, and a park area.

WHHA would like to investigate the feasibility of developing a viable water supply. WHHA would establish a rural water utility company to manage the water supply. Groundwater has proven to be a viable water source for many communities on Maui and is the focus of this feasibility assessment. Information from an onsite United States Geological Survey (USGS) Waiohuli Test Well (Well No. 6-4422-001) and the Commission on Water Resource Management coupled with other local well information, relevant studies, and planning documents informed this assessment.

1.2 Purpose of Study

This study focuses on the feasibility of developing onsite groundwater well(s) to supply water for the WHHA Site. This study is a part of the necessary due diligence process and will inform the economic plan to obtain a lease from the Department of Hawaiian Home Lands.

1.3 Approach and Organization of Report

This study provides a background on the regional hydrogeology and relevant characteristics of the WHHA site followed by a feasibility analysis on developing local groundwater as the source of water supply for the new community. Feasibility factors included are local groundwater levels, well production capacity relative to community water demands, local groundwater quality, aquifer reliability, and future risks entailing future development and climate change. A rough order of magnitude (ROM) cost estimate, financing options, and permitting information are also provided.

This report is organized into the following sections:

- Section 2 - Regional Site Considerations
- Section 3 – Feasibility Factors
- Section 4 –Cost Estimate and Funding
- Section 5 – Permitting
- Section 6 – Conclusions and Recommendations

2.0 REGIONAL SITE CONSIDERATIONS

2.1 Site Description

The WHHA Site is on the leeward (southwest facing) side of Maui, as shown in Figure 1. The site is makai and down gradient of the of the Kula Highway or State Road (Rd) 37. It is adjacent to an established rural residential development. Most of the lands immediately surrounding the WHHA Site consist of open space encompassing grass and shrub lands, developed rural subdivisions, and forested lands.

Data from the USGS Waiohuli Test Well (State Well No. 6-4422-001) provides valuable hydrogeological information. The well was drilled in 2001 to investigate the availability of groundwater and geology on the western slope of Haleakalā. As shown in Figure 1, the well is located on the WHHA Site which appears to be in use as ranchland. No perennial surface-water bodies are within 4 miles of the well. The nearest intermittent stream valley is Waiohuli Gulch about 0.1 miles south of the well.

The WHHA Site and USGS Waiohuli Test Well is in Upcountry Maui. This is a diverse ecological region ranging in 9,800 feet in elevation at the upper ridge of Haleakalā to the lower slopes of the mountain. The region primarily consists of agricultural and conservation lands with small urban centers. Figure 2 shows the predominant land uses. The middle elevations where the WHHA Site is located consist of dry forest and grassland.

The climate in this mountainous area is subtropical with temperatures ranging from a low of 50 degrees F in the winter to the mid-80 degrees F during the summer. As shown in Figure 3, the windward side receives more rainfall while the leeward sides are much dryer. The WHHA site is on the leeward side and is relatively dry with rainfall at about 20 inches per year.

2.2 Regional Hydrogeology

2.2.1 Geology of East Maui and the Waiohuli

Waiohuli is located on the Haleakalā Volcano. Haleakalā is composed of three volcanic formations and alluvium (Figures 4 and 5). The shield-stage Honomanū Basalt comprises most of the volume of the volcano. The Honomanū Basalt is mantled or thinly covered by the postshield-stage Kula and rejuvenated Hāna Volcanics. The Kula and Hāna Volcanics constitute only about 0.4 percent of the Haleakalā Volcano's volume (Eakins and Robinson, 2006) and are generally 50 to 200 feet thick (Stearns and Macdonald 1942). Alluvium is generally found along the coast in the Kihei area, with dunes in the isthmus. The Waiohuli site is located on the Kula Volcanics and Hāna Volcanics are found to the east of the site. The most recent Haleakalā eruption was composed of Hāna Volcanics about 230 years ago (Langenheim and Clague, 1987).

The Honomanū Basalt is mostly composed tholeiitic basalt and forms thin bedded, flows of pāhoehoe and a'ā (Langenheim and Clague, 1987). The Kula Volcanics is composed mostly of hawaiiite with some ankaramite and alkalic basalt and represents the alkalic postshield stage. The Hāna Volcanics are rejuvenated stage lavas and are known to contain ankaramite and hawaiiite (Clague and Dalrymple 1987). The Honomanū Basalt is more permeable and forms a superior aquifer for water development.

High level water impounded by dikes may occur in the central portions of Haleakalā but has not been observed in the WHHA Site. Dikes are sub-vertical, sheet-like formations that intrude into the existing rock and are of low permeability. The dike structures impede the flow of groundwater and form the high-level aquifer (Macdonald et al., 1983). The nearest Haleakalā rift zone is the southwest rift zone trending from the Haleakalā Crater to Makena (Izuka et al, 2018). There are cinder cones from the Hāna Volcanics in the vicinity of the WHHA Site and these were fed by dikes, but data from the USGS Waiohuli Test Well indicates that the water is basal, not high level.

The USGS drilled the USGS Waiohuli Test Well to determine the water table elevation, salinity and subsurface geology. They drilled to 1,940 feet below ground surface (bgs). The USGS determined that the water table elevation was 5.58 feet msl (9/27/2001) and that the salinity was 66 mg/L chloride (4/2/2002). The cuttings from drilling were generally unweathered lavas composed of basanite, hawaiite and alkalic basalt. The boundary between the Kula Volcanics and Honomanū Basalt was found to be at about 925 feet bgs (939 feet msl). The available evidence indicates that the aquifer formation is the higher-permeability Honomanū Basalt.

2.2.2 Hydrogeology of the Kama‘ole Aquifer System

The WHHA Site is on the Kama‘ole Aquifer System, State Aquifer Code 60304 of East Maui (CWRM, 2019), as shown in Figure 6. The Kama‘ole Aquifer includes basal and caprock water bodies. High-level dike-impounded water may occur in the mauka areas (Izuka et al, 2018). The Commission on Water Resource Management (CWRM) established the Sustainable Yield of the Kama‘ole Aquifer at 11 mgd. The November 2021 12-month moving average (MAV) pumpage was about 3 mgd (CWRM 2022). The aquifer system is not designated as a Ground Water Management Area therefore a water use permit is not required. There are 181 drilled wells, dug wells and tunnels in the aquifer. The majority of wells were drilled near the coast. Although, there may be dike-impounded high-level groundwater in mauka regions, the primary groundwater resource is basal.

Groundwater basal aquifers, also called freshwater lens systems, are the most important sources of freshwater supply in Hawai‘i and occur in dike-free volcanic rocks and in sedimentary deposits. In a basal aquifer, lower density (lighter) fresh water can be thought of as floating on higher density (heavier) salt water. The fresh water and salt water are separated by a mixing or transition zone where salinity gradually increases from fresh to seawater concentrations. The quantity of available fresh water is partially a function of the dynamics of the transition zone. Figure 8 shows a conceptual diagram of a basal aquifer.

Factors such as tides, pumpage, variable recharge, groundwater flux rates and aquifer heterogeneities can result in a thick transition zone. Aquifers with thicker transition zones (relative to the vertical thickness of the freshwater zone) generally yield more brackish water to wells. The amount of water stored in the basal lens is significant. Basal aquifers provide the primary source for municipal water in Hawai‘i and is also withdrawn for various other uses. Basal aquifers can be either confined or unconfined. Unconfined aquifers occur where the upper surface of the saturated aquifer is not bounded by a confining less-permeable layer. The Kama‘ole Aquifer is an unconfined basal aquifer in the Waiahuli area.

The thickness of the freshwater basal lens can be estimated using the Ghyben-Herzberg equation. Two important assumptions implicit in the Ghyben-Herzberg theory are described as follows: (1) There is a

sharp interface between fresh water and seawater, and (2) the aquifer is at steady state. Ghyben-Herzberg indicates that for every foot of freshwater above msl there is 40 feet of fresh water below msl. For example, if fresh water is known to occur at an elevation 10 feet above msl, it can be estimated that the hypothetical sharp interface would be 400 feet below msl. The Ghyben-Herzberg model provides a reasonable estimate of the freshwater basal lens thickness; however, in reality, the interface between fresh water and seawater occurs not as a sharp interface, but as a brackish transition zone, with salinity gradually increasing with depth. Therefore, the Ghyben-Herzberg formula is used to estimate the midpoint of the transition zone, which is 50% seawater and 50% fresh water.

The thickness of the transition zone depends on various chemical and physical parameters, including but not limited to pumpage, advection and dispersion, mechanical mixing, physical properties of the aquifer, tidal fluctuation, and atmospheric pressure variation. The movement of the brackish transition zone, both horizontally inland from the seacoast and vertically upward, potentially affects all basal wells. This movement is monitored using deep monitor wells in some aquifers, but there no deep monitor wells in Kama‘ole. The water level at the Waiohuli Test Well has averaged 4.8 feet between 2018 and 2021. This equates to an aquifer thickness of 4.8 feet x 40 = 192 feet. As noted above, the actual aquifer thickness is also function of other dynamic factors and, for water development purposes, the production interval of a well should be well above the theoretical bottom of the freshwater.

The thickness of the transition zone can be monitored using geophysical logging. CWRM staff logged the USGS Waiohuli Test Well for vertical changes in temperature and salinity in November 2018. Figure 9 shows the log. The log indicates that the salinity from +4.8 feet msl to -20.2 msl remained constant at about 440 microS/cm. This is potable water in terms of salinity and the upper 25 feet of the aquifer are not in the transition zone.

3.0 FEASIBILITY FACTORS

This section addresses the factors that influence the feasibility of developing groundwater resources at the WHHA Site. These factors include local water levels, availability of groundwater supplies to meet demands, local water quality, and future considerations and risks involving future land development and climate change.

3.1 Local Groundwater Levels

An understanding of groundwater levels at the USGS Waiohuli Test Well and in nearby wells is important to characterize the sustainability of groundwater supplies within the region and in determining the depth of production well(s) needed at the WHHA Site. Figure 10 indicates that water levels were between 5.5 and 6 feet in 2002. Water levels from 2016 to the most recent vary between about 4.5 and 5 feet. These data indicate that groundwater levels under the WHHA Site have fluctuated by 0.5 feet over the past 1.5 years with an average groundwater level of 4.8 feet. Based on these data, it appears groundwater levels have declined from an average of 5.8 feet measured from September 2001 to August 2002 to approximately 4.71 feet measured in April 2021 . Unfortunately, no data are available from August 2002 to September 2015 to further characterize changes. Figure 11 shows daily water levels measured at the USGS Waiohuli Test Well between November 2018 and April 2021. More recent water levels are not available because of pandemic-related data collection delays. Water levels show seasonal fluctuations between 4.5 feet and 5 feet.

Figure 12 shows a map groundwater level observations in selected wells in the Kama‘ole, and Makawao Aquifer Systems. The mauka wells have similar groundwater levels, varying between 5 and 5.6 feet above sea level. These data corroborate the validity of the water level data collected at Waiohuli and suggest that the regional water level is about 5 feet msl.

CWRM has recently started collecting water level data from a well mauka of Maui Meadows. Figure 13 shows the groundwater observation in the Maui Meadows Monitor Well (Well No. 6-4225-001), which is approximately 4.2 miles southwest of the USGS Waiohuli Test Well. These data show that groundwater levels in this location have been relatively stable the past two years (January 2020 December 2021) with a fluctuation of 0.6 feet during this period. This supports the hypothesis that there has not been a recent broad regional decline in groundwater levels, however, the two-year data period is too short to identify long-term trends and the well is too far from the USGS Waiohuli Test Well to reflect any local groundwater level changes.

An issue of concern is the measured decline in water levels between 2002 and 2017 observed in the USGS Waiohuli Test Well. This decline may be reflective of physical water level declines in the aquifer. On the other hand, the change may be attributed to a change in benchmark datum between the period in which measurements were originally taken (2001 to 2002) and the current series of measurements from 2015 to 2021. There are no data from 2002 and 2015 so the effects of seasonal variations cannot be assessed. Assuming that the benchmark elevations were correct and water levels have declined, the water level is still adequate for the project needs.

Regional and local water levels are important for well design and regulatory compliance. A well drilled in a basal aquifer should be designed to minimize the chances of saltwater intrusion. In other words,

the well must not penetrate too deep into the aquifer or it may draw in brackish water. The average water level from 2018 to 2021 was 4.8 feet msl at the USGS Waiohuli Test Well and regional water levels were about 5 feet. We will assume that the equilibrium groundwater levels underlying the WHHA Site are about 5 feet. As mentioned in Section 2.2.2, this equates to a theoretical freshwater aquifer thickness of 200 feet. CWRM uses a modified interpretation of the Ghyben-Herzberg relationship. According to the Hawai'i Well Construction and Pump Installation Standards (HWCPIS), "any well, constructed in basal aquifers for the purpose of non-potable or potable water withdrawal, shall be initially designed and pump tested at a depth below sea level not exceeding one-fourth of the theoretical thickness (41 times the head) of the basal ground-water body, unless authorized by the Chairperson" (HWCPIS 2004).

The head or water level at the WHHA Site is approximately 5 feet; so, in accordance with HWCPIS, the producing portion of the well should not extend more than 46 feet below sea level or 5– (41 x 5)/4. For preliminary design purposes, we recommend well completion at -46 feet msl. The HWCPIS has provision for the Chairperson to allow wells to extend up to one-half of the thickness of the basal groundwater body, or in the case of the WHHA Site, up to -92 feet msl. This well depth is not recommended at this time, but data collected during the exploratory well construction may, if necessary, provide supporting evidence for a deeper well.

3.2 Ability to Meet Daily Water Demands

The ability to meet the water needs of the WHHA community will depend on the community's water needs and the rate in which water can be pumped from the underlying aquifer.

Community Water Demands

The average daily water demands at the WHHA Site once developed are estimated to be 308,700 gallons per day (gpd). Applying a peaking factor of 1.5,[1] the estimated peak day demand necessary to service the WHHA Site is 322 gallons per minute (gpm) or 463,100 gallons per day (gpd). These demands were estimated based on Section 111 Water Requirements of the Hawai'i Water System Standards[2] and WHHA's conceptual plans shown in Figure 14. Note that the Water System Standards usage criteria are conservative and actual water use will be less. WHHA's conceptual plans include four zones for development (A, B, C-1, C-2) along with an area designated for renewable energy. Our understanding is that the specific areas that will be developed have not yet been determined. For purposes of this study, it was assumed that areas A and B will be developed while areas C-1, C-2 and the area for renewable energy may be developed at a different time.[3] Table 1 details the Hawai'i's water use standards along with the estimated water use per different types of development based on WHHA's plans provided in Figure 15.

[1] This is the peaking factor recommended by Hawaii's Water System Standards.
[2] These standards provide a unit water use for different types of developed which is reflected in Table 1.
[3] There have been discussions that the renewable energy site would consist of photovoltaic energy. Solar panels require some water for cleaning. Additionally, the surrounding area may need to be irrigated for maintenance purposes. This should be considered for future demand projections if photovoltaic energy is selected for development.

Table 1. Estimate of Water Demands for WHHA Site (Areas A and B)

Type of Development	Unit Requirements per Section 111 Hawai'i's Water System Standards (Water Use Per Unit)	No. of Homes	No. of Acres	Total Water Use (gals/day)
Single Family	600	241	n/a	144,600
Multi-family	560	211[a]	n/a	118,160
Commercial[b]	6000	n/a	4.7	28,200
Schools/parks	1700	n/a	3.1	5,270
Agriculture	5000	n/a	2.5	12,500
Total				**308,730**
Peak Day (Total x 1.5)				**463,095**

a) A range of multi-family units was provided. The largest amount number was used to the water demand estimate to be conservative.

b) Commercial includes the Keiki Care Center and Education Center/Business.

Well Yield and Pumping Capacity

The water system must accommodate the maximum day capacity as calculated in the previous section. The maximum day is 0.463 mgd (322 gpm) and the average day is 0.308 mgd (214 gpm). Assuming that the water system will be designed so that the well will supply the maximum day (as opposed to a storage tank or reservoir), then the pump should be sized to 350 gpm.

From a hydrogeologic perspective, one well will provide adequate capacity for the expected demand. One well is not ideal from a system reliability point of view because of the difficulty and associated delays in repairing deep pumps in the event a motor or pump failure. We recommend an emergency cross-connection with the Maui Department of Water Supply (MDWS) system. If an emergency cross-connection cannot be obtained, two wells may be required.

Table 2 shows information from selected relevant wells in the Kama'ole and Makawao Aquifer Systems. The most pertinent wells for comparing salinity are the mauka wells (Kula 1800, Pulehu Farms and Siele). These wells were test pumped at rates varying from 90 to 557 gpm and chloride rates were acceptable, varying from 40 to 90 mg/L, indicating that the equilibrium salinity level at the proposed Waiohuli Well will also be in this range. Note the non-pumping salinity level of the USGS Waiohuli Test Well was 66 mg/L.

Specific capacity is a convenient way of comparing the pumping capacity of wells and of extrapolating the pumping capacity of a new wells. It is calculated by dividing the pumping rate by the drawdown and is expressed in gallons per minute per foot. The higher the value, the more efficient the well and adjacent aquifer are in yielding water. The median specific capacity of the wells in Table 2 is 115 gpm per foot. The projected drawdown from the proposed well pumped at 350 gpm will be approximately 3 feet.

Table 2. Well Capacities and Screened Intervals

Well No.	Well Name	Pump Capacity (gpm)	Casing Diameter (in)	Total Depth (feet)	Water Level (feet msl)	Chloride (mg/L)	Test Pumping Rate (gpm)	Drawdown During Test Pumping (feet)	Specific Capacity (gpm/feet)
6-4125-001	Wailea 670 1	500	12	559	2.8	316	350	0.7	500
6-4125-002	Wailea 670 2	500	12	550	3.7	182	420	2	210
6-4225-001	Maui Meadows		16	802	1.39	208	100	4	25
6-4225-002	Wailea 670 No. 1		12	581	2.22	256	370	14.2	26
6-4225-003	Wailea 670 No. 2		12	604	3.15	232	500	0.3	1667
6-4422-001	Waiohuli		4	1940	5.58	66			
6-4424-001	Keokea Highlands 2	300	8	577	2.6	320	266	3	89
6-4425-001	Keokea Highlands	300	6	570	2.76	300	260	2.26	115
6-4524-002	Kaonoulu 1		14	589	3.66	262			
6-4621-001	Kula 1800 No. 1	320	16	1832	5.19	63	550	2.8	196
6-4621-002	Kula 1800 No. 2	85	16	1815	6.31	60	557	4	139
6-4719-001	Pulehu Farms	320	14	2180	5.61	40	320	2.8	114
6-4720-001	Siele	85	8	1645	5.01	90	90	2.55	35
								Mean	283
								Median	115

3.3 Local Groundwater Quality

The groundwater quality underlying the WHHA Site is an important factor in determining whether the WHHA Site can be serviced with new well(s) for drinking water purposes. A review of Hawai'i Department of Health's (DOH) Groundwater Contamination Viewer Maps for Hawai'i (State of Hawai'i 2022a) indicated that there are no known organic contaminants that have been detected sources of contamination near this site. [4] Local groundwater quality concerns primarily relate to the presence of nitrate and salinity (concentration of salts in the water). This section focuses on the presence of chloride (Cl^-) in the groundwater which is a proxy indicator of salinity and on local nitrate concentrations.

[4] Such organic contaminants may originate from herbicides, pesticides, industrial solvents, fuels, and other sources that are either applied, spilled, leaked, or disposed of in the ground.

Salinity – Chloride Concentrations

The proposed production well is anticipated to yield water within potable salinity levels. The secondary maximum contaminant level (MCL) for chloride in drinking water is 250 mg/L. Figure 16 shows the concentration of chlorides and date(s) of measurements for the USGS Waiohuli Test Well and nearby wells. Chlorides at the USGS Waiohuli Test Well were 66 mg/L in 2001. These results show that chloride concentrations at the UGS Waiohuli Test Well and in the Upcountry Maui region are well below the MCL limit of 250 mg/L. In addition, as shown in Figure 9, the conductivity, temperature and depth (CTD) log of the test well conducted by CWRM in 2018 does not show vertical increases in salinity.

Concentrations in wells at lower elevations are higher with some exceeding the MCL. This is to be expected given that the freshwater lens above the brackish water is thinner near the coastline. The low levels of chloride concentrations at the USGS Waiohuli Test Well and at similar elevations nearby indicate that the groundwater is within drinking water chloride standards and therefore, salinity is not of near-term concern. Despite this, chloride concentrations in the proposed production well should be monitored monthly for upward trends.

Nitrate Concentrations

Nitrate (expressed as nitrogen) concentrations in Upcountry Maui range from naturally occurring background concentrations of 0.5 mg/L to elevated concentrations approaching the 10 mg/L drinking water MCL. [5] These elevated nitrate levels are attributed to the leaching of fertilizers, leaching of livestock and other animal waste products, and contamination of groundwater by wastewater. Average nitrate concentrations observed in a study completed by the Hawai‘i DOH in 2018, indicated that there are exceptionally high concentrations of nitrate in the northern portion of Upcountry Maui. These elevated concentrations are primarily attributed to agriculture and golf courses. In contrast, the nitrate concentration observed at the USGS Waiohuli Test Well is much lower, with an observed concentration of 2.5 mg/L taken August of 2017. While this concentration exceeds the 0.5 mg/L background level, it is well below the MCL and therefore this measurement suggests that the underlying groundwater is suitable for drinking water purposes. However, as shown in Figure 17, the USGS Waiohuli Test Well is just down gradient of a rural housing development that relies on onsite sewage disposal systems (OSDS). OSDS leach nitrogen into the groundwater and may have caused nitrate levels to exceed background levels at the USGS Waiohuli Test Well. Given these data, it is recommended that nitrate levels are routinely monitored to inform drinking water safety.

3.4 Future Considerations and Risks

Sections 3.1 – 3.3. demonstrate that the aquifer underlying the WHHA Site provides a sufficient yield at an acceptable water quality level for potable purposes under current conditions. This section focuses on the long-term reliability of the aquifer under future development and climate change. The following sections address a series of risks that should be considered prior to the development of new wells at the WHHA Site.

[5] Drinking water that contains elevated levels of nitrate can interfere with oxygen transport of the bloodstream of young children leading to methemoglobinemia (blue baby syndrome) which results in a blue color to the skin.

3.4.1 Future Land Development and Water Availability

The sustainable yield of the Kama‘ole Aquifer System is 11 mgd and the pumpage as of November 2018 was 3 mgd, therefore there is adequate sustainable capacity for an additional well. Currently, there are no permitted wells within 2.5 miles of the WHHA Site with exception to the Waiohuli Test Well. Additional land development that relies on groundwater pumping, could impact groundwater levels in the aquifer and contribute to groundwater level declines underlying the WHHA Site. As discussed in Section 3.1, groundwater level observations at the USGS Waiohuli Test Well may be indicative of a historical downward trend in water levels. Given this potential historical trend, coupled with the possibility of future wells within the immediate area of the WHHA Site, it is recommended that groundwater levels at the USGS Waiohuli Test Well be routinely monitored to further characterize any trends. Furthermore, it is encouraged that WHHA work with local developers and planners in the area to minimize potential impacts of future local groundwater development.

3.4.2 Future Land Development and Water Quality

New development upgradient and close to the WHHA Site that relies on OSDS could also impact groundwater quality. According to a 2018 Hawai‘i DOH study on nitrate contamination in the Upcountry Maui region, there is a strong relationship between OSDS and nitrate concentrations. This study entailed the development of a groundwater flow transport model to study the relationship of nitrogen loading sources and groundwater concentrations in the region. The model simulated nitrate concentrations within the range of 15.1 mg/L to 27.0 mg/L at the USGS Waiohuli Test Well site based on surrounding land use. While this is significantly higher than the observed nitrate concentration of 2.5 mg/L (sample taken in 2017), the modeling results emphasize the sensitivity that nitrate levels can have in response to land use and OSDS. New development with OSDS within close proximity to the WHHA Site could contribute to an increase in nitrate levels in the groundwater.

Additionally, new groundwater wells and pumping in the local area could result in saltwater intrusion. Saltwater intrusion occurs when brackish saltwater, below the lens of freshwater, migrates upward. Excessive groundwater pumpage will cause saltwater intrusion. Monthly chloride monitoring is recommended. The CWRM groundwater level and CTD monitoring is invaluable in monitoring the aquifer in the vicinity of the proposed well. As mentioned in Section 3.4.1, WHHA should work with local developers and planners in the area to minimize potential impacts of future local groundwater development.

It is recommended that water quality samples are taken at the USGS Waiohuli Test Well to better characterize nitrate levels prior to the onset of the development of the WHHA Site and that monitoring is conducted on a routine basis post development to assess any significant changes in water quality and to inform drinking water safety.

3.4.3 Projected Land Development Patterns

The development of lands upgradient and surrounding the proposed development community was assessed to better characterize how future development may play a role in future aquifer yields, quality and long-term sustainability of the underlying aquifer.

The WHHA Site is within a region that is highly valued for its agricultural lands and rural atmosphere. It is surrounded by agricultural lands designated by the Hawai'i State Department of Agriculture as Agricultural Land of Importance. These lands are referred to in Maui County's 2030 County Wide Policy Plan as an important resource. Designated rural growth boundaries within the local region are intended to limit growth to low-density residential area and clustered rural villages that support rural open spaces and agricultural activities and protect rural character.[6] Additionally, as shown in Figure 18, the Conservation District is upgradient of the WHHA Site where development will be controlled.

The Makawao-Pukalani-Kula Community Plan sets forth policy and the following objectives that emphasizes the importance of water to its economic base, supports the rural character of the region, supports agriculture, and discourages higher density urban growth and large-scale tourism (Maui County Council, 1996).

- Provide for the preservation and enhancement of agricultural lands and operations, emphasizing the importance of promoting diversified agriculture to the region's economic base and lifestyle.
- Support programs and plans to develop adequate water systems for agricultural use.
- Protect existing agricultural operations from urban encroachment
- Support bona fide "family subdivisions" that employ rural planned unit or cluster concepts and thereby encourage existing farms to remain in production.
- Recognize the rural, open space character of the Upcountry region as an economic asset of the island.
- Preserve agriculture by actively promoting locally grown agricultural products.
- Discourage large scale visitor industry facilities which result in high concentrations of visitors in the Makawao-Pukalani-Kula region (e.g., Maui Tropical Plantation).
- Support existing and new service and retail industry endeavors such as medical, law, accounting and architectural/engineering offices which will diversify the region's economic base without compromising its rural and agricultural integrity, and which will preserve the traditional scale and style of businesses in the Upcountry area.
- Encourage the continuation of sugar, pineapple, cattle ranching, and diversified agriculture as major agricultural activities in the region and at the same time encourage the pursuit of alternative agricultural industries.
- Promote agricultural practices that encourage energy efficient and environmentally sound measures such as catchment systems, and use of grey water, organic pesticides, organic fertilizers and biomass energy.

Assuming these policy objectives are indicative of future development patterns, future regional development will likely not have large regional implications on the underlying groundwater system. Nevertheless, it is recommended that the WHHA work with the appropriate planners and developers in the region to ensure that the policies and objectives outlined above are adhered to. It is also recommended that the WHHA closely follow proposed development within the immediate area of the WHHA Site and take appropriate actions necessary to minimize any potential impacts to the quantity and quality of groundwater within the local vicinity of the WHHA Site.

[6] Maui County's *Makawao-Pukalani-Kula Community Plan* lays out rural growth boundaries just north of the WHHA site at the intersection of State Road 37 and State Road 377. Any growth boundaries south of this intersection are not provided.

3.4.4 Climate Change

The increase in mean annual temperature for Hawai'i has quadrupled in the last 40 years to over 0.3 degrees F per decade. Annual rainfall has also decreased on more than 90 percent of the main Hawaiian Islands (University of Hawai'i at Manoa Sea Grant College Program, 2014). A 2016 study by the University of Hawai'i at Manoa projects that the climate will warm by 3.6 to 7.2 degrees F by the late twenty-first century for the Hawaiian Islands with the greatest warming at higher elevations. There is also a projected modest tendency for more warming on the leeward sides of the major islands relative to the windward. The wet windward sides are projected to experience an increase in average annual rainfall while the drier leeward sides are to become drier. Extreme rainfall events are projected to significantly increase (Brewington, 2016).

Warming temperatures can increase evaporation and transpiration water demand, which in turn can decrease groundwater recharge and storage. A 2019 study conducted by the East-West Center and USGS Pacific Islands Water Science Center explored potential changes in annual mean groundwater recharge on the island of Maui by the end of this century under four future land use cover scenarios. The four futures: 1) conservation-focused, 2) status-quo, 3) development-focused, and 4) balanced conservation and development, characterize a broad range of potential land use possibilities by the end of the century. Each of these land use futures were modeled with a wet and dry climate change scenario.[7] The results for all four futures under the wet and dry climate scenarios indicate that future changes to groundwater recharge at the proposed development site is minimal. However, the modeling results indicate a potential increase in recharge in portions of the currently forested region upgradient of the site by 4 to 6 inches a year. This could improve the local groundwater storage conditions (Brewington, 2016).

From a water demand perspective, as average temperatures increase within a greater number of warmer days, the evapotranspiration from residential landscaping can increase, requiring more water for maintenance purposes. Proactive planning where lower water use landscaping is incorporated into the designs for new development can help mitigate this impact. Native and less water intensive landscaping is accustomed to dry conditions and will require less water for maintenance purposes as the climate continues to warm.

[7] These climate change projections are based on downscaled modeling projections from applicable Global Climate Change models. The dry projection utilized a coupled model intercomparison project (CMIP) phase 5 (CMIP5) representative of the concentration pathway (RCP) of 8.5 and the wet scenario utilized a CMIP3 A1B "wet climate" projection.

4.0 COST ESTIMATE AND FUNDING

4.1 Preliminary Design and Cost Estimate

The approximate elevation of the site is 1,870 feet while the average groundwater level is 5 feet above sea level. To comply with CWRM rules, the new well(s) should penetrate less than a quarter of the theoretical thickness of the freshwater lens. This equates to 46 feet below sea level. Therefore, the well should be 1,916 feet deep, with 1,864 feet of blank (solid) casing and 52 feet of louvered casing. Fourteen-inch casing is recommended to accommodate the required pump. Tables 3 and 4 show the ROM costs for developing the water system to supply the project. The water well is very deep so the pump and well are expensive items. The water system cost is a high-level approximation non-itemized cost of transmission, distribution and storage lines. This cost may vary extensively based on the subdivision layout. Costs for one and two wells are presented.

Table 3. ROM Costing – One Well Option

ROM Costing (One Well Option)	
Water Well (1 well)	$2,400,000
Well pump, controller, electrical	$1,300,000
Water System	$3,700,000
TOTAL	$7,400,000

Table 4. ROM Costing – Two Well Option

ROM Costing (Two Well Option)	
Water Well (2 wells)	$4,670,000
Well pump, controller, electrical	$2,400,000
Water System	$3,700,000
TOTAL	$10,770,000

4.2 Source of Funding

Table 5 shows possible funding sources.

Table 5. Funding Sources

Entity	Description
U.S. Environmental Protection Agency, Public Water System Supervision (PWSS) Grant Program	Assists states, territories, and tribes to develop and implement PWSS programs to enforce the requirements of the Safe Drinking Water Act.
U.S. Department of Agriculture, Rural Development, Water and Environmental Programs	Provide loans, grants, and loan guarantees for drinking water, sanitary sewer, and storm drainage facilities in rural areas, cities, and towns with populations of 10,000 or less. Public bodies, non-profit organizations, and recognized Indian tribes may qualify for assistance.
U.S. Department of Housing and Urban Development, Community Development Block Grants	Provide funds for long-term community needs, including rehabilitation, construction, or purchase of public facilities and infrastructure for water treatment and centralized and decentralized wastewater systems.
Office of Hawaiian Affairs Grants Program	The purpose of the Office of Hawaiian Affairs Grants Program is to support Hawai'i based nonprofit organizations that have projects, programs, and initiatives to serve our Lāhui in alignment with OHA's Strategic Foundations, Directions & Outcomes
Hawai'i Department of Health, Safe Drinking Water Branch, Drinking Water State Revolving Fund	Funds infrastructure improvements in drinking water systems. The DWSRF emphasizes funding to small and economically disadvantaged communities and other programs that encourage preventing pollution to drinking water.
Venture Capital. Upwell Water LLC (https://www.water.llc/)	Upwell Water provides capital for sustainable water development.
CoBank (https://www.cobank.com/corporate/industry/water)	CoBank works with rural water and wastewater not-for-profit systems, municipalities, and investor-owned utility companies to provide interim and bridge financing, refinance of existing debt, term loans for system upgrades, and lines of credit.
National Rural Water Association	The Rural Water Loan Fund (RWLF) is a funding program specifically designed to meet the needs of small water and wastewater utilities. The RWLF provides low-cost loans for short-term repair costs, small capital projects, or pre-development costs associated with larger projects.
Small Business Administration (SBA) 504 Fixed Asset Program 7(a) Loan Guarantee	The 504 Loan Program provides approved small businesses with long-term, fixed-rate financing used to acquire fixed assets for expansion or modernization. The 7(a) program is a flexible tool that can be used to finance a variety of business purposes.

4.4 Permitting

Tables 6 and 7 show the permits that may be required for the project.

Table 6. Permits for Well Construction

Agency	Name/Description	Notes
CWRM	Well Construction/Pump Installation Permit	Well permit
State Historic Preservation Division (SHPD)	Hawai'i Revised Statute, Chapter 6E, Section 106	This process is required for the Well Construction Permit
County of Maui Department. of Public Works (DPW)	Grading Permit	May be necessary if significant site work is required before drilling
Dept. of Health (DOH)	National Pollutant Discharge Elimination System (NPDES) Permit. Appendix C (construction stormwater) and Appendix I (wastewater from well drilling activities).	Appendix C will be triggered if the site is over 1 acre. Appendix I will be required for test pumping and drilling fluid disposal.
DOH	Community Noise Permit	May be necessary for construction noise.
DOH, Environmental Review Program	Chapter 343 Compliance	Compliance is required for the well construction permit. A publicly funded project on DHHL lands will likely trigger an Environmental Assessment.

Table 7. Permits and Approvals for Pump Installation and Water System Development

Agency	Name/Description	Notes
CWRM	Well Construction/Pump Installation Permit.	Pump installation permit (if this was not done concurrent with the well construction permit.
SHPD	Hawai'i Revised Statute, Chapter 6E, Section 106	
DPW	Grading Permit	
DOH	National Pollutant Discharge Elimination System (NPDES) Permit. Appendix C (construction stormwater)	Appendix C will be triggered if the site is over 1 acre.
DOH	Community Noise Permit	May be necessary.
DOH, Environmental Review Program	Chapter 343 Compliance	The Environmental Assessment (EA) for the exploratory well may cover the entire project.
Public Utilities Commission	Approval for a public water utility	
Department of Health, Safe Drinking Water Branch	Public water system approval. Approval of Engineering Report.	

5.0 CONCLUSIONS AND RECOMMENDATIONS

The major findings and recommendations of this feasibility study are provided in the bulleted items below.

- Groundwater levels – Groundwater levels are currently within an acceptable level for the development of well(s) to supply water for the WHHA Site based on recent groundwater levels observed in the USGS Waiohuli Test Well and on historical groundwater levels observed within the interior of Upcountry Maui. That said, there is a potential for groundwater level declines in the future. Groundwater levels should be routinely monitored to characterize any declining trends.
- Aquifer yield and daily water demands – There is adequate water supply to meet the max day water demand of 0.463 mgd (322 gpm) and the average day is 0.308 mgd (214 gpm). From a hydrogeologic perspective, one well will provide adequate capacity for the expected demand. One well is not ideal from a system reliability point of view because of the difficulty and associated delays in repairing deep pumps in the event a motor or pump failure. We recommend an emergency cross-connection with the MDWS system. If an emergency cross-connection cannot be obtained, two wells may be required.
- Groundwater quality – Relatively recent water quality measurements suggest that groundwater is currently of adequate quality for drinking water purposes following disinfection. That said, water quality samples should be taken at the USGS Waiohuli Test Well to better characterize nitrate levels prior to the onset of the development of the WHHA Site given the presence of OSDS nearby. Standard monitoring should also occur on a routine basis post development to assess any significant changes in water quality and to inform drinking water safety.
- Cost feasibility – The estimated cost for one well is $2.4 million. The estimated total cost of the water system is $7.4 million.
- New development – New wells in the local area could impact groundwater levels, yields and quality underlying the WHHA site. While local policy and land use planning is supportive of preserving agriculture and open space with less intensive development, the WHHA should work with local developers and planners to minimize impacts
- In addition to these factors, a reliable energy source will be needed for pumping. While an energy assessment is outside the scope of this feasibility study, it is recommended that a back-up source of power is available if there is a disruption of the primary energy source, to minimize potable water service interruptions.

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FIGURES

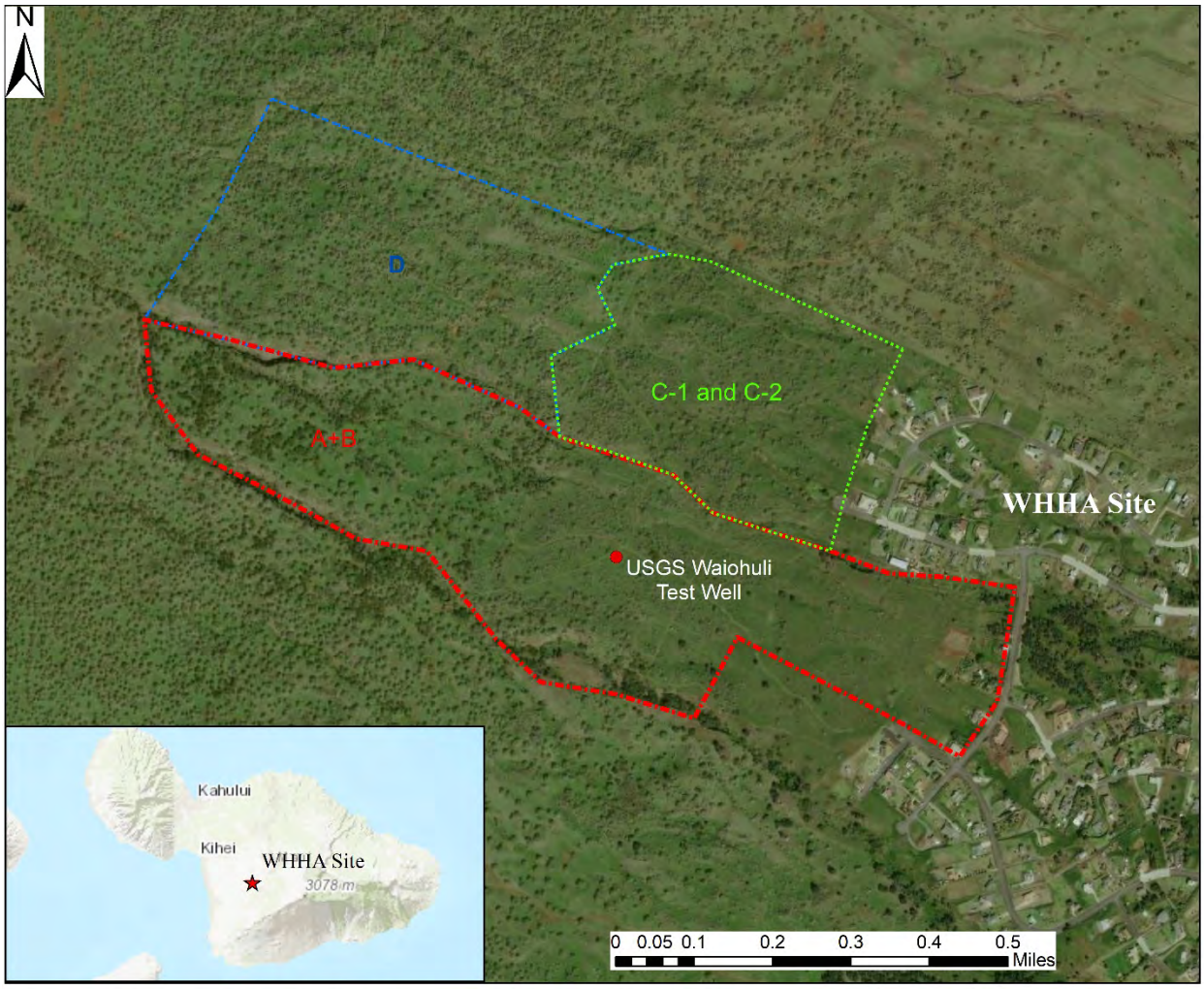

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Figure 1. Location of the WHHA Site

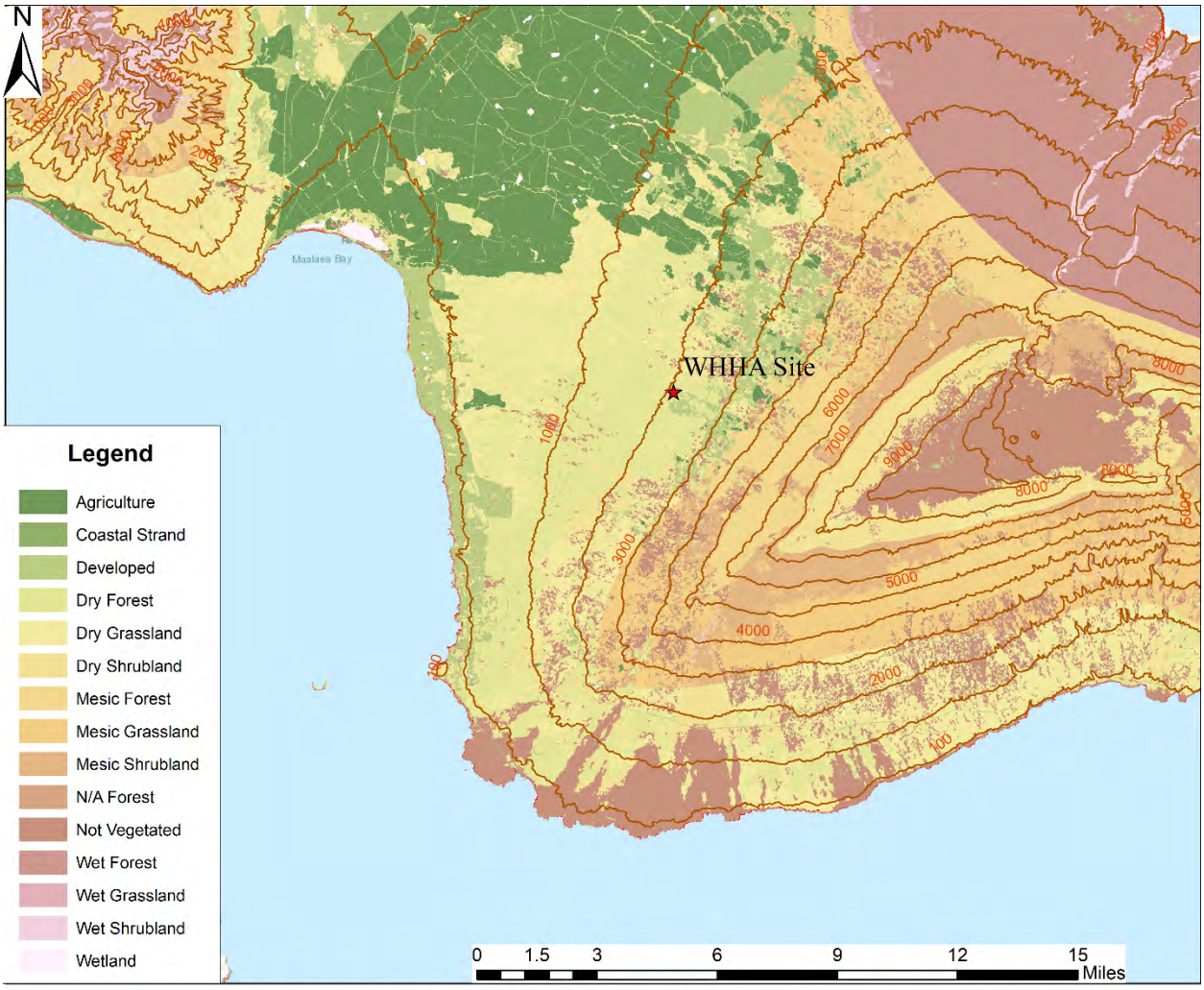

Figure 2. Predominant Regional Land Use (State of Hawai‘i 2022)

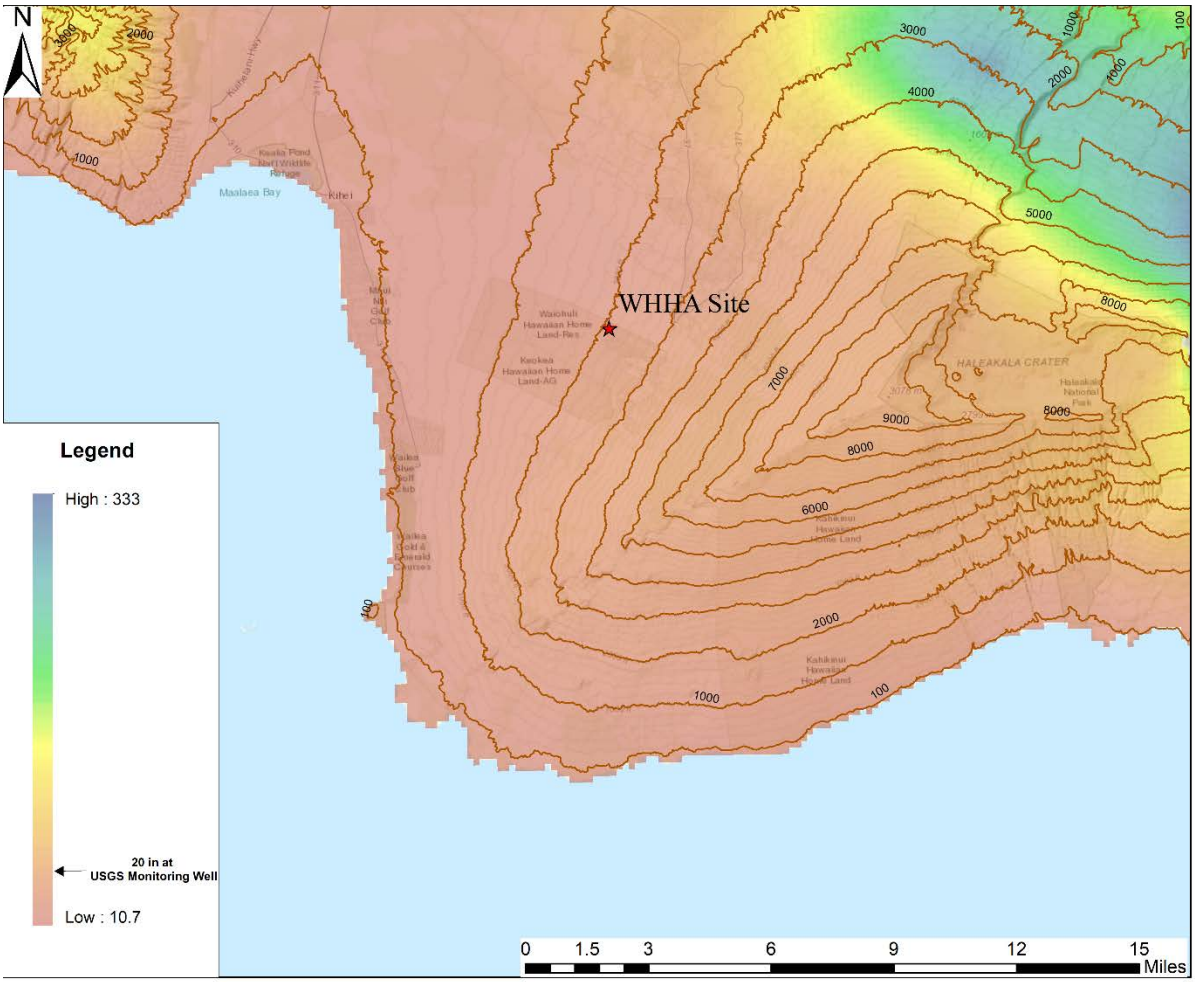

Figure 3. Average Annual Precipitation on Maui in inches per year (Frazier et al 2016).

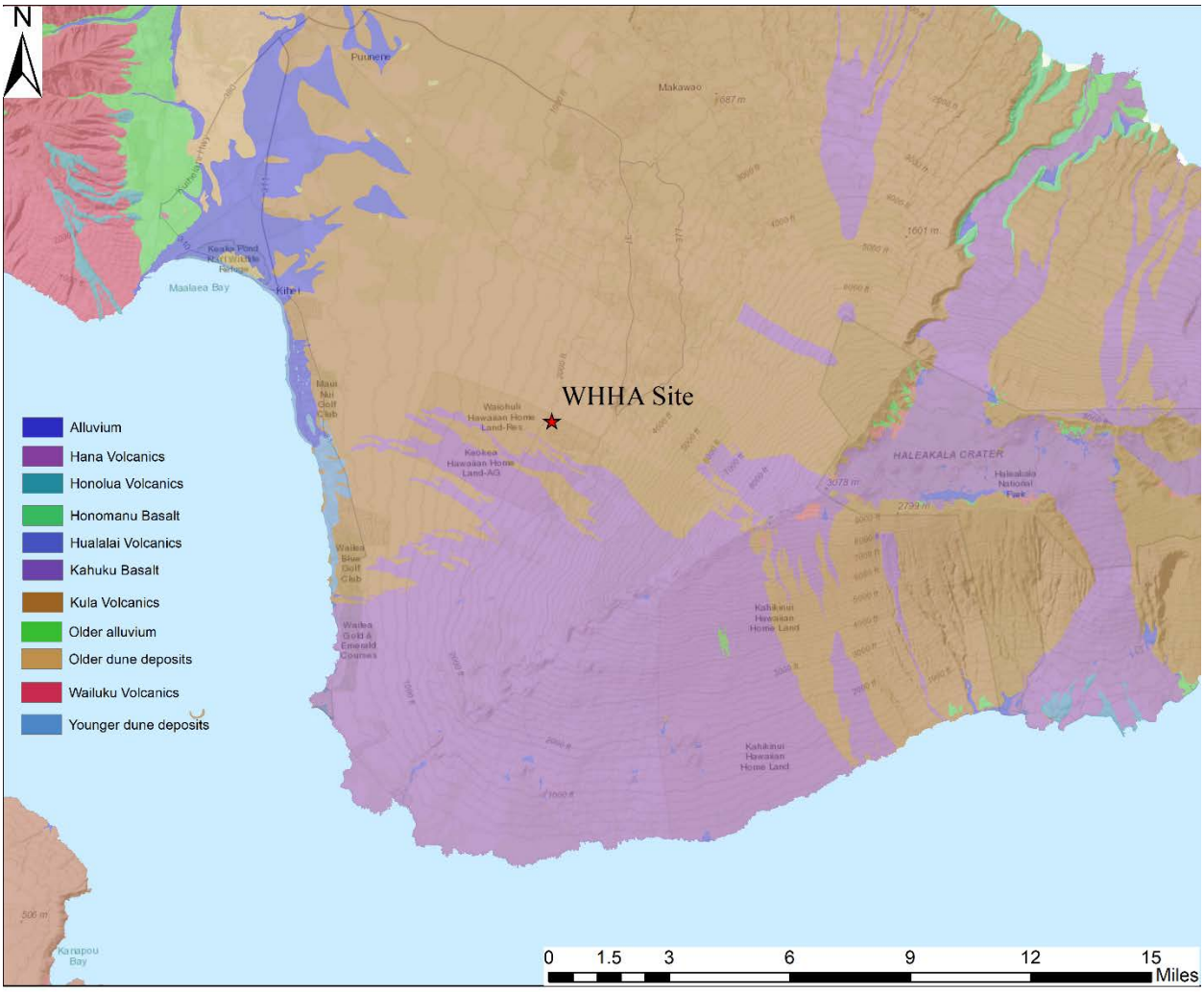

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Figure 4. Regional Geologic Formations (Sherrod and others, 2005)

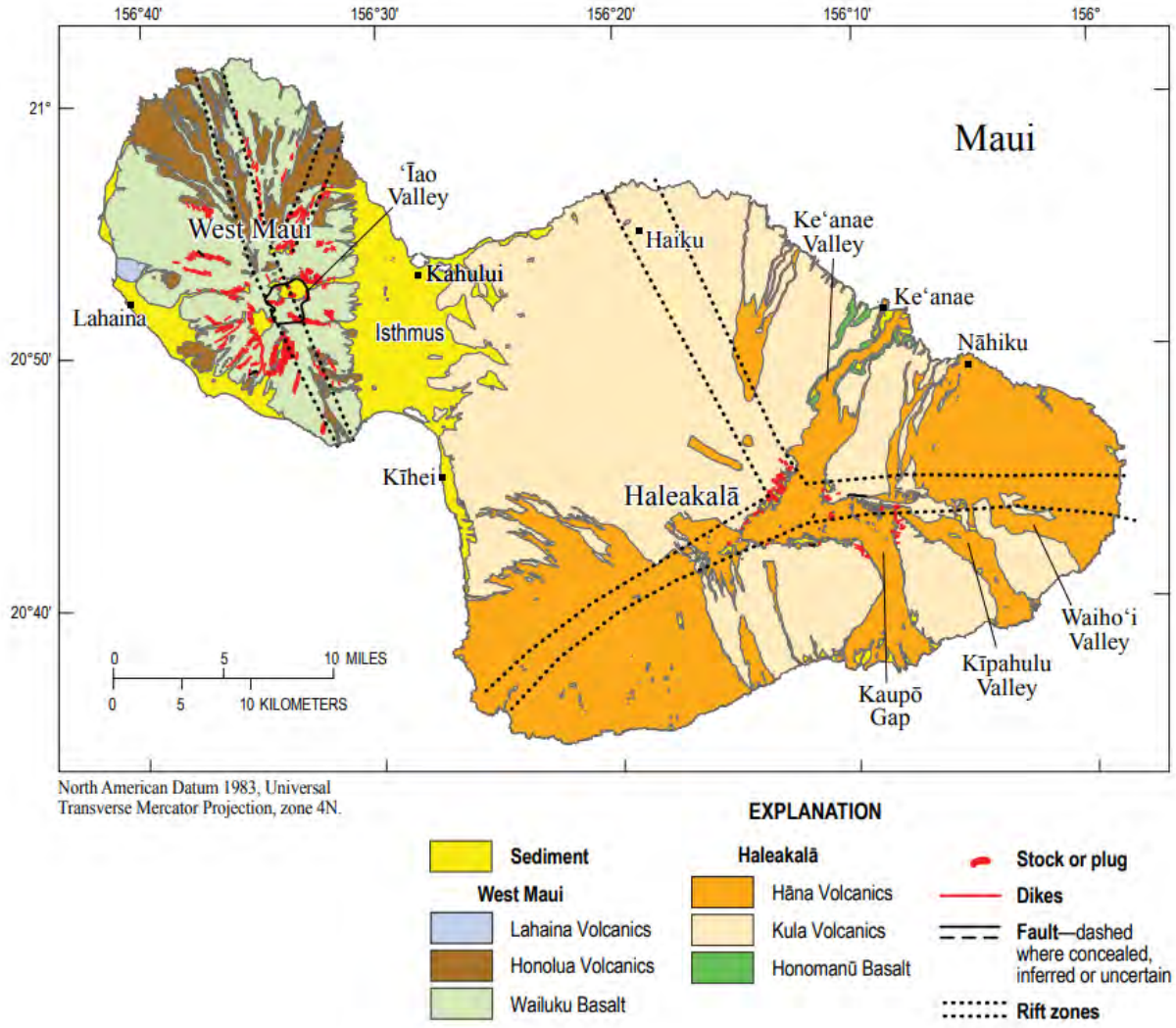

Figure 5. Hydrogeologic Framework of the Islands. From Izuka and others (2018)

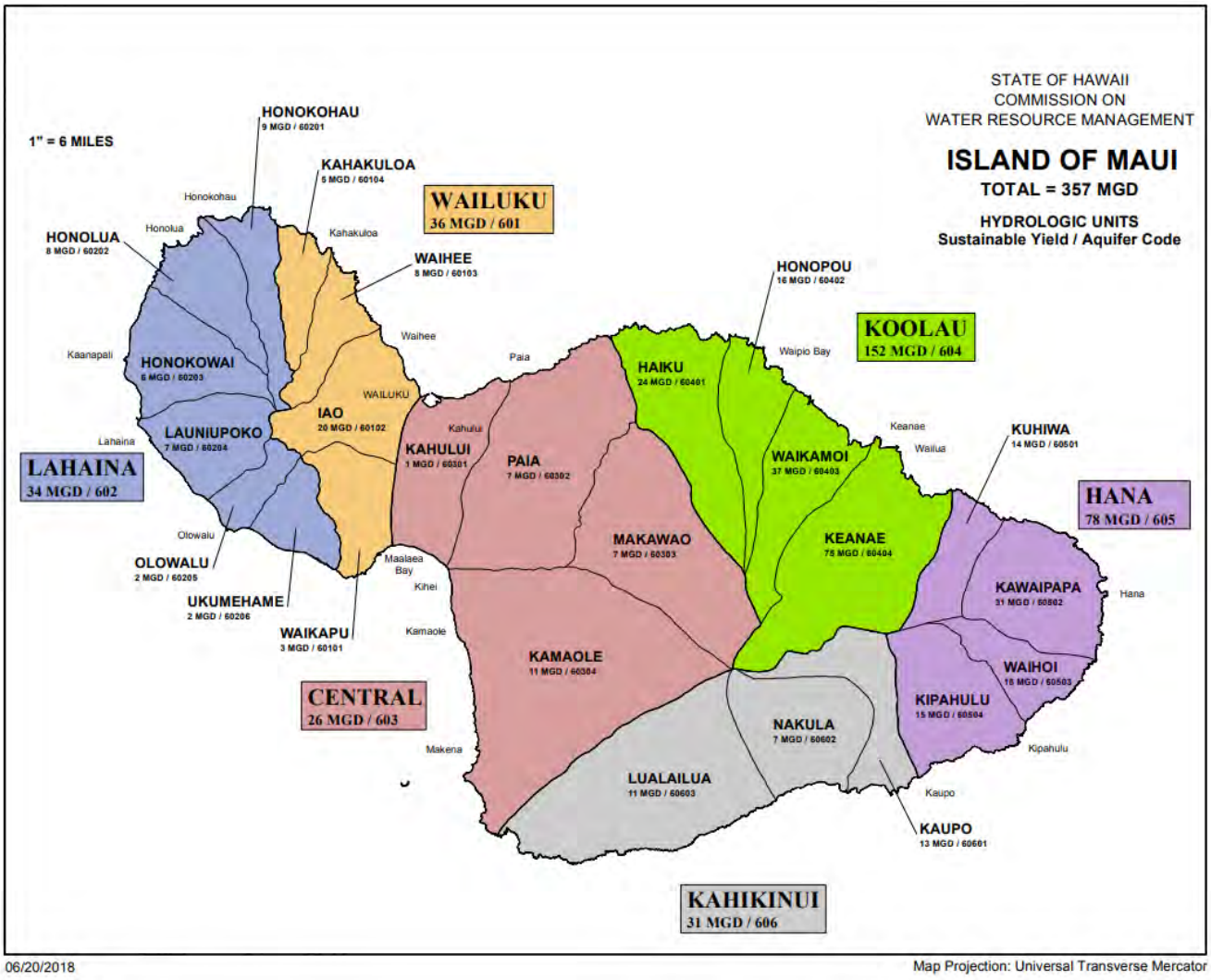

Figure 6. Regional Aquifers on Maui (CWRM, 2022a)

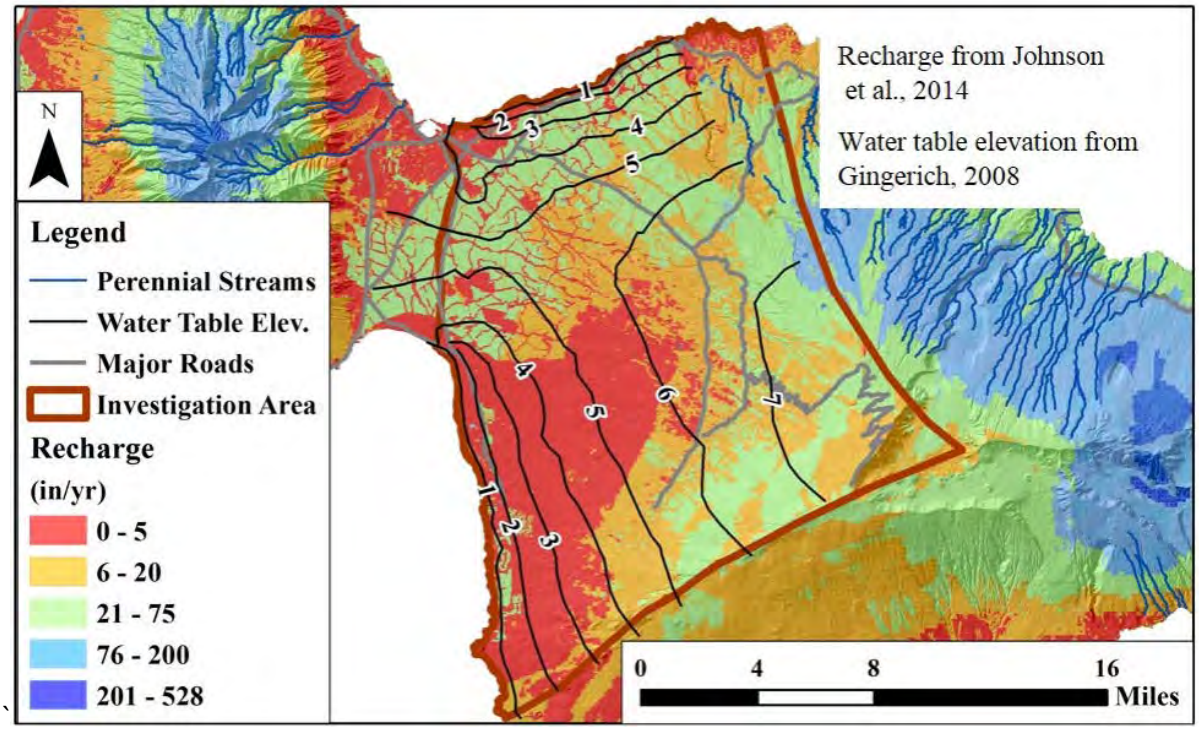

Figure 7. Groundwater Recharge Rates and the Groundwater Surface Elevation for East-Central Maui (Brewington, Laura et al., 2019)

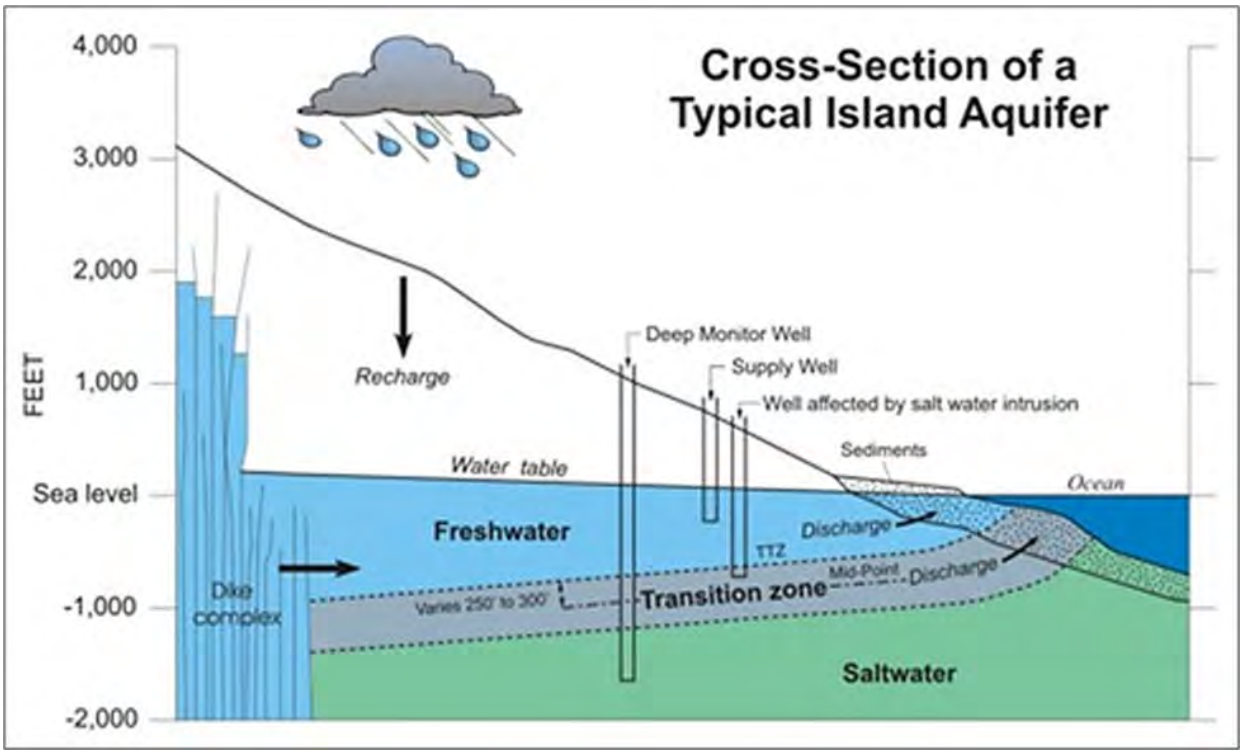

Figure 8. Conceptual Diagram of a Basal Aquifer CWRM (2021)

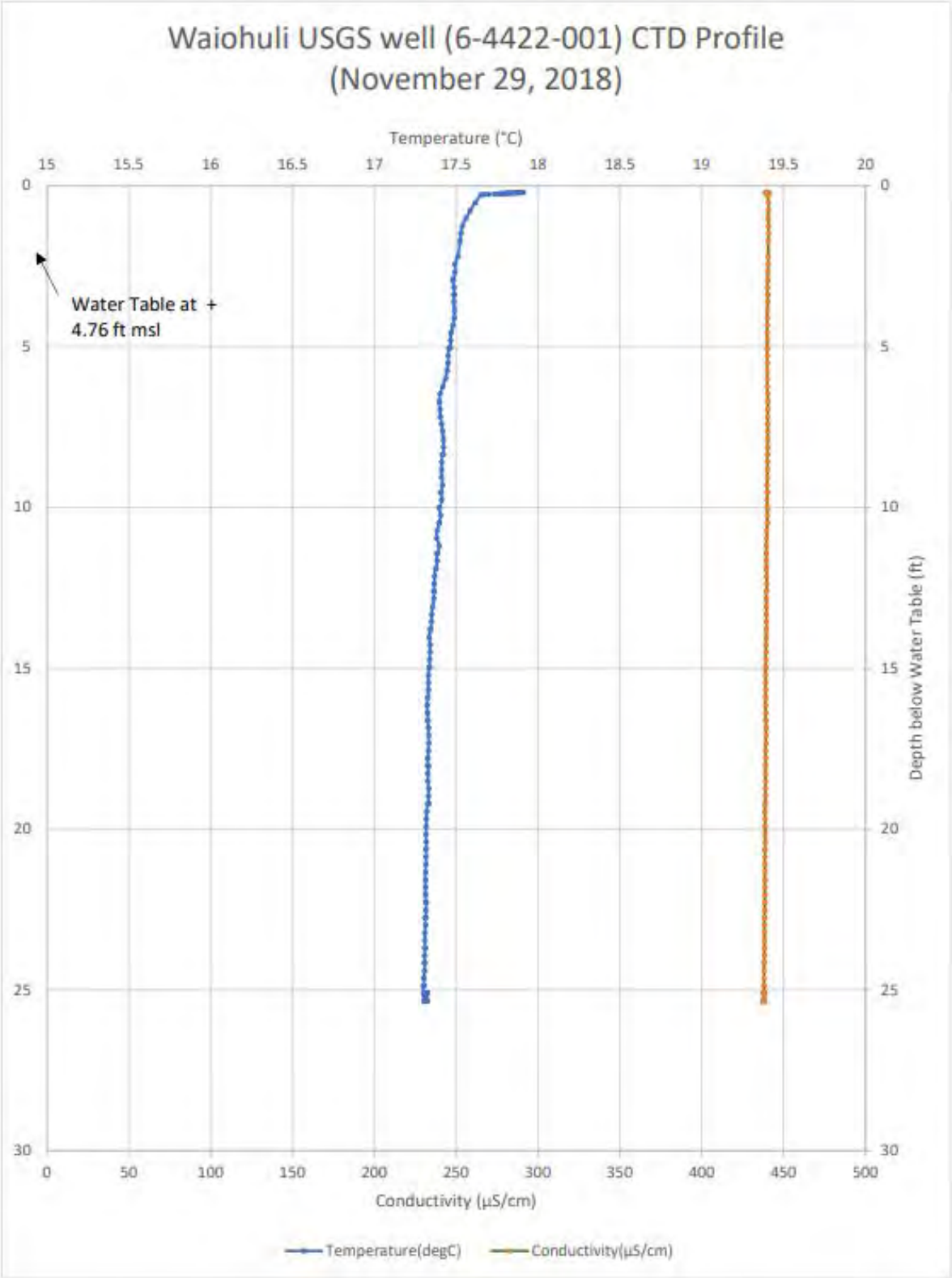

Figure 9. USGS Waiohuli Test Well CTD Profile CWRM (2022)

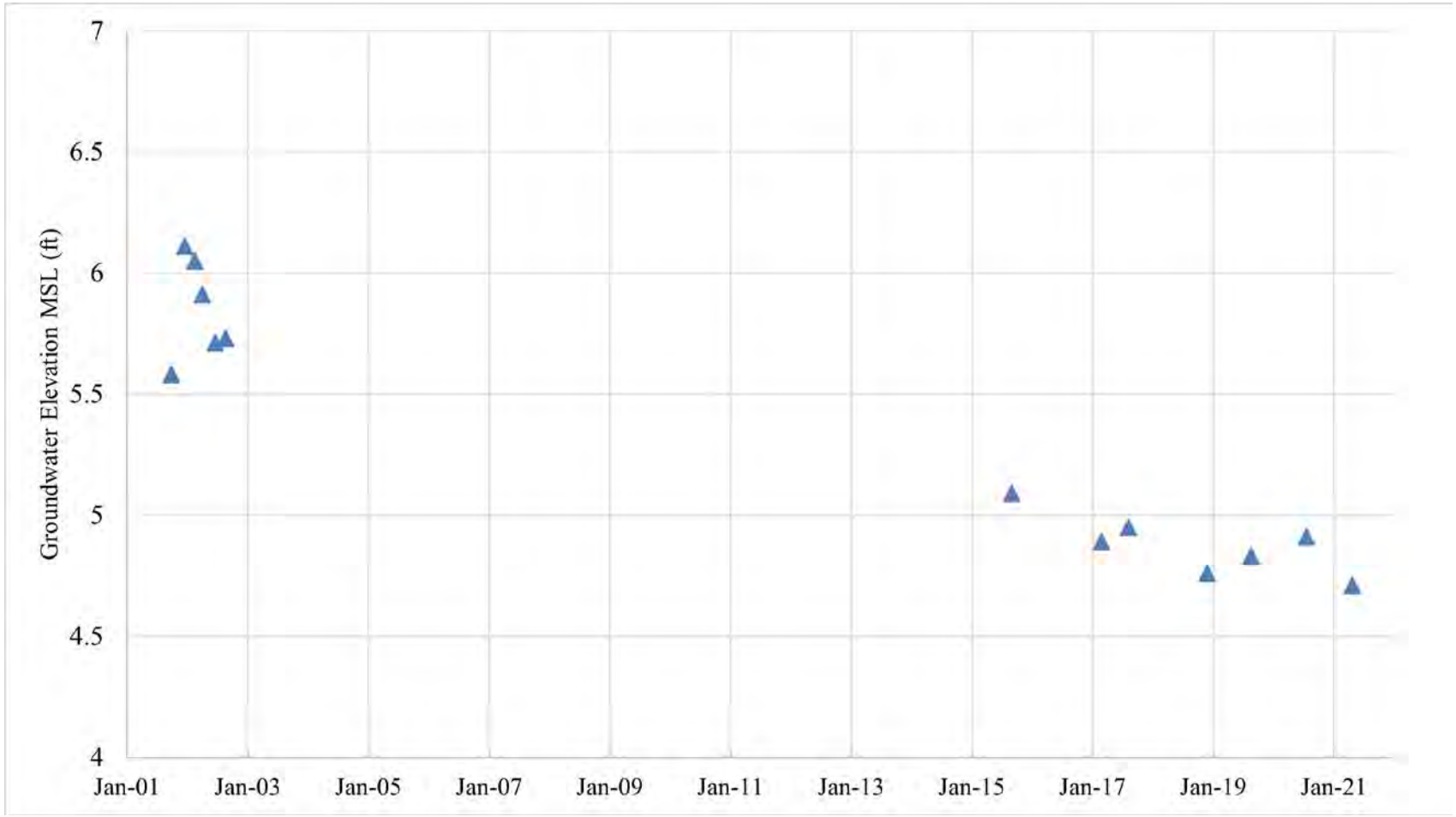

Figure 10. Comparison of Observed Groundwater level in the USGS Waiohuli Test Well (CWRM 2022)

Figure 11. Daily Timeseries of Water Levels in the USGS Waiohuli Test Well (CWRM 2022)

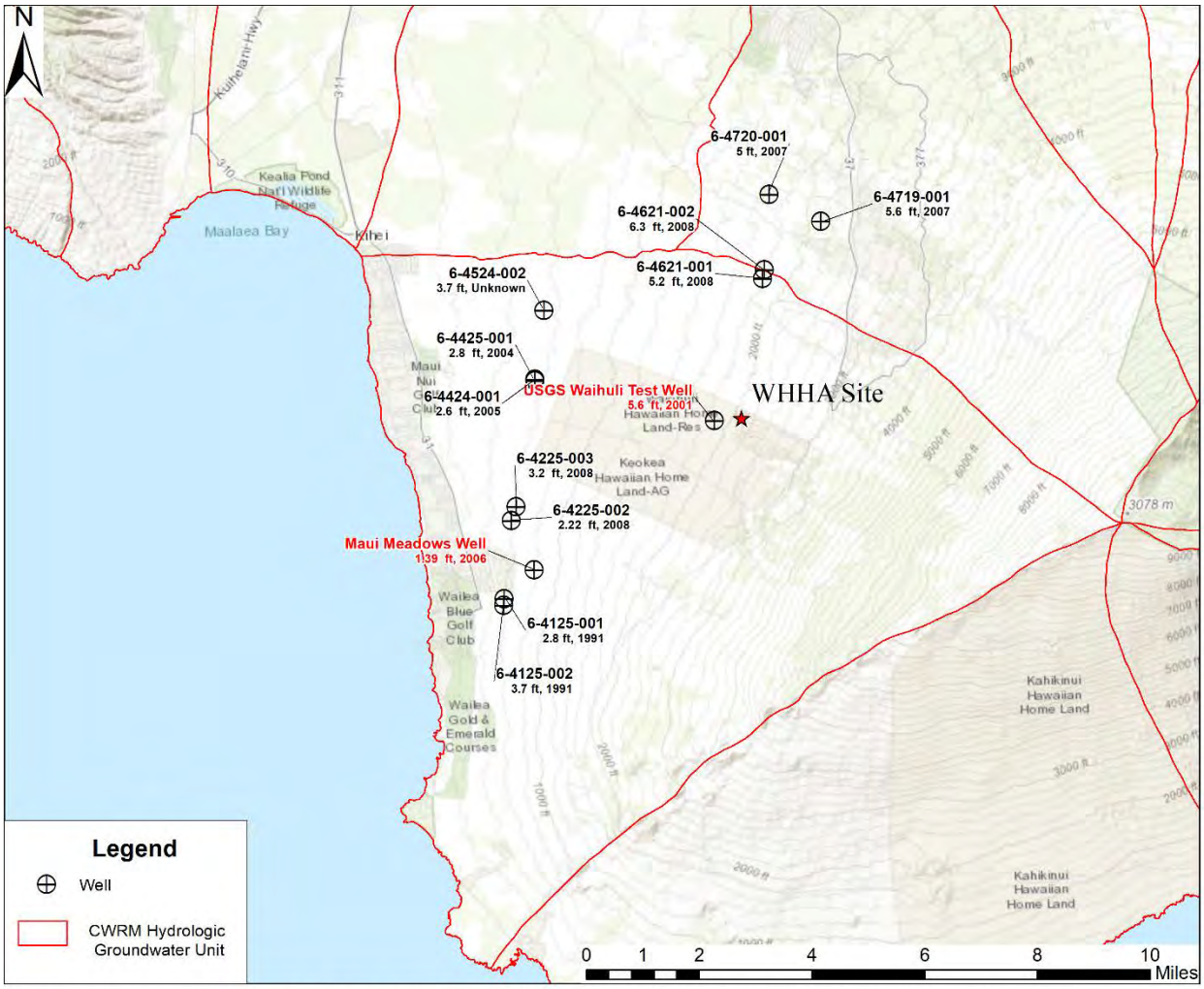

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Figure 12. Local Groundwater Levels of USGS Waiohuli Test Well and Nearby Wells (feet above msl) (CWRM 2021)

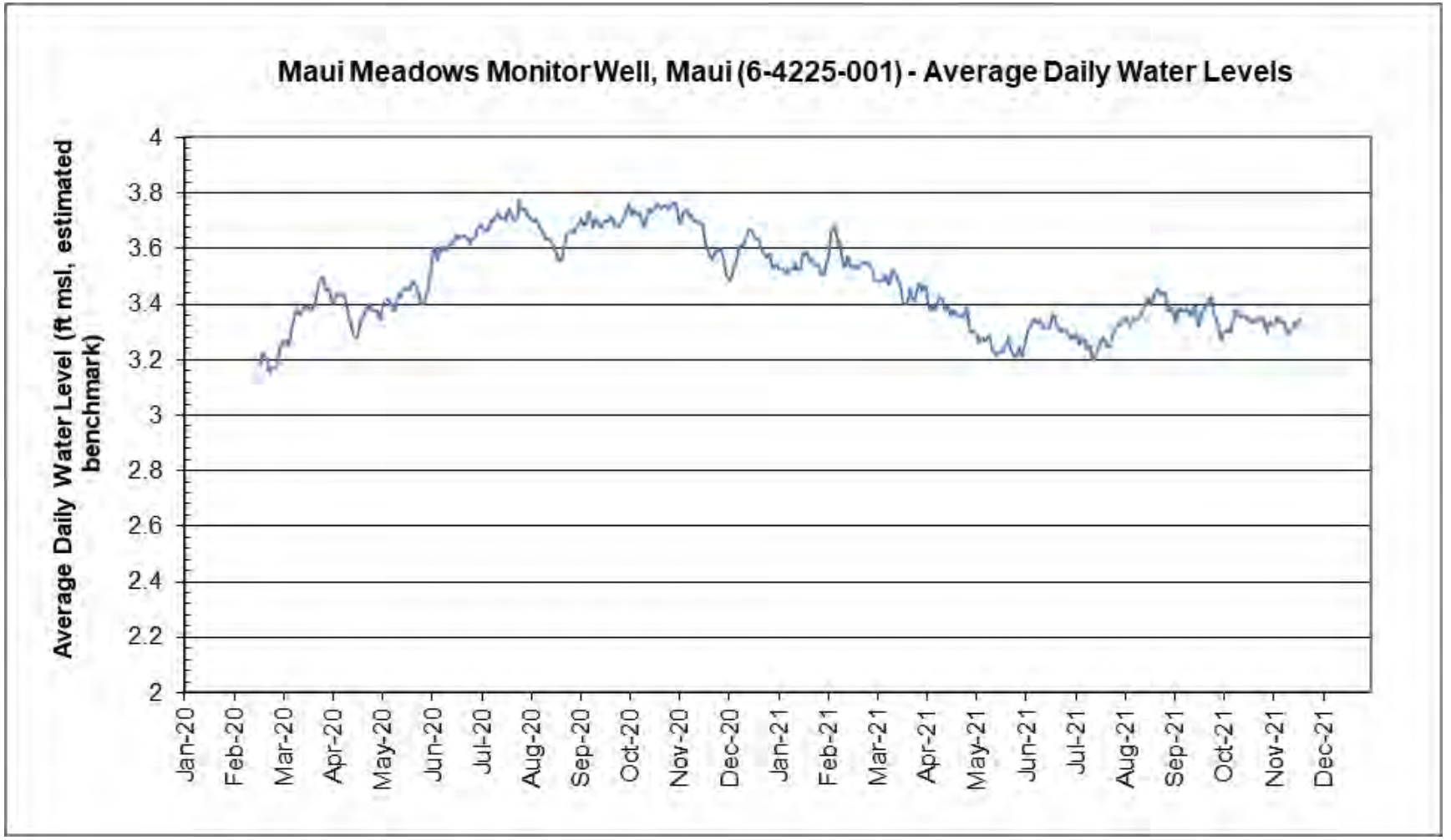

Figure 13. Timeseries of Groundwater Levels in the Maui Meadows Well (CWRM 2022)

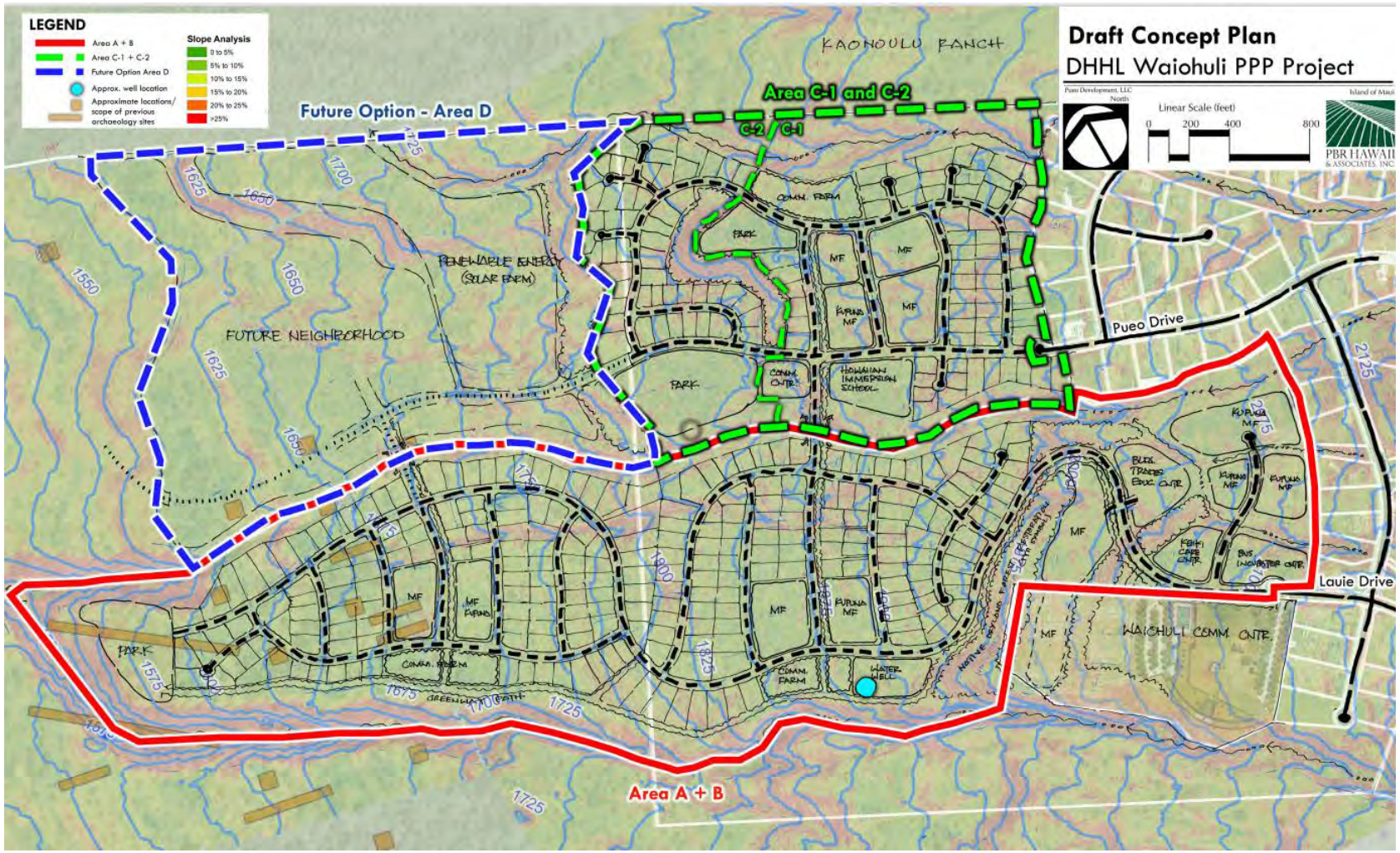

Figure 14. Conceptual Schematic of the Future Development of the WHHA Site (PBR Hawai‘i 2022)

DHHL Waiohuli PPP Project Site Area Calculations

DRAFT 11/18/2021

PROJECT AREA CALCULATIONS

Areas A+B	Acres	Units	Notes
Single Family Homesteads (SF)			
10,000 SF lots	29.1	127	
15,000 SF lots	26.3	114	
Multifamily (MF)	5.7	57-91 units	10-16 units/acre
Kūpuna MF	7.5	75-120 units	10-16 units/acre
Hawaiian Immersion School	0.0		
Keiki Care Center	1.2		
Community Farming	2.5		
Community Center	0.0		
Park	3.1		
Ed. Center / Business Incub.	3.5		
Water Well	1.3		
Renewable Energy	0.0		
Roads / Open Space / Gulches	67.2		
Total	147.4	373-452	Initial Pueo Area

Proposed Project Area Areas A+B+C-1	Acres	Units	Notes
Single Family Homesteads (SF)			
10,000 SF lots	32.6	142	
15,000 SF lots	36.1	157	
Multifamily (MF)	10.0	100-160 units	10-16 units/acre
Kūpuna MF	8.7	87-140 units	10-16 units/acre
Hawaiian Immersion School	1.9		
Keiki Care Center	1.2		
Community Farming	4.3		
Community Center	0.8		
Park	4.5		
Ed. Center / Business Incub.	3.5		
Water Well	1.3		
Renewable Energy	0.0		
Roads / Open Space / Gulches	86.1		
Total	191.2	486-599	Ideal Site

Alternative Areas A+B+C-1+C-2	Acres	Units	Notes
Single Family Homesteads (SF)			
10,000 SF lots	36.7	160	
15,000 SF lots	42.8	186	
Multifamily (MF)	10.0	100-160 units	10-16 units/acre
Kūpuna MF	8.7	87-140 units	10-16 units/acre
Hawaiian Immersion School	1.9		
Keiki Care Center	1.2		
Community Farming	4.3		
Community Center	0.8		
Park	8.9		
Ed. Center / Business Incub.	3.5		
Water Well	1.3		
Renewable Energy	0.0		
Roads / Open Space / Gulches	97.9		
Total	218.0	533-646	

All Areas (A+B+C-1+C-2+D)	Acres	Units	Notes
Single Family Homesteads (SF)			
10,000 SF lots	36.7	160	
15,000 SF lots	42.8	186	
Multifamily (MF)	10.0	100-160 units	10-16 units/acre
Kūpuna MF	8.7	87-140 units	10-16 units/acre
Hawaiian Immersion School	1.9		
Keiki Care Center	1.2		
Community Farming	4.3		
Community Center	0.8		
Park	8.9		
Ed. Center / Business Incub.	3.5		
Water Well	1.3		
Renewable Energy	20.8		Solar Farm
Roads / Open Space / Gulches	154.9		
Total	295.9	533-646	Max study area

Figure 15. Projected Type of Development for the WHHA Site (PBR Hawai‘i)

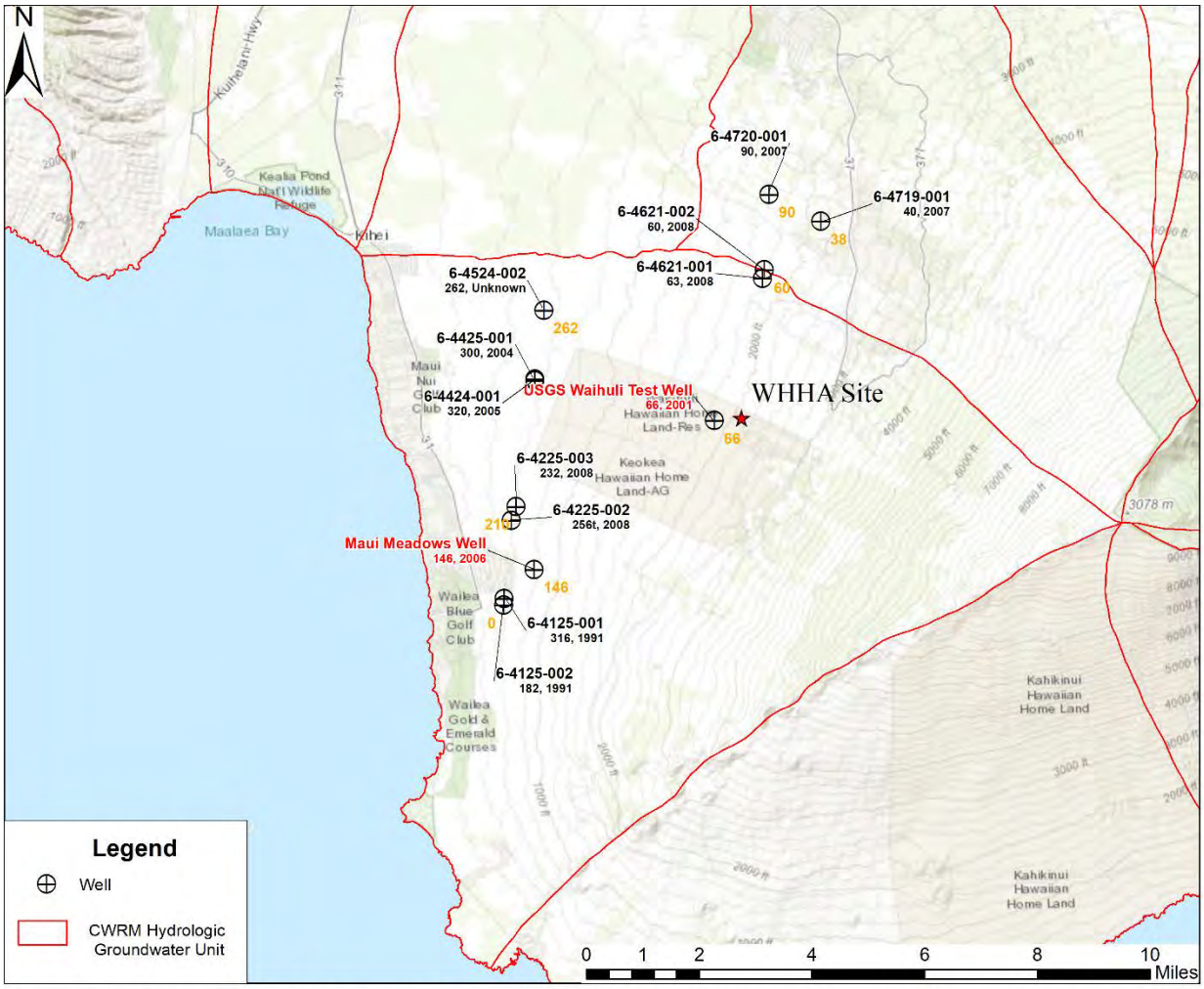

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Figure 16. Chloride Concentrations in Local Wells (CWRM 2021)

Note: For some of the wells, chloride measurements were taken for both when there was not any pumping and therefore there were static groundwater levels while other measurements were taken when wells were pumping. For purpose of this study, the highest concentrations recorded are shown.

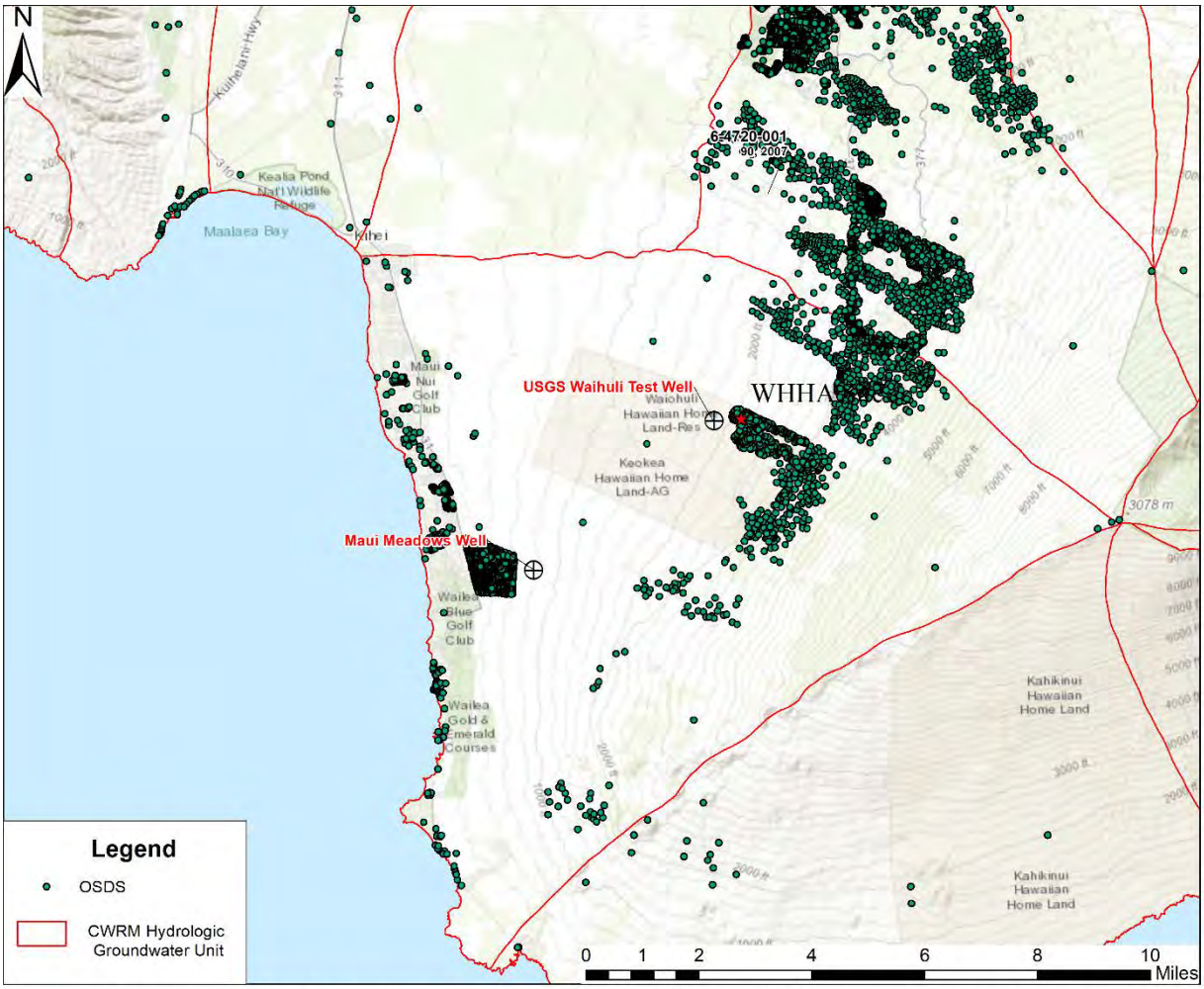

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Figure 17. Location OSDS Sites Relative to Waiohuli USGS Test Well and WHHA Site

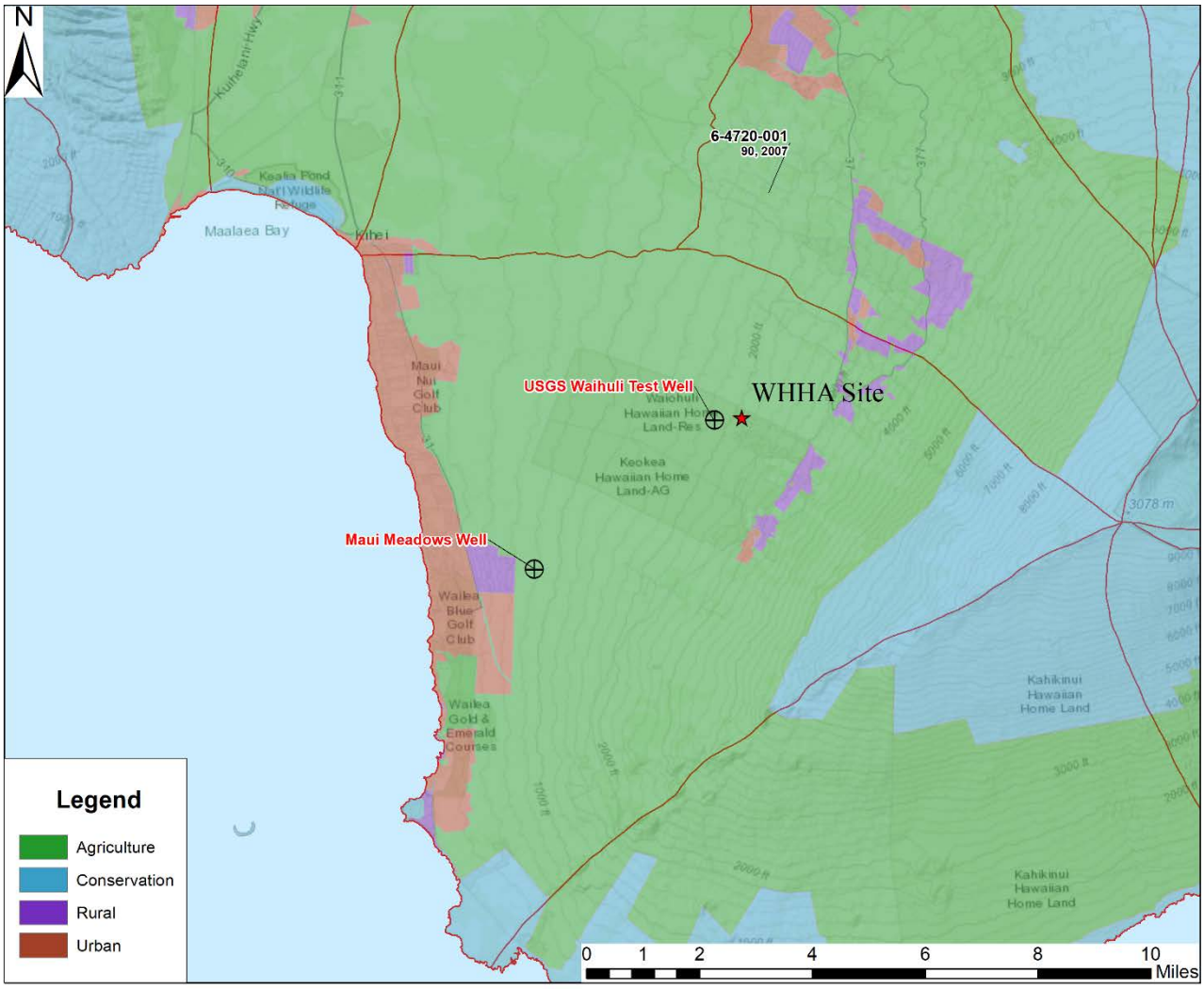

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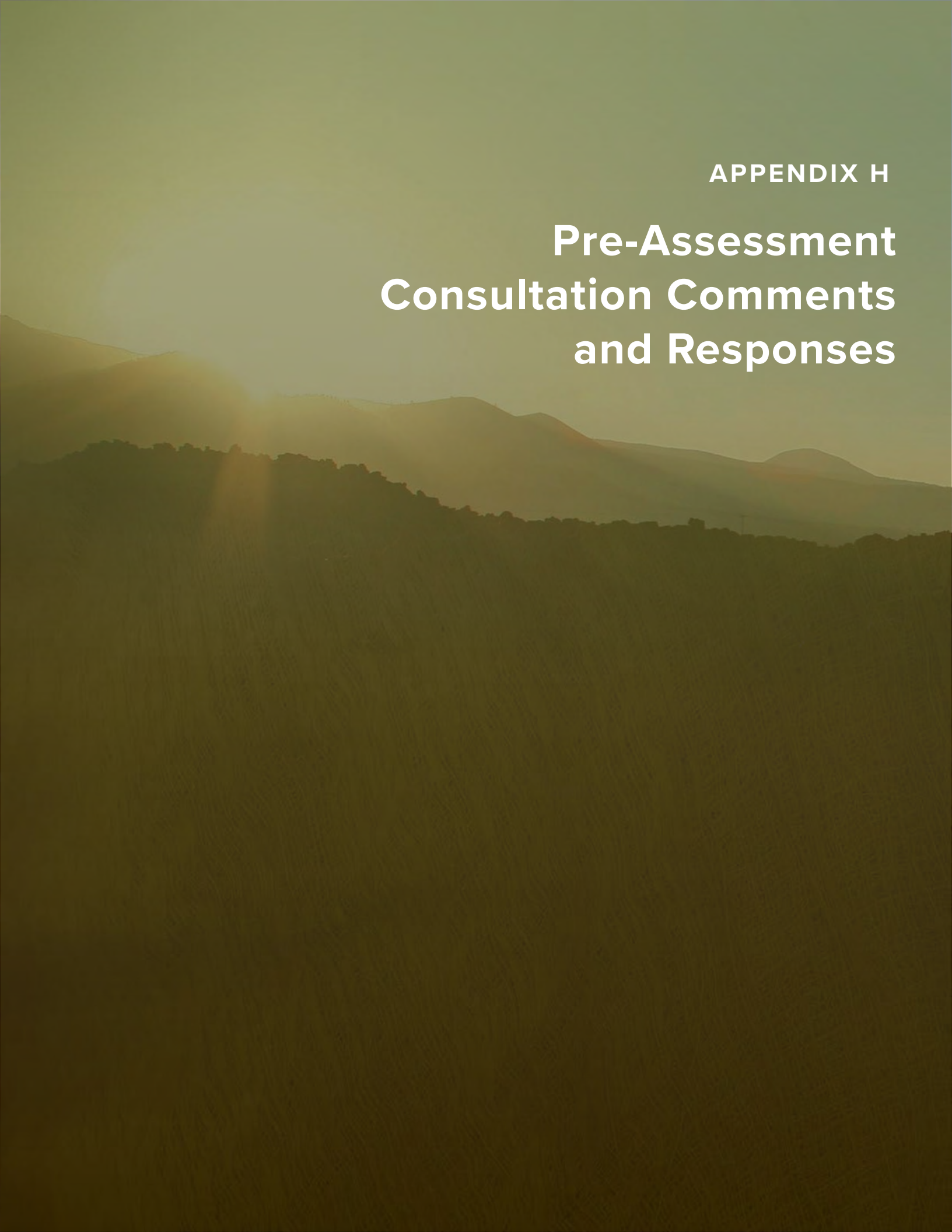
Figure 18. Conservation and Agricultural Land Use Districts



APPENDIX H

Pre-Assessment Consultation Comments and Responses

RICHARD T. BISSEN, JR.
Mayor

LORI TSUHAKO
Director

SAUMALU MATA'AFA
Deputy Director

DEPARTMENT OF HOUSING
& HUMAN CONCERNS
COUNTY OF MAUI
2200 MAIN STREET, SUITE 546
WAILUKU, MAUI, HAWAI'I 96793
PHONE: (808) 270-7805

November 14, 2023

Dave Simpson, Planner
PBR Hawaii & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813-3484

Dear Mr. Simpson:

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HAWAII REVISED STATUTE, CHAPTER 343, ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAII TAX MAP KEYS: (2) 2-2-028:181, (2) 2-2-002:014

The Department has reviewed the information submitted for the above subject project. Based on our review, we have determined that the project is not subject to Chapter 2.96, Maui County Code, and does not require a residential workforce housing agreement. At the present time, the Department has no additional comments to offer.

Please contact Mr. Buddy Almeida, Housing Administrator, at (808) 270-7351 if you have any questions.

Sincerely,

LORI TSUHAKO, LSW, ACSW
Director of Housing and Human Concerns

cc: Buddy Almeida, Housing Administrator

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
Executive Vice-President / Principal

VINCENT SHIGEKUNI
Senior Vice-President / Principal

GRANT T. MURAKAMI, AICP, LEED® AP BD+C
Senior Vice-President / Principal

KIMI MIKAMI YUEN, LEED® AP BD+C
Vice-President / Principal

CATIE CULLISON, AICP
Vice-President / Principal

TOM SCHNELL, AICP
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GREG NAKAI
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BRADLEY FURUYA, AICP
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C.R. 'IMIPONO WICHMAN
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THOMAS S. WITTEN, FASLA
Chairman Emeritus

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printed on recycled paper

November 8, 2024

Lori Tsuhako, Director
County of Maui
Department of Housing and Human Concerns
2200 Main Street, Suite 546
Wailuku HI 96793

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Ms. Tsuhako,

Thank you for your response letter dated November 14th, 2023, regarding the subject project. We acknowledge that the Department of Housing and Human Concerns has no comments and that the project does not require a residential workforce housing agreement based upon Chapter 2.96, Maui County Code.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII

Dave Simpson
Planner

RICHARD T. BISSEN, JR.
Mayor

KEKUHAUPIO R. AKANA
Managing Director

PATRICK S. MCCALL
Director

SHANE T. DUDOIT
Deputy Director

DEPARTMENT OF PARKS AND RECREATION
COUNTY OF MAUI
700 HALI'A NAKOA STREET, UNIT 2
WAILUKU, MAUI, HAWAI'I 96793
www.mauicounty.gov

November 28, 2023

Dave Simpson
PBR HAWAII & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813-3484

Dear Mr. Simpson:

SUBJECT: REQUEST FOR PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNTIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I; TMK (2)2-2-028:181, (2)2-2-002:014

Thank you for the opportunity to review and comment on the subject project. In accordance with Maui County Code 18.16.320 Parks and Playgrounds, this project is exempt from park assessment fees. The Department of Parks and Recreation has no further comments at this time.

Should you have any questions, please feel free to contact me or Samual A. Marvel, Chief of Planning and Development, at samual.marvel@co.maui.hi.us or (808) 270-6173.

Sincerely,

PATRICK S. MCCALL
Director of Parks and Recreation

c: Samual A. Marvel, Chief of Planning and Development

PSM:SAM:as

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

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RAYMOND T. HIGA, ASLA
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DACHENG DONG, LEED® AP
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NATHALIE RAZO
Associate Principal

ANN MIKIKO BOUSLOG, PhD
Director of Land Economics & Real Estate

RAMSAY R. M. TAUM
Cultural Sustainability Planner

ETSUYO KILA
Senior Associate

GREG NAKAI
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NICOLE SWANSON, ASLA
Associate

BRADLEY FURUYA, AICP
Associate

C.R. 'IMIPONO WICHMAN
Associate

THOMAS S. WITTEN, FASLA
Chairman Emeritus

W. FRANK BRANDT, FASLA
Founding Partner

1001 Bishop Street, Suite 650
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Tel: (808) 521-5631
Fax: (808) 523-1402
E-mail: sysadmin@pbrhawaii.com

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November 8, 2024

Patrick S. McCall, Director
County of Maui
Department of Parks and Recreation
700 Hali'a Nakoa Street, Unit 2
Wailuku HI 96793

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Mr. McCall,

Thank you for your response letter dated November 28th, 2023, regarding the subject project. We acknowledge that the Department of Parks and Recreation has no comments on the proposed project and that the project is exempt from park assessment fees.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII

Dave Simpson
Planner

RICHARD T. BISSEN, JR.
Mayor

KEKUHAUPIO R. AKANA
Managing Director

JOHN STUFFLEBEAN, P.E.
Director

JAMES A. LANDGRAF
Deputy Director

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAIʻI 96793
http://www.mauicounty.gov/water

December 1, 2023

Mr. Dave Simpson
PBR HAWAII & Associates
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484

Dear Mr. Simpson:

Re: Waiohuli Economic Development Opportunities Pre-Environmental Assessment (EA)
Makawao, Maui, Hawaiʻi
TMKs: (2) 2-2-028:181; (2) 2-2-002:014

Thank you for the opportunity for the County of Maui Department of Water Supply to submit a comment on the Waiohuli Economic Development Opportunities Pre-Environmental Assessment. For the upcoming EA, please include the following information:

1. What is the quantity of potable water use anticipated?
2. What is the quantity of non-potable water use anticipated?
3. What sources will be utilized?
4. What water conservation strategies will be implemented?
5. Will water reuse strategies will be implemented?

We hope you find this information useful. Should you have any questions, please contact staff planner Alex Buttaro at (808) 463-3103 or alex.buttaro@mauicounty.gov.

Sincerely,

John Stufflebean, P.E.
Director
BAB

Cc: MDWS Engineering

S:\PLANNING\Permit_Review\Projects Review\planning review\EA-EIS\Early Consult\Upcountry\ Waiohuli Economic Development Opportunities Pre-Environmental Assessment (EA)

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& ASSOCIATES, INC.

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President / Chairman

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Founding Partner

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Tel: (808) 521-5631
Fax: (808) 523-1402
E-mail: sysadmin@pbrhawaii.com

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November 8, 2024

John Stufflebean, Director
County of Maui
Department of Water Supply
Kalana O Maui Building
200 S High Street, 5th Floor
Wailuku HI 96793

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Mr. Stufflebean,

Thank you for your response letter dated December 1st, 2023 regarding the subject project. We acknowledge your comments below and provide the following responses.

For the upcoming EA, please include the following information:

1. *What is the quantity of potable water use anticipated?*

The projected potable water use will be contingent on whether the community and DHHL select to pursue the potential full buildout scenario. This hypothetical scenario was evaluated for the preliminary engineering report (See Appendix F of the Draft Environmental Assessment). Water demand and capacity was evaluated collectively for both potable and non-potable uses. Under these potential future conditions, the anticipated water use for the project would be 357,610 gallons per day (gpd) for domestic use with a maximum daily demand of 536,415 gpd. Potable water use for the project will be determined as plans are being finalized.

2. *What is the quantity of non-potable water use anticipated?*

Non-potable water use will be contingent on whether the community and DHHL select to pursue the potential full buildout scenario. This hypothetical scenario was evaluated for the preliminary engineering report (See Appendix F of the Draft Environmental Assessment). Water demand and capacity was evaluated collectively for both potable and non-potable uses. Under these potential future conditions, the anticipated water use for the project would be 357,610 gallons per day (gpd) for domestic use with a maximum daily demand of 536,415 gpd. Non-potable water use for the project will be determined as plans are being finalized.

3. *What sources will be utilized?*

Water sources for the project will be contingent on whether the community and DHHL select to pursue the potential full buildout scenario. This hypothetical scenario was evaluated for the preliminary engineering report (See Appendix F

of the Draft Environmental Assessment). The Project is not anticipated to be connected to the existing municipal water system and will develop a private water system to service its needs. During initial phases, the Project may require connections to existing municipal water until a private water system is developed. The proposed private water system will be provided for domestic use, irrigation and fire protection.

4. *What water conservation strategies will be implemented?*

The project is anticipated to utilize best practices for water conservation throughout the Site, including landscaping that incorporates drought-tolerant native plants and other water efficient landscape design techniques. Various water conservation technology and design are anticipated, such as rainwater catchment systems, water-efficient fixtures and monitoring systems to track water use.

5. *Will water reuse strategies be implemented?*

Specific water reuse strategies are not named in the plans at this time. Water reuse may be considered as plans are being finalized.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

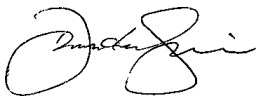
We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII



Dave Simpson
Planner

RICHARD T. BISSEN, JR.
Mayor

KEKUHAUPIO R. AKANA
Acting Managing Director

BRADFORD K. VENTURA
Fire Chief

GAVIN L.M. FUJIOKA
Deputy Fire Chief

DEPARTMENT OF FIRE & PUBLIC SAFETY
COUNTY OF MAUI
200 DAIRY ROAD
KAHULUI, MAUI, HAWAI'I 96732
www.mauicounty.gov

December 20, 2023

VIA EMAIL: dsimpson@pbrhawaii.com

PBR HAW All & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMK: (2) 2-2-028:181, (2) 2-2-002:014

Dear Applicant,

Thank you for the opportunity to review your project. At this time Fire Prevention Bureau provides the following comments:

Meet the subdivision land use requirements for water supply and access for all fronting and any proposed internal roads.

For Schools, Neighborhood Businesses, Small Shopping Centers, and High Rise Apartments the land use requirements are:

1. Water supply for fire protection shall be provided prior to the location and construction of buildings. Water supply for fire protection shall have a minimum flow of 2000 gallons per minute for a two-hour duration with hydrant spacing a maximum of 250 feet between hydrants. Dead-ends shall have a hydrant within 125 feet. Once construction of buildings are planned, there shall be at least one hydrant within 400 feet of any building to be constructed.

2. Service roads to proposed properties shall have a clear width of 20 feet, with an all-weather surface relative to grade. Any dead-end roads if greater than 150 feet in length, shall be provided with an approved fire apparatus turn-around. All turns and required turnarounds shall have an outside turning radius of 40.5 feet. The maximum grade for the service roads shall meet Dept of Public Works standards. Service roads with a width of 20 to 27 feet require No Parking signs on both sides of the street. Service roads with a width of 28 to 34 feet, parking is allowed on only one side of the street. Service roads with a width of 36 feet or larger, parking is allowed on both sides of the street.

Formal review comments will be provided in response to the subdivision application. More information is needed for this project to determine if an additional access road (or increased fire protection) will be required. Our office does reserve the right to review and comment on future building permit applications when detailed plans for this project are routed to our office for review.

If there are any questions or comments, please feel free to contact our office at (808) 876-4690 or by email at fire.prevention@mauicounty.gov

Sincerely,

Plans Review - Fire Prevention Bureau

CG

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
Executive Vice-President / Principal

VINCENT SHIGEKUNI
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Fax: (808) 523-1402
E-mail: sysadmin@pbrhawaii.com

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November 8, 2024

Bradford Ventura, Fire Chief
County of Maui
Department of Fire and Public Safety
200 Dairy Road
Kahului HI 96733

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Chief Ventura,

Thank you for your response letter dated December 20th, 2023 regarding the subject project. We acknowledge your comments below and provide the following responses.

For Schools, Neighborhood Businesses, Small Shopping Centers, and High Rise Apartments the land use requirements are:

1. *Water supply for fire protection shall be provided prior to the location and construction of buildings. Water supply for fire protection shall have a minimum flow of 2000 gallons per minute for a two-hour duration with hydrant spacing a maximum of 250 feet between hydrants. Dead-ends shall have a hydrant within 125 feet. Once construction of buildings are planned, there shall be at least one hydrant within 400 feet of any building to be constructed.*

The maximum fire flow demand to service the Project under the potential full buildout scenario is anticipated to be 2,000 gallons per minute (gpm). After completion of the Project under the potential full buildout scenario, the proposed water system will include accommodations for fire protection and fire hydrants will be designed and spaced based on requisite standards to offer sufficient fire protection across the Site with at least one hydrant within 400 feet of any building.

2. *Service roads to proposed properties shall have a clear width of 20 feet, with an all-weather surface relative to grade. Any dead-end roads if greater than 150 feet in length, shall be provided with an approved fire apparatus turn-around. All turns and required turnarounds shall have an outside turning radius of 40.5 feet. The maximum grade for the service roads shall meet Dept of Public Works standards. Service roads with a width of 20 to 27 feet require No Parking signs on both sides of the street. Service roads with a width of 28 to 34 feet, parking is allowed on only one side of the street. Service roads with a width of 36 feet or larger, parking is allowed on both sides of the street.*

After completion of the Project under the potential full buildout scenario, the Site will be designed to support emergency services for fire protection, including appropriate roadway design for access throughout the Site and adequate spacing for turnaround necessary to accommodate emergency vehicles. The project will meet all requirements for roadway width, turnaround, grade, and signage for all proposed internal roads.

See Sections 4.7.1 and 4.9.2 of the Draft Environmental Assessment for more information on fire protection.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII

Dave Simpson
Planner

POLICE DEPARTMENT
COUNTY OF MAUI
55 MAHALANI STREET
WAILUKU, MAUI, HAWAII 96793
TELEPHONE: (808) 244-6400
FAX: (808) 244-6411

RICHARD T. BISSEN, JR.
MAYOR

OUR REFERENCE

YOUR REFERENCE

JOHN PELLETIER
CHIEF OF POLICE

WADE M. MAEDA
DEPUTY CHIEF OF POLICE

November 20, 2023

Mr. Dave Simpson
PBR HAWAII & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813-3484

Re: Pre-Assessment Consultation for a HRS Chapter 343 Environmental Assessment – Waiohuli Economic Development Opportunities, Makawao District, Island of Maui, Hawaii; TMKs (2) 2-2-028:181 & (2) 2-2-002:014

Dear Mr. Simpson:

This is in response to your letter dated November 3, 2023 requesting comments on the Environmental Assessment for the proposed Waiohuli Economic Development Opportunities project.

In review of the submitted documents, we have no objections to the upcoming construction project if it meets the minimal standards set forth by county codes and state laws. Efforts should be made to minimize noise, dust, and debris so not to inhibit those whose health and well-being may be affected. We suggest utilizing adequate traffic control devices and/or personnel to minimize the impacts to pedestrian and vehicular movement by heavy construction equipment/vehicles traveling in and out of the area. If the roads will be temporarily closed due to alternating traffic, we recommend the project manager utilize flag men to conduct traffic control and to have proper signage posted along the routes during construction. Lastly, we recommend using proper and adequate lighting during evening, late night, and early morning hours during construction until completion. Thank you for giving us the opportunity to comment on this project.

Sincerely,

Assistant Chief Keola Tom
for: JOHN PELLETIER
Chief of Police

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
Executive Vice-President / Principal

VINCENT SHIGEKUNI
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Founding Partner

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Honolulu, Hawai'i 96813-3484
Tel: (808) 521-5631
Fax: (808) 523-1402
E-mail: sysadmin@pbrhawaii.com

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November 8, 2024

John Pelletier, Chief of Police
County of Maui
Police Department
55 Mahalani Street
Wailuku HI 96793

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Chief Pelletier,

Thank you for your response letter dated November 20th, 2023 regarding the subject project. We acknowledge your comments below and provide the following responses.

> *In review of the submitted documents, we have no objections to the upcoming construction project if it meets the minimal standards set forth by county codes and state laws. Efforts should be made to minimize noise, dust, and debris so not to inhibit those whose health and well-being may be affected. We suggest utilizing adequate traffic control devices and/or personnel to minimize the impacts to pedestrian and vehicular movement by heavy construction equipment/ vehicles traveling in and out of the area. If the roads will be temporarily closed due to alternating traffic, we recommend the project manager utilize flag men to conduct traffic control and to have proper signage posted along the routes during construction. Lastly, we recommend using proper and adequate lighting during the evening, late night, and early morning hours during construction until completion. Thank you for giving us the opportunity to comment on this project.*

We acknowledge you have no objections to the proposed project. The project will meet minimal standards in compliance with all county codes and state laws. During construction, the project will generate noise and may generate dust, however, appropriate measures will be taken to minimize these potential impacts to the surrounding area. Appropriate measures will also be taken to mitigate the impacts during construction as recommended for traffic control and lighting.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

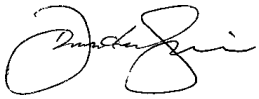
We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII



Dave Simpson
Planner

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

KEITH A. REGAN
COMPTROLLER
KA LUNA HO'OMALU HANA LAULĀ

MEOH-LENG SILLIMAN
DEPUTY COMPTROLLER
KA HOPE LUNA HO'OMALU HANA LAULĀ

STATE OF HAWAI'I | KA MOKU'ĀINA O HAWAI'I
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES | KA 'OIHANA LOIHELU A LAWELAWE LAULĀ
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)23.197

NOV 16 2023

Dave Simpson, Planner
PBR HAWAII & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813-3484

Dear Dave Simpson:

Subject: Pre-Assessment Consultation for a Environmental Assessment
Waiohuli Economic Development Opportunities
Makawao District, Island of Maui, Hawaii
TMK# (2) 2-2-028:181, (2) 2-2-002:014

Thank you for the opportunity to comment on the subject project. We have no comments to offer at this time as the proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities.

If you have any questions, your staff may call Dora Choy-Johnson of the Planning Branch at (808) 586-0488.

Sincerely,

CHRISTINE L. KINIMAKA
Public Works Administrator

DC: mc
c: Jeff Pearson, DAGS-MDO

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
Executive Vice-President / Principal

VINCENT SHIGEKUNI
Senior Vice-President / Principal

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Senior Vice-President / Principal

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Honolulu, Hawai'i 96813-3484
Tel: (808) 521-5631
Fax: (808) 523-1402
E-mail: sysadmin@pbrhawaii.com

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November 8, 2024

Keith Regan, Comptroller
State of Hawaii
Department of Accounting & General Services
P.O. Box 119
Honolulu HI 96810

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Mr. Regan,

Thank you for your response letter dated November 16th, 2023 regarding the subject project (File No. (P)23.197). We acknowledge that the Department of Accounting and General Services (DAGS) has no comments and that the proposed project will not impact any DAGS projects or existing facilities.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII

Dave Simpson
Planner

LAND USE COMMISSION

Komikina Hoʻohana ʻĀina

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

Ka ʻOihana Hoʻomōhala Pāʻoihana, ʻImi Wai wai a Hoʻomākaʻikaʻi

235 S. Beretania Street, RM 406, Honolulu, Hawaiʻi 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaiʻi 96804
Email Address: dbedt.luc.web@hawaii.gov

Telephone: (808) 587-3822
Fax: (808) 587-3827
Website: luc.hawaii.gov

JOSH GREEN, M.D.
GOVERNOR

SYLVIA LUKE
LT. GOVERNOR

DANIEL ORODENKER
LUC EXECUTIVE OFFICER

November 14, 2023

Dave Simpson
PBR HAWAII & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

SUBJECT: Pre-Assessment Consultation for Waiohuli Economic Development Opportunities, Makawao District, Maui

Dear Mr.Simpson:

Thank you for the Pre-assessment Consultation (“pre-assesmet”) for a HRS Chapter 343 Environmental Assessment for the Waiohuli Economic Development Opportunities (“Project”) in Makawao, Maui. The Land Use Commission Staff has reviewed the pre-assessment, and has the following comments and recommendations:

After review of the State Land Use District Maps, it is determined that the proposed project is within the State Agricultural District, and since the project is above 15 acres, the Department of Hawaiian Home Lands should petition the LUC for a land use designation change to prevent future confusion. When the environmental assessment is being completed ensure that all acreage being used is included, this includes access roads.

When compiling the environmental assessment for the Project, please include an explanation of who the accepting authority is and the justification for choosing the accepting authority.

Also, please be sure the applicable laws and criteria set forth in HAR §11-200.1 are met in the environmental assessment.

The Land Use Commission Staff looks forward to continued communication and collaboration on this matter.

Should you have any questions, please contact Martina Segura, at (808) 587-3823 or via email at martina.t.segura@hawaii.gov.

Sincerely,

Daniel Orodenker
Executive Officer
Land Use Commission
State of Hawai‘i

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
Executive Vice-President / Principal

VINCENT SHIGEKUNI
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GRANT T. MURAKAMI, AICP, LEED® AP BD+C
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Principal

RAYMOND T. HIGA, ASLA
Associate Principal

DACHENG DONG, LEED® AP
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NATHALIE RAZO
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ANN MIKIKO BOUSLOG, PhD
Director of Land Economics & Real Estate

RAMSAY R. M. TAUM
Cultural Sustainability Planner

ETSUYO KILA
Senior Associate

GREG NAKAI
Senior Associate

NICOLE SWANSON, ASLA
Associate

BRADLEY FURUYA, AICP
Associate

C.R. 'IMIPONO WICHMAN
Associate

THOMAS S. WITTEN, FASLA
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W. FRANK BRANDT, FASLA
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E-mail: sysadmin@pbrhawaii.com

printed on recycled paper

November 8, 2024

Daniel Orodenker, Executive Officer
State of Hawaii
DBEDT - Land Use Commission
P O Box 2359
Honolulu HI 96804

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Mr. Orodenker,

Thank you for your response letter dated November 14th, 2023 regarding the subject project. We acknowledge your comments below and provide the following responses.

After review of the State Land Use District Maps, it is determined that the proposed project is within the State Agricultural District, and since the project is above 15 acres, the Department of Hawaiian Home Lands should petition the LUC for a land use designation change to prevent future confusion. When the environmental assessment is being completed ensure that all acreage being used is included, this includes access roads.

We acknowledge the recommendation for the Department of Hawaiian Home Lands to petition for a land use designation change that will align with the proposed project. The project is still in the planning phase and will consider the suggested petition once the Department of Hawaiian Home Lands makes a decision on whether to implement the potential full buildout scenario.

When compiling the environmental assessment for the Project, please include an explanation of who the accepting authority is and the justification for choosing the accepting authority.

The accepting authority for the proposed project is the Department of Hawaiian Home Lands.

Also, please be sure the applicable laws and criteria set forth in HAR §11-200.1 are met in the environmental assessment.

See Section 7.1 of the Draft Environmental Assessment for more detailed information on compliance with the significance criteria set forth under HAR §11-200.1.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

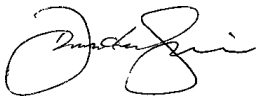
We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII



Dave Simpson
Planner

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

CATHY BETTS
DIRECTOR
KA LUNA HO'OKELE

JOSEPH CAMPOS II
DEPUTY DIRECTOR
KA HOPE LUNA HO'OKELE

TRISTA SPEER
DEPUTY DIRECTOR
KA HOPE LUNA HO'OKELE

STATE OF HAWAII
KA MOKU'ĀINA O HAWAI'I
DEPARTMENT OF HUMAN SERVICES
KA 'OIHANA MĀLAMA LAWELAWE KANAKA
BENEFIT, EMPLOYMENT AND SUPPORT SERVICES DIVISION
1010 Richards Street, Suite 512
Honolulu, Hawaii 96813

Re: 23-00286

December 1, 2023

Mr. Dave Simpson
PBR HAWAII & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813-3484

Dear Mr. Simpson:

Subject: Pre-Assessment Consultation for a HRS Chapter 343 Environmental Assessment – Waiohuli Economic Development Opportunities, Makawao District, Island of Maui, Hawaii
TMKs (2) 2-2-028:181, (2) 2-2-002:014

This is in response to letter dated November 3, 2023 requesting the Department of Human Services (DHS) to comment on the above-named project.

DHS has reviewed the Waiohuli Economic Development Opportunities project and the map of the area. At this time, DHS has no comments.

Should you have any questions regarding this matter, please contact Ms. Tracy Oshita, Acting Child Care Regulation Program Specialist at (808) 586-5243.

Sincerely,

Scott Nakasone
Assistant Division Administrator

c: Cathy Betts, Director

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
Executive Vice-President / Principal

VINCENT SHIGEKUNI
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November 8, 2024

Cathy Betts, Director
State of Hawaii
Department of Human Services
P.O. Box 339
Honolulu HI 96809-0339

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Ms. Betts,

Thank you for your response letter dated December 1st, 2023 regarding the subject project (File No. 23-00286). We acknowledge that the Department of Human Services has no comments and the proposed project.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII

Dave Simpson
Planner

O:\Job39\3940.02 Kula Maui PPP EA\Pre Consultation\Pre Consultation Comments and Responses\Responses\STATE- DHS Pre Consultation Response 2023-12-01.doc

JOSH GREEN, M.D.
GOVERNOR | KE KIAʻĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIAʻĀINA

DAWN N. S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA
LAND DIVISION

P.O. BOX 621
HONOLULU, HAWAII 96809

November 9, 2023

MEMORANDUM

FROM: **DLNR Agencies:**
___Div. of Aquatic Resources
___Div. of Boating & Ocean Recreation
_X_ Engineering Division (DLNR.ENGR@hawaii.gov)
_X_ Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
___Div. of State Parks
_X_ Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
___Office of Conservation & Coastal Lands
_X_ Land Division – Maui District (daniel.l.ornellas@hawaii.gov)
_X_ Aha Moku Advisory Committee (leimana.k.damate@hawaii.gov)

TO: Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Pre-Assessment Consultation for EA for the Proposed **Waiohuli Economic Development Opportunities** Project
LOCATION: Makawao, Island of Maui; TMKs: (2) 2-2-028:181 and (2) 2-2-002:014
APPLICANT: PBR Hawaii & Associates, Inc. on behalf of Waiohuli Hawaiian Homestead Association Inc., and Department of Hawaiian Home Lands

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit any comments by **December 1, 2023.**

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Darlene Nakamura at darlene.k.nakamura@hawaii.gov. Thank you.

BRIEF COMMENTS:

( ) We have no objections.
( ) We have no comments.
( ) We have no additional comments.
(☑) Comments are included/attached.

Signed: JDO
Print Name: Jason D. Omick, Acting Wildlife Prog. Mgr.
Division: Forestry and Wildlife
Date: Dec 7, 2023

Attachments
cc: Central File

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET, ROOM 325
HONOLULU, HAWAII 96813

December 5, 2023

Log no. 4324

MEMORANDUM

TO: RUSSELL Y. TSUJI, Administrator
Land Division

FROM: JASON D. OMICK, Acting Wildlife Program Manager
Division of Forestry and Wildlife

SUBJECT: Request for Comments on the Pre-Assessment Consultation for the EA for the Proposed Waiohuli Economic Development Opportunities Project, Maui

The Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) has received your request for comments on the pre-assessment for the Environmental Assessment (EA) of the Waiohuli Economic Development Opportunities Project, located within the Makawao District on the Island of Maui; TMKs: (2) 2-2-028:181, (2) 2-2-002:014. The proposed project is a public-private collaboration with Waiohuli Hawaiian Homestead Association (WHHA) and Pueo Development LLC that combines traditional construction of a master plan development with community-based job opportunities. These opportunities focus on developing infrastructure, agricultural cultivation, renewable energy, and water source development to create long-term economic sustainability for the Waiohuli community. Work on the land will be divided into Community Support Training Facilities, Infrastructure Training Sites, Agricultural Development Training Sites, Renewable Energy Development/Training Sites, and Natural Drainage Gulch Areas. The goal of the project is to create community-based economic opportunities, and the project involves the development of a master plan that incorporates a variety of land uses to support the community.

DOFAW provides the following comments regarding the potential for the proposed work to affect listed species in the vicinity of the project area.

The State listed ʻōpeʻapeʻa or Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) could potentially occur at or in the vicinity of the project and may roost in nearby trees. Any required site clearing should be timed to avoid disturbance to bats during their birthing and pup rearing season (June 1 through September 15). During this period woody plants greater than 15 feet (4.6 meters) tall should not be disturbed, removed, or trimmed. Barbed wire should also be

avoided for any construction because bats can become ensnared and killed by such fencing material during flight.

Artificial lighting can adversely impact seabirds that may pass through the area at night by causing them to become disoriented. This disorientation can result in their collision with manmade structures or the grounding of birds. For nighttime work that might be required, DOFAW recommends that all lights used be fully shielded to minimize the attraction of seabirds. Nighttime work that requires outdoor lighting should be avoided during the seabird fledging season, from September 15 through December 15, when young seabirds make their maiden voyage to sea.

If nighttime construction is required during the seabird fledgling season (September 15 to December 15), we recommend that a qualified biologist be present at the project site to monitor and assess the risk of seabirds being attracted or grounded due to the lighting. If seabirds are seen circling around the area, lights should then be turned off. If a downed seabird is detected, please follow DOFAW's recommended response protocol by visiting https://dlnr.hawaii.gov/wildlife/seabird-fallout-season/#response.

Permanent lighting also poses a risk of seabird attraction, and as such should be minimized or eliminated to protect seabird flyways and preserve the night sky. For illustrations and guidance related to seabird-friendly light styles that also protect seabirds and the dark starry skies of Hawai‘i please visit https://dlnr.hawaii.gov/wildlife/files/2016/03/DOC439.pdf.

The State listed nēnē or Hawaiian Goose (*Branta sandvicensis*) could potentially occur in the vicinity of the proposed project site. It is against State law to harm or harass these species. If any are present during construction, all activities within 100 feet (30 meters) should cease and the bird or birds should not be approached. Work may continue after the bird or birds leave the area of their own accord. If a nest is discovered at any point, please contact the Maui Island Branch DOFAW Office at (808) 984-8100 and establish a buffer zone around the nest.

The State endangered pueo or Hawaiian Short-eared owl (*Asio flammeus sandwichensis*) could potentially occur in the project vicinity. Pueo are most active during dawn and dusk twilights. Remove and exclude non-native mammals such as mongoose, cats, dogs, and ungulates from the nesting area. Minimize habitat alterations and disturbance during pueo breeding season. Before any potentially disturbing activity like clearing vegetation, especially ground-based disturbance, DOFAW recommends a qualified biologist conduct surveys during crepuscular hours and walk line transects through the area to detect any active pueo nests. If a pueo nest is discovered, notify DOFAW staff, minimize time spent at the nest, and establish a minimum buffer distance of 100 meters from the nest until chicks are capable of flight.

The project area is within the range of the State listed Blackburn's Sphinx Moth (*Manduca blackburni*) or BSM. Larvae of BSM feed on many nonnative hostplants, which includes tree tobacco (*Nicotiana glauca*), that grow in disturbed soil. We recommend contacting the Maui Island Branch DOFAW office at (808) 984-8100 for further information about where BSM may be present and whether a vegetation survey should be conducted to determine the presence of plants preferred by BSM. DOFAW recommends removing plants less than one meter in height or during the dry season to avoid harm to BSM. If you intend to either remove tree tobacco over one meter in height or to disturb the ground around or within several meters of these plants, they must be thoroughly inspected by a qualified entomologist for the presence of BSM eggs and larvae.

The project site is nearby Mau's lowland dry unit 2 critical habitat which is home to endangered species of plants including *Alectryon micrococcus, Bidens micrantha ssp. Kalealaha, Bonamia menziesii, Canavalia pubescens, Cenchrus agrimonioides, Colubrina oppositifolia, Ctenitis squamigera, Flueggea neowawraea, Hibiscus brackenridgei, Melanthera kamolensis, Melicope mucronulata, Neraudia sericea, Nototrichium humile, Santalum haleakalae var. lanaiense, Sesbania tomentosa, Solanum incompletum, Spermolepis hawaiiensis, and Zanthoxylum hawaiiense*. DOFAW recommends that a botanical survey be conducted by a qualified botanist in the project area prior to commencing work to determine if any of these rare or endangered plants are present in the project area. We recommend that the survey consists of a complete species list and is conducted during the wettest time of year when plants are more likely to be visible, especially in drier areas. If any listed species are found, please notify DOFAW at (808) 587-0166. For information on avoidance and minimization measures for plants, please refer to the following link: https://www.fws.gov/media/plant-avoidance-and-minimization-measures-may-2023

DOFAW recommends using native plant species for landscaping that are appropriate for the area; i.e., plants for which climate conditions are suitable for them to thrive, plants that historically occurred there, etc. Please do not plant invasive species. DOFAW also recommends referring to www.plantpono.org for guidance on the selection and evaluation of landscaping plants and to determine the potential invasiveness of plants proposed for use in the project.

DOFAW recommends minimizing the movement of plant or soil material between worksites. Soil and plant material may contain detrimental fungal pathogens (e.g., Rapid ʻŌhiʻa Death), vertebrate and invertebrate pests (e.g., Coqui Frogs, Little Fire Ants, etc.), or invasive plant parts (e.g., Miconia, Mullein, etc.) that could harm our native species and ecosystems. We recommend consulting the Maui Invasive Species Committee (MISC) at (808) 573-6472 to help plan, design, and construct the project, learn of any high-risk invasive species in the area, and ways to mitigate their spread. All equipment, materials, and personnel should be cleaned of excess soil and debris to minimize the risk of spreading invasive species.

To prevent the spread of Rapid ʻŌhiʻa Death (ROD), DOFAW requests that the information and guidance at the following website be reviewed and followed if ʻōhiʻa trees are present at the project site that will be removed, trimmed, or potentially injured: https://cms.ctahr.hawaii.edu/rod.

Due to the arid climate and risks of wildfire to listed species, we recommend coordinating with the Hawaiʻi Wildfire Management Organization at (808) 850-0900 or admin@hawaiiwildfire.org, on how wildfire prevention can be addressed in the project area. When engaging in activities that have a high risk of starting a wildfire (i.e. welding in grass), it is recommended that you:

- Wet down the area before starting your task,
- Continuously wet down the area as needed,
- Have a fire extinguisher on hand, and
- In the event that your vision is impaired, (i.e. welding goggles) have a spotter to watch for fire starts.

We appreciate your efforts to work with our office for the conservation of our native species. These comments are general guidelines and should not be considered comprehensive for this site or project. It is the responsibility of the applicant to do their own due diligence to avoid any negative environmental impacts. Should the scope of the project change significantly, or should it become apparent that threatened or endangered species may be impacted, please contact our staff as soon as possible. If you have any questions, please contact Myrna N. Girald Pérez, Protected Species Habitat Conservation Planning Coordinator at (808) 265-3276 or myrna.girald-perez@hawaii.gov.

Sincerely,

JASON D. OMICK
Acting Wildlife Program Manager

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
Executive Vice-President / Principal

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Tel: (808) 521-5631
Fax: (808) 523-1402
E-mail: sysadmin@pbrhawaii.com

printed on recycled paper

November 8, 2024

Jason Omick, Acting Wildlife Program Manager
State of Hawaii
DLNR - Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu HI 96813

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Mr. Omick,

Thank you for your response letter dated December 5th, 2023 regarding the subject project (File No. 4324). We acknowledge your comments below and provide the following responses.

The State listed 'ōpe'ape'a or Hawaiian Hoary Bat (Lasiurus cinereus semotus) could potentially occur at or in the vicinity of the project and may roost in nearby trees. Any required site clearing should be timed to avoid disturbance to bats during their birthing and pup rearing season (June 1 through September 15). During this period woody plants greater than 15 feet (4.6 meters) tall should not be disturbed, removed, or trimmed. Barbed wire should also be avoided for any construction because bats can become ensnared and killed by such fencing material during flight.

To avoid impacts to the Hawaiian hoary bat, woody vegetation taller than 15 feet will not be cleared during the bat pupping season between June 1 and September 15. Barbed wire will not be used within the project site.

Artificial lighting can adversely impact seabirds that may pass through the area at night by causing them to become disoriented. This disorientation can result in their collision with manmade structures or the grounding of birds. For nighttime work that might be required, DOFAW recommends that all lights used be fully shielded to minimize the attraction of seabirds. Nighttime work that requires outdoor lighting should be avoided during the seabird fledging season, from September 15 through December 15, when young seabirds make their maiden voyage to sea.

If nighttime construction is required during the seabird fledgling season (September 15 to December 15), we recommend that a qualified biologist be present at the project site to monitor and assess the risk of seabirds being attracted or grounded due to the lighting. If seabirds are seen circling around the area, lights should then be turned off. If a downed seabird is detected, please follow DOFAW's recommended response protocol by visiting https://dlnr.hawaii.gov/wildlife/seabird-fallout-season/#response.

Permanent lighting also poses a risk of seabird attraction, and as such should be minimized or eliminated to protect seabird flyways and preserve the night sky. For illustrations and guidance related to seabird-friendly light styles that also protect seabirds and the dark starry skies of Hawai'i please visit https://dlnr.hawaii.gov/wildlife/files/2016/03/DOC439.pdf.

To mitigate against seabird fallout, nighttime construction will be avoided. Automatic motion sensors switches and controls on all permanent outdoor lighting should be turned off when human activity is not occurring in the area.

The State listed nēnē or Hawaiian Goose (Branta sandvicensis) could potentially occur in the vicinity of the proposed project site. It is against State law to harm or harass these species. If any are present during construction, all activities within 100 feet (30 meters) should cease and the bird or birds should not be approached. Work may continue after the bird or birds leave the area of their own accord. If a nest is discovered at any point, please contact the Maui Island Branch DOFAW Office at (808) 984-8100 and establish a buffer zone around the nest.

To minimize impacts to the Hawaiian Goose, the following measures will be taken:

- Don't feed birds especially if they approach for handouts.
- Secure all food rubbish in close trash receptacles.
- Establish a 15 mile an hour speed limit within the site.

The State endangered pueo or Hawaiian Short-eared owl (Asio flammeus sandwichensis) could potentially occur in the project vicinity. Pueo are most active during dawn and dusk twilights. Remove and exclude non-native mammals such as mongoose, cats, dogs, and ungulates from the nesting area. Minimize habitat alterations and disturbance during pueo breeding season. Before any potentially disturbing activity like clearing vegetation, especially ground-based disturbance, DOFAW recommends a qualified biologist conduct surveys during crepuscular hours and walk line transects through the area to detect any active pueo nests. If a pueo nest is discovered, notify DOFAW staff, minimize time spent at the nest, and establish a minimum buffer distance of 100 meters from the nest until chicks are capable of flight.

There were no pueo observed during the biological evaluation and no active pueo nests were discovered during the survey of the site. However, we acknowledge that Pueo may potentially utilize habitat within the site. While it is unlikely that the proposed project will have an impact on pueo, mitigation measures will be implemented during construction to ensure that potential habitats are not disturbed, especially during pueo breeding season. If a pueo nest is discovered, DOFAW staff will be notified and a minimum buffer distance of 100 meters will be established from the nest until chicks are capable of flight.

The project area is within the range of the State listed Blackburn's Sphinx Moth (Manduca blackburni) or BSM. Larvae of BSM feed on many nonnative hostplants, which includes tree tobacco (Nicotiana glauca), that grow in disturbed soil. We recommend contacting the Maui Island Branch DOFAW office at (808) 984-8100 for further information about where BSM may be present and whether a vegetation survey should be conducted to determine the presence of plants preferred by BSM. DOFAW recommends removing plants less than one meter in height or during the dry season to avoid harm to BSM. If you intend to either remove tree tobacco over one meter in height or to disturb the ground around or within several meters of these plants, they must be thoroughly inspected by a qualified entomologist for the presence of BSM eggs and larvae.

The applicant will coordinate with the Maui Island Branch DOFAW office to determine best management practices to be conducted during construction to ensure plant removals do not disturb any potential Blackburn's Sphinx Moth species inhabiting the site.

The project site is nearby Mau's lowland dry unit 2 critical habitat which is home to endangered species of plants including Alectryon micrococcus, Bidens micrantha ssp. Kalealaha, Bonamia menziesii, Canavalia pubescens, Cenchrus agrimonioides, Colubrina oppositifolia, Ctenitis squamigera, Flueggea neowawraea, Hibiscus brackenridgei, Melanthera kamolensis, Melicope mucronulata, Neraudia sericea, Nototrichium humile, Santalum haleakalae var. lanaiense, Sesbania tomentosa, Solanum incompletum, Spermolepis hawaiiensis, and Zanthoxylum hawaiiense. DOFAW recommends that a botanical survey be conducted by a qualified botanist in the project area prior to commencing work to determine if any of these rare or endangered plants are present in the project area. We recommend that the survey consists of a complete species list and is conducted during the wettest time of year when plants are more likely to be visible, especially in drier areas. If any listed species are found, please notify DOFAW at (808) 587-0166. For information on avoidance and minimization measures for plants, please refer to the following link: https://www.fws.gov/media/plant-avoidance-and-minimization-measuresmay-2023

A botanical survey was conducted as part of the natural resources assessment in February 2024, documenting the current plant species within the project area. See Section 3.7.1 and Appendix B of the Draft Environmental Assessment for more detailed information on flora and the complete Natural Resources Assessment.

DOFAW recommends using native plant species for landscaping that are appropriate for the area; i.e., plants for which climate conditions are suitable for them to thrive, plants that historically occurred there, etc. Please do not plant invasive species. DOFAW also recommends referring to www.plantpono.org for guidance on the selection and evaluation of landscaping plants and to determine the potential invasiveness of plants proposed for use in the project.

The Project is anticipated to include landscaping that incorporates drought-tolerant native plants under the potential full buildout scenario. We acknowledge the recommended guidance for determining the best landscaping plants to consider in the design of landscaping for the proposed project.

DOFAW recommends minimizing the movement of plant or soil material between worksites. Soil and plant material may contain detrimental fungal pathogens (e.g., Rapid 'Ōhi'a Death), vertebrate and invertebrate pests (e.g., Coqui Frogs, Little Fire Ants, etc.), or invasive plant parts (e.g., Miconia, Mullein, etc.) that could harm our native species and ecosystems. We recommend consulting the Maui Invasive Species Committee (MISC) at (808) 573-6472 to help plan, design, and construct the project, learn of any high-risk invasive species in the area, and ways to mitigate their spread. All equipment, materials, and personnel should be cleaned of excess soil and debris to minimize the risk of spreading invasive species.

The applicant will coordinate with the Maui Invasive Species Committee to determine high-risk invasive species in the area and ways to the mitigate spread of Rapid 'Ōhi'a Death. All equipment, materials, and personnel will be cleaned of excess soil and debris to minimize the risk of spreading invasive species. Gear that may contain soil, such as work boots and vehicles, will be thoroughly cleaned with water and sprayed with 70% alcohol solution to prevent the spread of Rapid 'Ōhi'a Death and other harmful fungal pathogens.

To prevent the spread of Rapid 'Ōhi'a Death (ROD), DOFAW requests that the information and guidance at the following website be reviewed and followed if 'ōhi'a trees are present at the project site that will be removed, trimmed, or potentially injured: https://cms.ctahr.hawaii.edu/rod.

We acknowledge the recommendation to review the information and guidance to determine best practices to be implemented if any ʻōhiʻa trees are discovered on the project site.

Due to the arid climate and risks of wildfire to listed species, we recommend coordinating with the Hawai'i Wildfire Management Organization at (808) 850-0900 or admin@hawaiiwildfire.org, on how wildfire prevention can be addressed in the project area. When engaging in activities that have a high risk of starting a wildfire (i.e. welding in grass), it is recommended that you:

- *Wet down the area before starting your task,*
- *Continuously wet down the area as needed,*
- *Have a fire extinguisher on hand, and*
- *In the event that your vision is impaired, (i.e. welding goggles) have a spotter to watch for fire starts.*

The applicant will coordinate with Hawai'i Wildfire Management Organization and other local officials to mitigate the risks associated with wildfire hazards

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

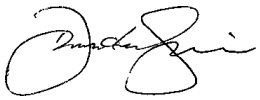
We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII



Dave Simpson
Planner

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA

DAWN N. S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA 'OIHANA KUMUWAIWAI 'ĀINA
LAND DIVISION

P.O. BOX 621
HONOLULU, HAWAII 96809

November 9, 2023

MEMORANDUM

FROM: ~~TO:~~ **DLNR Agencies:**
___Div. of Aquatic Resources
___Div. of Boating & Ocean Recreation
_X_ Engineering Division (DLNR.ENGR@hawaii.gov)
_X_ Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
___Div. of State Parks
_X_ Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
___Office of Conservation & Coastal Lands
_X_ Land Division – Maui District (daniel.l.ornellas@hawaii.gov)
_X_ Aha Moku Advisory Committee (leimana.k.damate@hawaii.gov)

TO: ~~FROM:~~ Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Pre-Assessment Consultation for EA for the Proposed **Waiohuli Economic Development Opportunities** Project
LOCATION: Makawao, Island of Maui; TMKs: (2) 2-2-028:181 and (2) 2-2-002:014
APPLICANT: PBR Hawaii & Associates, Inc. on behalf of Waiohuli Hawaiian Homestead Association Inc., and Department of Hawaiian Home Lands

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit any comments by **December 1, 2023.**

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Darlene Nakamura at darlene.k.nakamura@hawaii.gov. Thank you.

BRIEF COMMENTS:

( ) We have no objections.
( ) We have no comments.
( ) We have no additional comments.
(✓) Comments are included/attached.

Signed: *Carty S. Chang*
Print Name: Carty S. Chang, Chief Engineer
Division: Engineering Division
Date: Nov 28, 2023

Attachments
cc: Central File

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/Russell Y. Tsuji

Ref: Pre-Assessment Consultation for EA for the Proposed Waiohuli Economic Development Opportunities Project
Location: Makawao, Island of Maui
TMK(s): (2) 2-2-028:181 and (2) 2-2-002:014
Applicant: PBR Hawaii & Associates, Inc. on behalf of Waiohuli Hawaiian Homestead Association Inc., and Department of Hawaiian Home Lands

COMMENTS

The rules and regulations of the National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR), are in effect when development falls within a Special Flood Hazard Area (high-risk areas). State projects are required to comply with 44CFR regulations as stipulated in Section 60.12. Be advised that 44CFR, Chapter 1, Subchapter B, part 60 reflects the minimum standards as set forth by the NFIP. Local community flood ordinances may stipulate higher standards that can be more restrictive and would take precedence over the minimum NFIP standards.

The owner of the project property and/or their representative is responsible to research the Flood Hazard Zone designation for the project. Flood Hazard Zones are designated on FEMA's Flood Insurance Rate Maps (FIRM). The official FIRMs can be accessed through FEMA's Map Service Center (msc.fema.gov). Our Flood Hazard Assessment Tool (FHAT) (fhat.hawaii.gov) could also be used to research flood hazard information.

If there are questions regarding the local flood ordinances, please contact the applicable County NFIP coordinating agency below:

- Oahu: City and County of Honolulu, Department of Planning and Permitting (808) 768-8098.
- Hawaii Island: County of Hawaii, Department of Public Works (808) 961-8327.
- Maui/Molokai/Lanai County of Maui, Department of Planning (808) 270-7139.
- Kauai: County of Kauai, Department of Public Works (808) 241-4896.

The applicant should include water demands and infrastructure required to meet project needs. Please note that all State projects requiring water service from their local Department/Board of Water Supply system will be required to pay a resource development charge, in addition to Water Facilities Charges for transmission and daily storage.

The applicant is required to provide water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update projections.

Signed: 
CARTY S. CHANG, CHIEF ENGINEER

Date: Nov 28, 2023

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
Executive Vice-President / Principal

VINCENT SHIGEKUNI
Senior Vice-President / Principal

GRANT T. MURAKAMI, AICP, LEED® AP BD+C
Senior Vice-President / Principal

KIMI MIKAMI YUEN, LEED® AP BD+C
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CATIE CULLISON, AICP
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ANN MIKIKO BOUSLOG, PhD
Director of Land Economics & Real Estate

RAMSAY R. M. TAUM
Cultural Sustainability Planner

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C.R. 'IMIPONO WICHMAN
Associate

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Founding Partner

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Honolulu, Hawai'i 96813-3484
Tel: (808) 521-5631
Fax: (808) 523-1402
E-mail: sysadmin@pbrhawaii.com

printed on recycled paper

November 8, 2024

Carty Chang, Chief Engineer
State of Hawaii
DLNR - Engineering Division
P.O. Box 373
Honolulu HI 96809

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAIʻI
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Mr. Chang,

Thank you for your response letter dated November 28th, 2023 regarding the subject project. We acknowledge your comments below and provide the following responses.

The rules and regulations of the National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR), are in effect when development falls within a Special Flood Hazard Area (high-risk areas). State projects are required to comply with 44CFR regulations as stipulated in Section 60.12. Be advised that 44CFR, Chapter 1, Subchapter B, part 60 reflects the minimum standards as set forth by the NFIP. Local community flood ordinances may stipulate higher standards that can be more restrictive and would take precedence over the minimum NFIP standards.

The owner of the project property and/or their representative is responsible to research the Flood Hazard Zone designation for the project. Flood Hazard Zones are designated on FEMA's Flood Insurance Rate Maps (FIRM). The official FIRMs can be accessed through FEMA's Map Service Center (msc.fema.gov). Our Flood Hazard Assessment Tool (FHAT) (fhat.hawaii.gov) could also be used to research flood hazard information.

According to the Flood Insurance Rate Map (FIRM), prepared by the Federal Emergency Management Agency (FEMA), National Flood Insurance Program (NFIP), the Site is located within Zone X. Zone X indicates an area of minimal flood hazard with a less than 1 percent chance flood event. The proposed project will comply with all standards set forth by the NFIP and will further comply with any local community flood ordinances that may stipulate higher standards.

While development of the site under the potential full buildout scenario will increase the existing stormwater runoff due to addition of impervious surfaces, it is not anticipated to generate any adverse drainage effects on downstream properties and roadways. The proposed project has been designed to mitigate potential flooding-related impacts to the Project Site by preserving the natural drainageways formed by the gulches along the boundaries of the property.

Drainage improvements recommended by the preliminary engineering report include retention of runoff volume generated by the Project to reduce stormwater runoff into the downstream properties. Retention basins will also mitigate the potential for sediments contained in the runoff from impacting downstream properties and eventually the ocean. Additionally, a drainage system will include a series of grated drain inlets with drain lines to collect and convey surface stormwater into the gulches surrounding the Site. The proposed design also includes green spaces buffers following land contours along the boundary of the site to further protect existing drainageways.

See Sections 3.5.1 and 4.7.3 of the Draft Environmental Assessment for more detailed information on flooding hazards and drainage improvements proposed.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

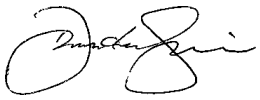
We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII



Dave Simpson
Planner

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

KENNETH S. HARA
MAJOR GENERAL
ADJUTANT GENERAL
KA 'AKUKANA KENELALA

STEPHEN F. LOGAN
BRIGADIER GENERAL
DEPUTY ADJUTANT GENERAL
KA HOPE 'AKUKANA KENELALA

STATE OF HAWAI'I
KA MOKU'ĀINA O HAWAI'I
DEPARTMENT OF DEFENSE
KA 'OIHANA PILI KAUA
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAI'I 96816-4495

November 28, 2023

Mr. Dave Simpson
PBR HAWAII & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484

SUBJECT: Pre-Assessment Consultation Environmental Assessment – Waiohuli Economic Development Opportunities, Makawao District, Maui Island, Hawaii
TMK: (2) 2-2-028:181 and (2) 2-2-002:014

Dear Mr. Simpson:

Thank you for the opportunity to comment on the above project. The State of Hawaii Department of Defense has no comments to offer relative to the project at this time.

Should there be any questions, please contact Mr. Tad T. Nakayama at 808-369-3490 or tad.t.nakayama@hawaii.gov.

Sincerely,

Shao Yu L. Lee, R.A.
Major, Hawaii National Guard
Chief Engineering Officer

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
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November 8, 2024

Shao Yu Lee, Contracting and Engineering Officer
State of Hawaii
Department of Defense
3949 Diamond Head Road
Honolulu HI 96816

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Captain Lee,

Thank you for your response letter dated November 28th, 2023 regarding the subject project. We acknowledge that the Department of Defense has no comments and the proposed project.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII

Dave Simpson
Planner

JOSH GREEN, M.D.
GOVERNOR

KEITH T. HAYASHI
SUPERINTENDENT

STATE OF HAWAI`I
DEPARTMENT OF EDUCATION
KA 'OIHANA HO'ONA'AUAO
P.O. BOX 2360
HONOLULU, HAWAI`I 96804

OFFICE OF FACILITIES AND OPERATIONS

December 1, 2023

Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813

Re: Pre-Assessment Consultation for a HRS Chapter 343 Environmental Assessment
Waiohuli Economic Development Opportunities, Makawao District, Island of Maui, Hawaii, TMKs (2)2-2-028:181, (2)2-2-002:014

Dear Mr. Simpson:

Thank you for your letter dated November 3, 2023. Based on the information provided, the proposed project will not impact Hawaii State Department of Education Facilities.

Should you have any questions, please contact Cori China of the Facilities Development Branch, Planning Section, at (808) 784-5080 or via email at cori.china@k12.hi.us.

We appreciate the opportunity to comment.

Sincerely,

Roy Ikeda
Interim Public Works Manager
Planning Section

RI:ctc

c: Facilities Development Branch

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
Executive Vice-President / Principal

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Tel: (808) 521-5631
Fax: (808) 523-1402
E-mail: sysadmin@pbrhawaii.com

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November 8, 2024

Roy Ikeda, Interim Public Works Manager
State of Hawaii
Department of Education
P.O. Box 2360
Honolulu HI 96804

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Mr. Ikeda,

Thank you for your response letter dated December 1st, 2023 regarding the subject project. We acknowledge that the proposed project will not impact Department of Education's facilities.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII

Dave Simpson
Planner

From: DOH.CABPDTSS
To: Dave Simpson
Subject: DOH-CAB Comments on the proposed Waiohuli Economic Development Opportunities Project
Date: Monday, November 20, 2023 1:40:17 PM

Subject: Environmental Assessment – Waiohuli Economic Development Opportunities

Agency: PBR HAWAII & Associates, Inc.
Mr. Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3483
dsimpson@pbrhawaii.com

Aloha,

Thank you for the opportunity to provide comments on the subject Environmental Assessment for The proposed Waiohuli Economic Development Opportunities. The Clean Air Branch would like to make the following comments on the subject Waiohuli Economic Development Opportunities Project:

- For construction activities associated with the project, the applicable provisions of Hawaii Administrative Rules §11-60.1-33 shall be followed to mitigate fugitive dust impacts.
- Also, please see our standard comments at:

https://health.hawaii.gov/cab/files/2022/05/Standard-Comments-for-Land-Use-Reviews-Clean-Air-Branch-2022-1.pdf

Please let us know if you have any questions or concerns.

Best regards,
Anna

Standard Comments for Land Use Reviews
Clean Air Branch
Hawaii State Department of Health

If your proposed project:

Requires an Air Pollution Control Permit

- You must obtain an air pollution control permit from the Clean Air Branch and comply with all applicable conditions and requirements. If you do not know if you need an air pollution control permit, please contact the Permitting Section of the Clean Air Branch.
- Permit application forms can be found here: https://health.hawaii.gov/cab/permit-application-forms/

Includes construction, demolition, or renovation activities that involve potential asbestos and lead containing materials:

- Asbestos may be present in any existing structure. Prior to demolition, you must contact the Indoor and Radiological Health Branch, Asbestos-Lead Section. Testing may be required to determine if building materials may contain asbestos, such as: drywall, vinyl floor tile, mastic, caulking, roofing materials, insulation, special coatings, etc.
- Structures built prior to 1980 may also contain lead paint. Prior to demolition, contact the Indoor and Radiological Health Branch, Asbestos-Lead Section. Testing may need to be conducted to determine if building materials contain lead.
- Some construction activities have the potential to create excessive noise and may require noise permits. For DOH Noise Permits and/or Variances and for more information on the Indoor and Radiological Health Branch, please visit: https://health.hawaii.gov/irhb/

Includes demolition of structures or land clearing

- Department of Health, Administrative Rule: Title 11, Chapter 26, Vector Control, Section 11-26-35, Rodents; Demolition of Structures and Clearing of Sites and Vacant Lots, requires that:
    - No person, firm or corporation shall demolish or clear any structure, site, or vacant lot without first ascertaining the presence or absence of rodents which may endanger the public health by dispersal from such premises.
    - Should such inspection reveal the presence of rodents, the person, firm, or corporation shall eradicate the rodents before demolishing or clearing the structure, site, or vacant lot.
    - The Department may conduct an independent inspection to monitor compliance, or request a written report.
- The purpose of this rule is to prevent rodents from dispersing into adjacent areas from infested buildings or vacant lands during demolition or land clearing.
- Contractors may either hire a pest control firm or do the job themselves with a qualified employee. Rodenticides must be inspected daily and replenished as necessary to provide a continuous supply for at least one week prior to the start of any work.

- To submit notifications or for more information, contract the Vector Control Branch: https://health.hawaii.gov/vcb/

Has the potential to generate fugitive dust

- You must reasonably control the generation of all airborne, visible fugitive dust. Note that construction activities that occur near to existing residences, businesses, public areas and major thoroughfares exacerbate potential dust concerns. It is recommended that a dust control management plan be developed which identifies and mitigates all activities that may generate airborne, visible fugitive dust. The plan, which does *not* require Department of Health approval, should help you recognize and minimize potential airborne, visible fugitive dust problems.
- Construction activities must comply with the provisions of Hawaii Administrative Rules, §11-60.1-33 on Fugitive Dust. In addition, for cases involving mixed land use, we strongly recommend that buffer zones be established, wherever possible, in order to alleviate potential nuisance complaints.
- You must provide reasonable measures to control airborne, visible fugitive dust from the road areas and during the various phases of construction. These measures include, but are not limited to, the following:
    - Planning the different phases of construction, focusing on minimizing the amount of airborne, visible fugitive dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;
    - Providing an adequate water source at the site prior to start-up of construction activities; Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;
    - Minimizing airborne, visible fugitive dust from shoulders and access roads;
    - Providing reasonable dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
    - Controlling airborne, visible fugitive dust from debris being hauled away from the project site.
- If you have questions about fugitive dust, please contact the Enforcement Section of the Clean Air Branch

Increases the population and potential number of vehicles in an area:

- The creation of apartment buildings, complexes, and residential communities may increase the overall population in an area. Increasing the population in an area may inadvertently lead to more air pollution via vehicle exhaust. Vehicle exhaust releases molecules in the air that negatively impact human health and air quality, as they are known lung irritants, carcinogens, and greenhouse gases.
- Ensure that residents keep their vehicle idling time to three (3) minutes or less.
- Provide bike racks and/or electric vehicle charging stations for residents.
- Ensure that there are sufficient and safe pedestrian walkways and crosswalks throughout and around the development.
- Conduct a traffic study to ensure that the new development does not significantly impact traffic in the area.

Clean Air Branch (808) 586-4200 cab@doh.hawaii.gov	Indoor Radiological Health Branch (808) 586-4700	Vector Control Branch (808) 586-4400

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printed on recycled paper

November 8, 2024

Marianne Rossio, P.E.
State of Hawaii
Department of Health Clean Air Branch
Hale Ola
2827 Waimano Home Rd #130
Pearl City HI 96782-1487

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Ms. Rossio,

Thank you for your response letter dated November 29th, 2023 regarding the subject project. We acknowledge your comments below and provide the following responses:

The Clean Air Branch would like to make the following comments on the subject Waiohuli Economic Development Opportunities Project:

- *For construction activities associated with the project, the applicable provisions of Hawaii Administrative Rules §11-60.1-33 shall be followed to mitigate fugitive dust impacts.*

The proposed project is not anticipated to have a significant impact on air quality locally or in the broader region. There may be some temporary impacts during construction but these are anticipated to be minimal and will be mitigated with best management practices (BMPs). The Applicant will comply with all applicable provisions under HAR §11-60.1-33 related to air quality control and will coordinate with relevant agencies.

Requires an Air Pollution Control Permit

- *You must obtain an air pollution control permit from the Clean Air Branch and comply with all applicable conditions and requirements. If you do not know if you need an air pollution control permit, please contact the Permitting Section of the Clean Air Branch.*
- *Permit application forms can be found here: https://health.hawaii.gov/cab/permit-application- forms*

The applicant will coordinate with the Department of Health to ensure compliance and obtain the pertinent air pollution control permits prior to construction.

Includes construction, demolition, or renovation activities that involve potential asbestos and lead containing materials

- *Prior to demolition, you must contact the Indoor and Radiological Health Branch, Asbestos-Lead Section. Testing may be required to determine if asbestos exists in any building materials, such as: drywall, vinyl floor tile, mastic, caulking, roofing materials, insulation, special coatings, etc.*
- *Structures built prior to 1980 may contain lead paint. Prior to demolition, contact the Indoor and Radiological Health Branch, Asbestos-Lead Section to determine if testing is needed to identify building materials that may contain lead.*

The applicant will coordinate with the Department of Health Indoor and Radiological Health Branch, Asbestos-Lead Section to ensure compliance and determination prior to construction. We do not anticipate hazardous materials will be present as the project area is undeveloped vacant land far from any potential land uses that could produce hazardous materials.

Has the potential to generate fugitive dust

- *You must reasonably control the generation of all airborne, visible fugitive dust. Note that construction activities that occur near to existing residences, businesses, public areas and major thoroughfares exacerbate potential dust concerns. It is recommended that a dust control management plan be developed which identifies and mitigates all activities that may generate airborne, visible fugitive dust. The plan, which does not require Department of Health approval, should help you recognize and minimize potential airborne, visible fugitive dust problems.*
- *Construction activities must comply with the provisions of Hawaii Administrative Rules, §11- 60.1-33 on Fugitive Dust. In addition, for cases involving mixed land use, we strongly recommend that buffer zones be established, wherever possible, in order to alleviate potential nuisance complaints.*
- *You must provide reasonable measures to control airborne, visible fugitive dust from the road areas and during the various phases of construction. These measures include, but are not limited to, the following:*
  - *Planning the different phases of construction, focusing on minimizing the amount of airborne, visible fugitive dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;*
  - *Providing an adequate water source at the site prior to start-up of construction activities; Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;*
  - *Minimizing airborne, visible fugitive dust from shoulders and access roads;*
  - *Providing reasonable dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and*
  - *Controlling airborne, visible fugitive dust from debris being hauled away from the project site.*
- *If you have questions about fugitive dust, please contact the Enforcement Section of the Clean Air Branch*

Mitigation measures related to short term air quality impacts during construction are provided in Section 4.4 of the Draft Environmental Assessment. To minimize fugitive dust impacts during construction, all construction activities will comply with all applicable provisions of HAR Title 11, Chapter 59, related to Ambient Air Quality Standards and HAR §11-60.1-33, related to Fugitive Dust. Long-term negative impacts related to air quality are not anticipated as construction equipment will utilize technology and standards which meet State and Federal air quality requirements.

Increases the population and potential number of vehicles in an area:

- *The creation of apartment buildings, complexes, and residential communities may increase the overall population in an area. Increasing the population in an area may inadvertently lead to more*

air pollution via vehicle exhaust. Vehicle exhaust releases molecules in the air that negatively impact human health and air quality, as they are known lung irritants, carcinogens, and greenhouse gases.

- *Ensure that residents keep their vehicle idling time to three (3) minutes or less.*
- *Provide bike racks and/or electric vehicle charging stations for residents.*
- *Ensure that there are sufficient and safe pedestrian walkways and crosswalks throughout and around the development*
- *Conduct a traffic study to ensure that the new development does not significantly impact traffic in the area.*

The proposed project has the potential for residential development in the future under the potential full buildout scenario, if desired by the Waiohuli community. The proposed project may result in a moderate population increase for the community by providing new homesteading opportunities for native Hawaiians on the Maui homestead waitlist. However, under a full-build out scenario, any increase in air pollution as a result of the proposed project will be negligible. The proposed project includes safe pedestrian pathways throughout the site under the potential full buildout. The Draft Environmental Assessment includes a detailed traffic study to evaluate potential traffic impacts in the surrounding area. See Section 4.7 and Appendix E of the DEA for more information on traffic.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

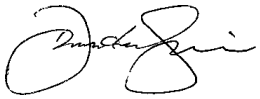
We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII



Dave Simpson
Planner

JOSH GREEN, M.D.
GOVERNOR OF HAWAI'I
KE KIA'ĀINA O KA MOKU'ĀINA 'O HAWAI'I

KENNETH S. FINK, MD, MGA, MPH
DIRECTOR OF HEALTH
KA LUNA HO'OKELE

Lorrin W. Pang, M.D., M.P.H.
District Health Officer

STATE OF HAWAI'I
DEPARTMENT OF HEALTH
KA 'OIHANA OLAKINO
Maui District Health Office
54 South High St. Rm. #300
Wailuku, HI 96793

November 29, 2023

Mr. Dave Simpson, Planner
PBR HAWAII & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813
dsimpson@pbrhawaii.com

Dear Mr. Simpson:

Subject: Pre-Assessment consultation for a HRS Chapter 343 Environmental Assessment-Waiohuli Economic Development Opportunities, Makawao District, Island of Maui, Hawaii. TMKs: (2) 2-2-028:181, (2) 2-2-002:014

Thank you for the opportunity to review this project. The Environmental Health Services Division has no comments to offer.
It is strongly recommended that the Standard Comments found at the Department's website: https://health.hawaii.gov/epo/landuse/ be reviewed and any comments specifically applicable to this project should be adhered to.

Should you have any questions, please contact me at patricia.kitkowski@doh.hawaii.gov or 808 984-8230.

Sincerely,

Patti Kitkowski
District Environmental Health Program Chief

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

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November 8, 2024

Patti Kitkowski, Program Chief
State of Hawaii
Department of Health, Maui District Health Office
54 South High Street Room 300
Wailuku HI 96793

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Ms. Kitkowski,

Thank you for your comments submitted electronically on November 29th, 2023 regarding the subject project. We acknowledge that the Department of Health, Environmental Health Services Division has no comments.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII

Dave Simpson
Planner

From:	Aragon, Michelle
To:	Dave Simpson
Subject:	EA Comment from SHWB Waiohuli Economic Development Opportunities
Date:	Friday, November 17, 2023 7:03:47 AM
Attachments:	11132023_Proposed Land Use.pdf STANDARD COMMENTS.pdf

Aloha,

Attached is our Comments to Waiohuli Economic Development Opportunities, Makawao District, Island of Maui.

Solid and Hazardous Waste Branch
State of Hawaii | Department of Health
2827 Waimano Home Road, #100, Pearl City, HI 96782
Phone Number: (808) 586-4226 | Fax Number: (808) 586-7509

Solid and Hazardous Waste Branch Standard Comments

November 26, 2018

The Solid and Hazardous Waste Branch administers programs in the areas of:

1) Management of hazardous waste;
2) Management of solid waste; and
3) Regulation of underground storage tanks.

Our general comments on projects are below. For further information about these programs, please contact the Solid and Hazardous Waste Branch at (808) 586-4226. All chapters of the Hawaii Revised Statutes (HRS) are at https://www.capitol.hawaii .gov/hrscurrent/.

Hazardous Waste Program

- The state regulations for hazardous waste and used oil are in chapters 11-260.1 to 11-279.1, Hawaii Administrative Rules (HAR) [http://health.hawaii.go v/shwb/hwrules/]. These rules apply to the identification, handling, transportation, storage, and disposal of regulated hazardous waste and used oil. Generators, transporters and treatment, storage, and disposal facilities of hazardous waste and used oil must adhere to these requirements. Violations are subject to penalties under chapter 342J, HRS.

Solid Waste Section

- The Solid Waste Section (SWS) enforces laws and regulations contained in chapters 342H and 3421, HRS, and chapter 11-58.1, HAR, "Solid Waste Management Control" [http://health.hawaii .gov/shwb/solid-waste/].

- The purpose of the rules is to establish minimum standards governing the design, construction, installation, operation, and maintenance of solid waste disposal, recycling, reclamation, and transfer systems.

- All facilities that accept solid wastes are required to obtain a solid waste management permit from the SWS. Examples of the types of facilities governed by these regulations include landfills, transfer stations and convenience centers, recycling facilities, composting facilities, and salvage facilities. Medical waste, infectious waste, and foreign waste treatment facilities are also included.

- Generators of solid waste are required to ensure that their wastes are properly delivered to permitted solid waste management facilities. Managers of construction and demolition projects should require their waste contractors to submit disposal receipts and invoices to ensure proper disposal of wastes.

Office of Solid Waste Management

- The Office of Solid Waste Management (OSWM) administers statewide integrated solid waste management planning activities, which apply to the counties, as well as various recycling programs, e.g., the Glass Advance Disposal Fee (ADF) and Deposit Beverage Container (DBC) Programs. Management of the DBC Program is conducted pursuant to chapter 342G, HRS, which contains compliance and enforcement provisions, and chapter 11-282, HAR, "Deposit Beverage Recycling" [http://health.hawaii.gov/hi5/rules-regulations- additional- links/]. OSWM is also responsible for limited enforcement and compliance of solid waste management facilities that operate primarily as certified DBC redemption centers pursuant to chapter 342H, HRS, and chapter 11-58.1, HAR, "Solid Waste Management Control" [http://health.hawaii.gov/shwb/solid-waste/]. Authority for the integrated solid waste management planning and ADF programs is contained in chapter 342G, HRS.

- Glass Advance Disposal Fee Program: Businesses that import glass containers into Hawaii are required to register with the Department of Health (DOH) and pay a 1.5 cent per container fee. Fee revenue is distributed to the counties for the operation of glass recycling programs.

- Deposit Beverage Container Program: Business that manufacture or import deposit beverage containers into Hawaii are required to register with the DOH and pay the five-cent deposit and one cent container fee on each deposit container. Deposits and fees are deposited into a special fund and are used to reimburse DBC redemption center refunds paid to consumers; and to pay handling fees to redemption/recycling companies to process and recycle collected deposit beverage containers; and to pay program administrative costs.

- The DOH reimburses and pays an associated handling fee for the redemption of DBC. These transactions are conducted only with certified redemption centers. Certification requires obtaining a solid waste management permit from the SWS (which addresses environmental issues) and a certification from the DBC program (which standardizes the redemption process).

- Chapter 342G, HRS, encourages the reduction of waste generation, reuse of discarded materials, and the recycling of solid waste. Businesses, property managers and developers, and government entities are highly encouraged to develop solid waste management plans to ensure proper handling of wastes and divert recyclables from being landfilled.

- Solid waste management plans seek to maximize waste diversion and minimize disposal. Such plans should include designated areas to promote the collection of reusable and recyclable materials.

Underground Storage Tank Program

- The state's underground storage tank (UST) regulations, found in chapter 11-280.1, HAR [http://health.hawaii.gov/shwb/underg round-storage-tanks /], include specific requirements that UST owners and operators must meet when installing, operating, and permanently closing their UST systems and addressing releases from USTs. Violations are subject to penalties under chapter 11-280.1, HAR, and chapter 342L, HRS.

- A permit is required prior to the installation and operation of a UST. Any new UST system that will be installed must have secondary containment with interstitial monitoring. Refer to subchapters 2, 3, 4, and 12 of chapter 11-280.1, HAR. The installation permit expires 1 year from the date of issuance. The operation permit expires 5 years from the date of issuance.

- §11-280.1-50, HAR, requires owners and operators of USTs or tank systems to notify DOH within 24) hours and follow the procedures in §11-280.1-52, HAR, if any of the following occur, with specific exceptions found in the rules:

  1) The discovery by any person of evidence of regulated substances which may have been released at the UST site or in the surrounding area (such as the presence of free product or vapors in soils, basements, sewer and utility lines, or nearby surface water);
  2) Unusual UST system operating conditions observed or experienced (such as the erratic behavior of product dispensing equipment, the sudden loss of product from the UST, or an unexplained presence of water in the tank); or
  3) Monitoring results from a release detection method required under §§11-280.1-41 or 11-280 .1-42 indicate a release may have occurred.

- For release response actions, responsible parties and their consultants and contractors should follow the applicable guidance in the DOH, Hazard Evaluation Emergency (HEER) Office Technical Guidance Manual, HEER Environmental Action Level (EAL) guidance, and other guidance documents on the DOH HEER Office website [http://eha- web.doh.hawaii.gov /eha-cma/Org/HEER/], including those pertaining to Multi-Increment Sampling of soil, low flow groundwater sampling, soil vapor sampling, and Environmental Hazard Evaluations /Environmental Hazard Management Plans.

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November 8, 2024

Lene Ichinotsubo, Chief
State of Hawaii
Department of Health Solid & Hazardous Waste Branch
2827 Waimano Home Rd #100
Pearl City, HI 96782

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Ms. Ichinotsubo,

Thank you for your comments submitted electronically on November 17th, 2023 regarding the subject project. We acknowledge your comments below and provide the following responses.

Hazardous Waste Program

- *The state regulations for hazardous waste and used oil are in chapters 11-260.1 to 11-279.1, Hawaii Administrative Rules (HAR) [http://health.hawaii.gov/shwb/hwrules/]. These rules apply to the identification, handling, transportation, storage, and disposal of regulated hazardous waste and used oil. Generators, transporters and treatment, storage, and disposal facilities of hazardous waste and used oil must adhere to these requirements. Violations are subject to penalties under chapter 342J, HRS.*

The Applicant will comply with all applicable provisions under HAR §11-260.1 to 11-279.1 related to hazardous waste and will coordinate with relevant agencies.

Solid Waste Section

- *The Solid Waste Section (SWS) enforces laws and regulations contained in chapters 342H and 3421, HRS, and chapter 11-58.1, HAR, "Solid Waste Management Control" [http://health.hawaii .gov/shwb/solid-waste/].*
- *The purpose of the rules is to establish minimum standards governing the design, construction, installation, operation, and maintenance of solid waste disposal, recycling, reclamation, and transfer systems.*
- *All facilities that accept solid wastes are required to obtain a solid waste management permit from the SWS. Examples of the types of facilities governed by these regulations include landfills, transfer stations and convenience centers, recycling facilities, composting facilities, and salvage facilities. Medical waste, infectious waste, and foreign waste treatment facilities are also included.*

- *Generators of solid waste are required to ensure that their wastes are properly delivered to permitted solid waste management facilities. Managers of construction and demolition projects should require their waste contractors to submit disposal receipts and invoices to ensure proper disposal of wastes.*

The proposed project will ensure that any solid waste generated both during construction and after completion will properly delivered to permitted solid waste management facilities. During construction, all solid waste materials will be properly handled and contractors will follow all applicable requirements to submit disposal receipts and invoices to ensure proper disposal of wastes. Under the potential full buildout scenario, the project will create adequate accommodations to manage solid waste generated within the site and facilitate disposal in compliance with applicable laws and regulations.

Office of Solid Waste Management

- *The Office of Solid Waste Management (OSWM) administers statewide integrated solid waste management planning activities, which apply to the counties, as well as various recycling programs, e.g., the Glass Advance Disposal Fee (ADF) and Deposit Beverage Container (DBC) Programs. Management of the DBC Program is conducted pursuant to chapter 342G, HRS, which contains compliance and enforcement provisions, and chapter 11-282, HAR, "Deposit Beverage Recycling" [http://hea lth.hawaii.gov/hi5 /rules-regulationsadditional- links/]. OSWM is also responsible for limited enforcement and compliance of solid waste management facilities that operate primarily as certified DBC redemption centers pursuant to chapter 342H, HRS, and chapter 11-58.1, HAR, "Solid Waste Management Control" [http://health.hawaii.gov/shwb/solid-waste/]. Authority for the integrated solid waste management planning and ADF programs is contained in chapter 342G, HRS*
- *Glass Advance Disposal Fee Program: Businesses that import glass containers into Hawaii are required to register with the Department of Health (DOH) and pay a 1.5 cent per container fee. Fee revenue is distributed to the counties for the operation of glass recycling programs.*
- *Deposit Beverage Container Program: Business that manufacture or import deposit beverage containers into Hawaii are required to register with the DOH and pay the five-cent deposit and one cent container fee on each deposit container. Deposits and fees are deposited into a special fund and are used to reimburse DBC redemption center refunds paid to consumers; and to pay handling fees to redemption/recycling companies to process and recycle collected deposit beverage containers; and to pay program administrative costs.*
- *The DOH reimburses and pays an associated handling fee for the redemption of DBC. These transactions are conducted only with certified redemption centers. Certification requires obtaining a solid waste management permit from the SWS (which addresses environmental issues) and a certification from the DBC program (which standardizes the redemption process).*
- *Chapter 342G, HRS, encourages the reduction of waste generation, reuse of discarded materials, and the recycling of solid waste. Businesses, property managers and developers, and government entities are highly encouraged to develop solid waste management plans to ensure proper handling of wastes and divert recyclables from being landfilled.*
- *Solid waste management plans seek to maximize waste diversion and minimize disposal. Such plans should include designated areas to promote the collection of reusable and recyclable materials.*

We acknowledge your comments on solid waste management planning activities and the information on various recycling programs. Under the potential full buildout scenario, the project will encourage the reduction of waste generation, reuse of discarded materials, and the recycling of solid waste within the site and will evaluate opportunities to integrate participation in waste diversion programs.

Underground Storage Tank Program

- *The state's underground storage tank (UST) regulations, found in chapter 11-280.1, HAR [http://health.hawaii.gov/shwb/underg round-storage-tanks /], include specific requirements that UST owners and operators must meet when installing, operating, and permanently closing their UST systems and addressing releases from USTs. Violations are subject to penalties under chapter 11-280.1, HAR, and chapter 342L, HRS.*
- *A permit is required prior to the installation and operation of a UST. Any new UST system that will be installed must have secondary containment with interstitial monitoring. Refer to subchapters 2, 3, 4, and 12 of chapter 11-280.1, HAR. The installation permit expires 1 year from the date of issuance. The operation permit expires 5 years from the date of issuance.*
- *§11-280.1-50, HAR, requires owners and operators of USTs or tank systems to notify DOH within 24) hours and follow the procedures in §11-280.1-52, HAR, if any of the following occur, with specific exceptions found in the rules:*
  1. *The discovery by any person of evidence of regulated substances which may have been released at the UST site or in the surrounding area (such as the presence of free product or vapors in soils, basements, sewer and utility lines, or nearby surface water);*
  2. *Unusual UST system operating conditions observed or experienced (such as the erratic behavior of product dispensing equipment, the sudden loss of product from the UST, or an unexplained presence of water in the tank); or*
  3. *Monitoring results from a release detection method required under §§11-280.1-41 or 11-280 .1-42 indicate a release may have occurred*
- *For release response actions, responsible parties and their consultants and contractors should follow the applicable guidance in the DOH, Hazard Evaluation Emergency (HEER) Office Technical Guidance Manual, HEER Environmental Action Level (EAL) guidance, and other guidance documents on the DOH HEER Office website [http://ehaweb.doh.hawaii.gov /eha-cma/Org/HEER/], including those pertaining to Multi-Increment Sampling of soil, low flow groundwater sampling, soil vapor sampling, and Environmental Hazard Evaluations /Environmental Hazard Management Plans.*

The Applicant will comply with all applicable provisions under HAR §11-280.1 related to underground storage tanks that may be implemented under the potential full buildout scenario and will coordinate with relevant agencies.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

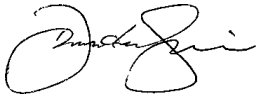
We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII



Dave Simpson
Planner

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

EDWIN H. SNIFFEN
DIRECTOR
KA LUNA HO'OKELE

Deputy Directors
Nā Hope Luna Ho'okele
DREANALEE K. KALILI
TAMMY L. LEE
ROBIN K. SHISHIDO

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF TRANSPORTATION | KA 'OIHANA ALAKAU
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

DIR 0809
STP 8.3684

December 1, 2023

VIA EMAIL: dsimpson@pbrhawaii.com

Mr. Dave Simpson, Planner
PBR HAWAII & Associates, Inc,
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813

Dear Mr. Simpson:

Subject: Pre-Assessment Consultation for an Environmental Assessment
Waiohuli Economic Development Opportunities
Makawao, Maui, Hawaii
Tax Map Keys: (2) 2-2-028:181; 2-2-002:014

Thank you for your letter dated November 3, 2023, requesting the Hawaii Department of Transportations (HDOT) pre-assessment review and comments on the subject Waiohuli Economic Development Opportunities (WE DO) project. HDOT understands that the Waiohuli Hawaiian Homestead Association and Pueo Development LLC is collaborating to construct a master plan development with community-based job opportunities. The WE DO project will be constructed on a 150-acre site and include Community Support Training Facilities, Infrastructure Training Sites, Agricultural Development Training Sites, Renewable Energy Development and Training Sites, and Natural Drainage Gulch Areas. The project site will be accessed via Lauie Drive which connects to Kula Highway (State Route 37).

HDOT has the following comments:

1. The upcoming Draft Environmental Assessment (DEA) should confirm where the proposed access points will be if there are more than one.

2. An evaluation should be provided in the upcoming DEA which determines if the proposed land use, typical trip patterns and activities will have any direct or local impacts on the nearby Kula Highway. If relevant, a Traffic Assessment shall be included and prepared by a traffic engineer licensed in the State of Hawaii. The study should also include any recommendations for mitigation measures to be implemented by the development.

Please submit any subsequent land use entitlement-related requests for review or correspondence to the HDOT Land Use Intake email address at DOT.LandUse@hawaii.gov.

If there are any questions, please contact Mr. Blayne Nikaido, Planner, Land Use Section of the HDOT Statewide Transportation Planning Office at (808) 831-7979 or via email at blayne.h.nikaido@hawaii.gov.

Sincerely,

EDWIN H. SNIFFEN
Director of Transportation

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
Executive Vice-President / Principal

VINCENT SHIGEKUNI
Senior Vice-President / Principal

GRANT T. MURAKAMI, AICP, LEED® AP BD+C
Senior Vice-President / Principal

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Vice-President / Principal

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DACHENG DONG, LEED® AP
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NATHALIE RAZO
Associate Principal

ANN MIKIKO BOUSLOG, PhD
Director of Land Economics & Real Estate

RAMSAY R. M. TAUM
Cultural Sustainability Planner

ETSUYO KILA
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C.R. 'IMIPONO WICHMAN
Associate

THOMAS S. WITTEN, FASLA
Chairman Emeritus

W. FRANK BRANDT, FASLA
Founding Partner

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Tel: (808) 521-5631
Fax: (808) 523-1402
E-mail: sysadmin@pbrhawaii.com

printed on recycled paper

November 8, 2024

Ed Sniffen, Director
State of Hawaii
Department of Transportation
Ali'iaimoku Hale
869 Punchbowl Street Room 509
Honolulu HI 96813

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Mr. Sniffen,

Thank you for your response letter dated December 1st, 2023 regarding the subject project (File NO. DIR0809, STP8.3684). We acknowledge your comments below and provide the following responses.

1. *The upcoming Draft Environmental Assessment (DEA) should confirm where the proposed access points will be if there are more than one.*

Direct access to the project site will be provided via connection to Lau'ie Drive where it terminates near the existing Waiohuli Community Center. This is the one access point proposed for the site. Under a potential full buildout, the design will include an extension of Lau'ie Drive into the Site, which will ultimately offer vehicular access to Kula Highway to the east. More detailed information on transportation and access is provided in Section 4.6.1 and Appendix E of the Draft Environmental Assessment.

2. *An evaluation should be provided in the upcoming DEA which determines if the proposed land use, typical trip patterns and activities will have any direct or local impacts on the nearby Kula Highway. If relevant, a Traffic Assessment shall be included and prepared by a traffic engineer licensed in the State of Hawaii. The study should also include any recommendations for mitigation measures to be implemented by the development.*

A Traffic Impact Analysis Report (TIAR) was conducted by Austin, Tsutsumi & Associates, Inc. to analyze the potential impacts of the proposed project to the surrounding transportation system, including roadways, traffic patterns, and pedestrian and bicycle facilities. The analysis includes assessment of how the proposed land uses and trip patterns generated by the project could have direct or local impacts on Kula Highway, as well as recommendations to address these impacts. See Section 4.6.1 and Appendix E of the Draft Environmental Assessment for more detailed information on transportation.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

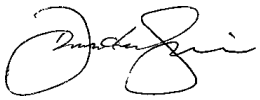
We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII



Dave Simpson
Planner

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF PUBLIC SAFETY
Ka 'Oihana Ho'opalekana Lehulehu
1177 Alakea Street
Honolulu, Hawai'i 96813

TOMMY JOHNSON
DIRECTOR

Melanie Martin
Deputy Director
Administration

Sanna Muñoz
Deputy Director
Corrections

Mark M. Hanohano
Deputy Director
Law Enforcement

No. 2023-2026

November 21, 2023

PBR HAWAII & Associates, Inc
ATTN: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, Hawai'i 96813-3484

Dear Mr. Simpson

Subject: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT 0 WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I TMKs (2) 2-2-028:181, (20) 2-2-002:014

In response to your letter dated November 3, 2023, we reviewed the proposed project in Makawao, Maui, and have no comments at this time.

If you or your staff have any questions, please contact Mr. Wayne Takara, Chief Planner, at 808-587-3463 or email wayne.j.takara@hawaii.gov.

Sincerely,

Tommy Johnson
Director

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
Executive Vice-President / Principal

VINCENT SHIGEKUNI
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November 8, 2024

Tommy Johnson, Director
State of Hawaii
Department of Public Safety
1177 Alakea Street Suite 300
Honolulu HI 96813

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Mr. Johnson,

Thank you for your response letter dated November 21st, 2023 regarding the subject project (File No. 2023-2026). We acknowledge that the Department of Public Safety has no comments.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII

Dave Simpson
Planner

STATE OF HAWAIʻI
OFFICE OF PLANNING
& SUSTAINABLE DEVELOPMENT

235 South Beretania Street, 6th Floor, Honolulu, Hawaiʻi 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaiʻi 96804

JOSH GREEN, M.D.
GOVERNOR

SYLVIA LUKE
LT. GOVERNOR

MARY ALICE EVANS
INTERIM DIRECTOR

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: https://planning.hawaii.gov/

Coastal Zone Management Program

Environmental Review Program

Land Use Commission

Land Use Division

Special Plans Branch

State Transit-Oriented Development

Statewide Geographic Information System

Statewide Sustainability Branch

DTS202311081042NA

December 5, 2023

PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813-3484

Dear Mr. Simpson:

Subject: Chapter 343 HRS, Pre-Assessment Consultation for
Waiohuli Economic Development Opportunities
TMK Nos. (2) 2-2-028:181; and (2) 2-2-002:014
Makawao, Maui

Thank you for the opportunity to comment on the subject Pre-Assessment Consultation.

The Project Site and Proposed Project

The State Department of Hawaiian Home Lands (DHHL) proposes the construction of a master plan development with a community-based job training component in Makawao. The project is a public-private collaboration with the Waiohuli Hawaiian Homestead Association, Inc. (WHHA) and Pueo Development LLC.

The proposed development encompasses a total of 150 acres straddling portions of two lots in the State Agricultural District. Soils on the project site are rated "C" on the Land Study Bureau's productivity classification system. Surrounding agricultural lands are rated "E". DHHL's Waiohuli Hawaiian Homesteads is located to the east of the site, with the existing Waiohuli Community Center to the southeast. Access to the site would be through an extension of Lauie Drive from the Waiohuli Hawaiian Homesteads. Kula Highway, State Route 37, runs roughly parallel to the eastern edge of the site, approximately 1.2 miles away. Portions of land along the eastern side of the Highway are in the State Rural District. Further south along Kula Highway, approximately 1.7 miles from the project site, is Keokea town and the Kula Hospital in the State Urban District.

The project site plan designates five separate use areas, four for development and job training and one as a green space buffer. These are:

1. Community Support Training Facilities (6 acres). This area would complement the existing Waiohuli Community Center with community facilities and social services. Potential uses include recreational spaces, educational and workforce training facilities, multi-purpose spaces, and health and wellness facilities. The facilities could also serve any desired future community growth within the site.

2. Infrastructure Training Sites (31 acres). Several areas throughout the site are designated to support job training for infrastructure construction. Training site areas include areas for water source development with potential yield and pumping capacity to support build out of the site in the future, and a wastewater treatment plant for the proposed uses to serve the community support facilities and with the capacity to serve future single-, multi-family, and kupuna housing growth.

3. Agricultural Development Training Sites (42 acres). These areas provide land for agricultural industry educational and job training facilities. Agriculture cultivated in the areas would be a resource to the community and offer economic opportunities for commercial development to generate revenue for the Waiohuli community and potential future community growth within the site.

4. Renewable Energy Development/Training Sites (26 acres). This area is planned for training on renewable energy development that could also support potential future growth on the site and the neighboring communities.

5. Natural Drainage Gulch Areas (45 acres). This consists of a contiguous natural green space corridor around the perimeter of the site.

OPSD Comment

The Office of Planning and Sustainable Development has the following comments:

1. Although the project is framed as an economic development and job training venture, future permanent development features appear to be anticipated once the training is complete, e.g., community facilities, potable water supply and wastewater treatment facilities, commercial agriculture, and renewable energy facilities. The Environmental Assessment (EA) should disclose the location and amount of the site designated for each use to be used for job training and to be set aside for permanent facilities.

2. The EA should identify the entity(s) anticipated to conduct the job training, their qualifications, the source of trainees (Waiohuli Homestead beneficiaries, DHHL beneficiaries in general, or others), and training hours and duration. The training will likely result in impacts to the land that may need mitigation in the short- and long-term. The proposed mitigation should be described.

3. The EA should also discuss the potential expansion of the Waiohuli Homesteads with residential and agricultural lots in the project area as this is implied in the description of the training sites.

Please contact Aaron Setogawa at (808) 587-2883 or email aaron.h.setogawa@hawaii.gov if you have any questions.

Mahalo,

Mary Alice Evans

Mary Alice Evans
Interim Director

PBR HAWAII
& ASSOCIATES, INC.

R. STAN DUNCAN, ASLA
President / Chairman

RUSSELL Y. J. CHUNG, FASLA
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E-mail: sysadmin@pbrhawaii.com

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November 8, 2024

Mary Alice Evans, Director
State of Hawaii
Office of Sustainable Planning and Development
235 S. Beretania Street Suite 702
Honolulu HI 96813

SUBJECT: PRE-ASSESSMENT CONSULTATION FOR A HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Ms. Evans,

Thank you for your response letter dated December 5th, 2023 regarding the subject project (File No. DTS 202311081042NA). We acknowledge your comments below and provide the following responses.

1. *Although the project is framed as an economic development and job training venture, future permanent development features appear to be anticipated once the training is complete, e.g., community facilities, potable water supply and wastewater treatment facilities, commercial agriculture, and renewable energy facilities. The Environmental Assessment (EA) should disclose the location and amount of the site designated for each use to be used for job training and to be set aside for permanent facilities.*

To clarify, the economic development opportunities, and specifically capacity building opportunities are proposed to be realized through both construction and operation of the development phases. For example, construction trades apprenticeships may help to build a facility such as kūpuna housing while administrative, medical technician, and professional care giving learning opportunities provided through the operation of the facility.

2. *The EA should identify the entity(s) anticipated to conduct the job training, their qualifications, the source of trainees (Waiohuli Homestead beneficiaries, DHHL beneficiaries in general, or others), and training hours and duration. The training will likely result in impacts to the land that may need mitigation in the short- and long-term. The proposed mitigation should be described.*

The Draft Environmental Assessment provides detailed information on both short and long term land use impacts and mitigation measures under the potential full buildout scenario. Training opportunities will be sought throughout the construction and operations of the community and its component elements.

3. *The EA should also discuss the potential expansion of the Waiohuli Homesteads with residential and agricultural lots in the project area as this is implied in the description of the training sites.*

The Draft Environmental Assessment acknowledges the DHHL Beneficiary demand for additional housing in upcountry Maui (see Section 5 of the DEA which includes discussion on DHHL land use conformance). It is anticipated that the WE DO development will help to satisfy a portion of this demand and outlines a specific full buildout scenario for estimation of infrastructure required and evaluation of impacts. Please see Appendix F, the Preliminary Engineering Report. The full buildout scenario described in the Draft EA represents the most intensive anticipated development, so as to calculate infrastructure needs.

We will include you in future correspondence as we seek further input on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.

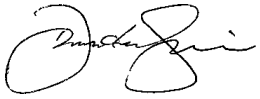
We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Draft Environmental Assessment.

Please provide any future comments to the following address:

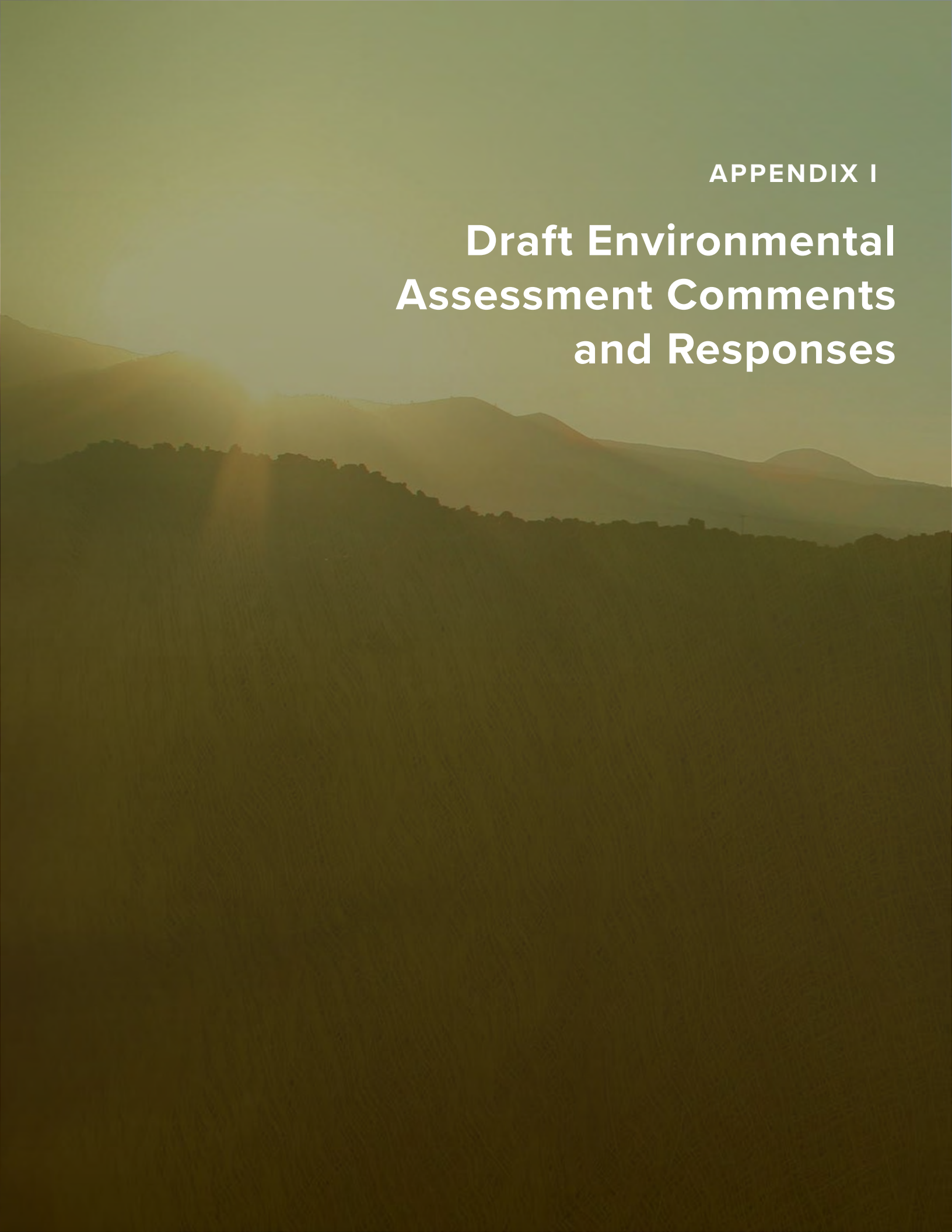
PBR HAWAII & Associates, Inc.
Attn: Dave Simpson
1001 Bishop Street, Suite 650
Honolulu, HI 96813-3484
dsimpson@pbrhawaii.com

Sincerely,

PBR HAWAII



Dave Simpson
Planner



APPENDIX I

Draft Environmental Assessment Comments and Responses

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

KEITH A. REGAN
COMPTROLLER
KA LUNA HO'OMALU HANA LAULĀ

MEOH-LENG SILLIMAN
DEPUTY COMPTROLLER
KA HOPE LUNA HO'OMALU HANA LAULĀ

STATE OF HAWAI'I | KA MOKU'ĀINA O HAWAI'I
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES | KA 'OIHANA LOIHELU A LAWELAWE LAULĀ
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)24.237

DEC 09 2024

Dave Simpson, Planner
PBR HAWAII & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813-3484

Dear Dave Simpson:

Subject: Draft Environmental Assessment
Waiohuli Economic Development Opportunities
Makawao District, Island of Maui, Hawaii
TMK# (2) 2-2-028:181 (por.), (2) 2-2-002:014 (por.)

Thank you for the opportunity to comment on the subject project. We have no comments to offer at this time as the proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities.

If you have any questions, your staff may call Dora Choy-Johnson of the Planning Branch at (808) 586-0488.

Sincerely,

GORDON S. WOOD
Public Works Administrator

DC:sn
c: Jeff Pearson, DAGS-MDO

PBR HAWAII
& ASSOCIATES, INC.

KIMI MIKAMI YUEN, LEED® AP BD+C
President / Chairperson

VINCENT SHIGEKUNI
Executive Vice-President / Principal

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Principal Emeritus

THOMAS S. WITTEN, FASLA
Principal Emeritus

W. FRANK BRANDT, FASLA
Founding Partner

February 8, 2025

Gordon S. Wood
State of Hawai‘i
Department of Accounting & General Services
P.O. Box 119
Honolulu HI 96810

SUBJECT: CHAPTER 343, HRS DRAFT ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI‘I
TMKs (2) 2-2-028:181 (portion), (2) 2-2-002:014 (portion)

Aloha Mr. Wood,

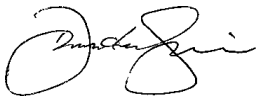
Thank you for your comment letter dated December 9, 2024, regarding the subject project (File No. (P)24.237). We acknowledge that the Department of Accounting and General Services (DAGS) has no comments and that the proposed project will not impact any DAGS projects or existing facilities.

We will include you in future correspondence regarding updates on the proposed project throughout the environmental review process in compliance with Chapter 343, HRS.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Final Environmental Assessment.

Sincerely,

PBR HAWAII



Dave Simpson
Planner

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Tel: (808) 521-5631
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STATE OF HAWAIʻI
OFFICE OF PLANNING
& SUSTAINABLE DEVELOPMENT

235 South Beretania Street, 6th Floor, Honolulu, Hawaiʻi 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaiʻi 96804

JOSH GREEN, M.D.
GOVERNOR

SYLVIA LUKE
LT. GOVERNOR

MARY ALICE EVANS
DIRECTOR

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: https://planning.hawaii.gov/

DTS202411121056NA

Coastal Zone Management Program

Environmental Review Program

Land Use Commission

Land Use Division

Special Plans Branch

State Transit-Oriented Development

Statewide Geographic Information System

Statewide Sustainability Branch

December 6, 2024

Dave Simpson, Planner
PBR HAWAII & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, Hawaiʻi 96813-3484

Dear Mr. Simpson:

Subject: Draft Environmental Assessment for
Waiohuli Economic Development Opportunities
Tax Map Key Nos.:
(2) 2-2-028:181 (portion); and (2) 2-2-002:014 (portion)
Makawao, Maui

Thank you for the opportunity to comment on the subject Draft Environmental Assessment – A Finding of No Significant Impact (DEA-AFONSI).

The Office of Planning and Sustainable Development has reviewed the DEA-AFONSI and has no further comments for the Final EA.

Please contact Aaron Setogawa at (808) 587-2883 or email aaron.h.setogawa@hawaii.gov if you have any questions. If you wish to respond to this comment letter, please include DTS202411121056NA in the subject line.

Mahalo,

Mary Alice Evans

Mary Alice Evans
Director

PBR HAWAII
& ASSOCIATES, INC.

KIMI MIKAMI YUEN, LEED® AP BD+C
President / Chairperson

VINCENT SHIGEKUNI
Executive Vice-President / Principal

GRANT T. MURAKAMI, AICP, LEED® AP BD+C
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Associate

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Chairman Emeritus

RUSSELL Y. J. CHUNG, PLA, FASLA
Principal Emeritus

THOMAS S. WITTEN, FASLA
Principal Emeritus

W. FRANK BRANDT, FASLA
Founding Partner

February 8, 2025

Mary Alice Evans, Director
State of Hawai‘i
Office of Sustainable Planning and Development
235 S. Beretania Street, Suite 702
Honolulu HI 96813

SUBJECT: CHAPTER 343, HRS DRAFT ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI‘I
TMKs (2) 2-2-028:181 (portion), (2) 2-2-002:014 (portion)

Aloha Ms. Evans,

Thank you for your comment letter dated December 6, 2024, regarding the subject project (File No. DTS 202411121056NA). We acknowledge that the Office of Planning and Sustainable Development (OPSD) has no further comments to add to the initial comments provided during the pre-consultation process.

We will include you in future correspondence regarding updates on the proposed project throughout the environmental review process in compliance with Chapter 343, HRS.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Final Environmental Assessment.

Sincerely,

PBR HAWAII

Dave Simpson
Planner

1001 Bishop Street, Suite 650
Honolulu, Hawai'i 96813-3484
Tel: (808) 521-5631
Fax: (808) 523-1402
E-mail: sysadmin@pbrhawaii.com

JOSH GREEN, M.D.
GOVERNOR

KEITH T. HAYASHI
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
KA 'OIHANA HO'ONA'AUAO
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

OFFICE OF FACILITIES AND OPERATIONS

November 27, 2024

Mr. Dave Simpson
PBR Hawaii & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813

Re: Draft Environmental Assessment (DEA) for the Waiohuli Economic Development Opportunities

Dear Mr. Simpson:

Thank you for your letter dated November 8, 2024. Based on the information provided for this project, we currently do not have any comments to provide at this time.

Should you have any questions, please contact Cori China, Professional Worker, of the Facilities Development Branch, Planning Section, at (808) 784-5080 or via email at cori.china@k12.hi.us.

We appreciate the opportunity to comment.

Sincerely,

Roy Ikeda
Interim Public Works Manager
Planning Section

RI:ctc
c: Facilities Development Branch

PBR HAWAII
& ASSOCIATES, INC.

KIMI MIKAMI YUEN, LEED® AP BD+C
President / Chairperson

VINCENT SHIGEKUNI
Executive Vice-President / Principal

GRANT T. MURAKAMI, AICP, LEED® AP BD+C
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February 8, 2025

Roy Ikeda, Interim Public Works Manager
State of Hawai'i
Department of Education
P.O. Box 2360
Honolulu HI 96804

SUBJECT: CHAPTER 343, HRS DRAFT ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181, (2) 2-2-002:014

Aloha Mr. Ikeda,

Thank you for your comment letter dated November 27, 2024, regarding the subject project. We acknowledge that the Department of Education (DOE) has no comments on the project at this time.

We will include you in future correspondence regarding updates on the proposed project throughout the environmental review process in compliance with Chapter 343, HRS.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Final Environmental Assessment.

Sincerely,

PBR HAWAII

Dave Simpson
Planner

From: DOH.CABPDTSS
To: Dave Simpson
Subject: DOH-CAB"s comments on Review Request
Date: Friday, November 15, 2024 8:17:13 AM

Thank you for your notice regarding a DEA for the Waiohuli Economic Development Opportunities. We have updated our system and our policy.

Please find CAB website including our standard comments for Land Use Reviews below:
https://health.hawaii.gov/cab/clean-air-branch/standard-comments-for-land-use-reviews/

Thank you so much for your understanding.

Anna

Anna Gardner
Program Specialist | Clean Air Branch
Hawai'i State Department of Health | Ka 'Oihana Olakino
2827 Waimano Home Road #130 | Pearl CIty, HI 96782
Office: (808) 586-4200

JOSH GREEN, M.D.
GOVERNOR OF HAWAI'I
KE KIA'ĀINA O KA MOKU'ĀINA 'O HAWAI'I

KENNETH S. FINK, MD, MGA, MPH
DIRECTOR OF HEALTH
KA LUNA HO'OKELE

STATE OF HAWAII
DEPARTMENT OF HEALTH
KA 'OIHANA OLAKINO
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
File:

24-288A CAB

July 3, 2024

MEMORANDUM

TO: Agencies and Project Owners

FROM: MARIANNE ROSSIO, P.E., CHIEF
Clean Air Branch

SUBJECT: Clean Air Branch Standard Project Comments

This memo is provided for your information and sharing. You are encouraged to share this memo with your project partners, team members, and appropriate personnel.

The Department of Health (DOH), Clean Air Branch (CAB), will no longer be responding directly to requests for comments on the following documents (including pre-consultation, early consultation, preparation notice, draft, final, addendums, and/or supplements):

- Environmental Impact Statements (EIS)
- Environmental Assessments (EA)
- Anticipated Finding of No Environmental Significant Impacts (AFONSI)
- Conservation District Use Applications (CDUA)
- Special Management Area Permits (SMAP)

For agencies or project owners requiring DOH-CAB comments on one or more of these documents, please utilize the DOH-CAB Standard Comments below regarding your project's responsibilities to maintain air quality and any necessary permitting. DOH-CAB Standard Comments are also available on the DOH-CAB website located at: https://health.hawaii.gov/cab/files/2024/07/Standard-Comments-for-Land-Use-Reviews-Clean-Air-Branch-July_2024.pdf.

If you have any questions, please the Clean Air Branch at (808) 586-4200.

CH:rkb

Standard Comments for Land Use Reviews
Clean Air Branch
Hawaii State Department of Health
July 3, 2024

All project activities shall comply with Hawaii Administrative Rules (HAR), Chapter 11-59 and 11-60.1.

If your proposed project:

Requires an Air Pollution Control Permit

- You must obtain an air pollution control permit from the Clean Air Branch and comply with all applicable conditions and requirements. If you do not know if you need an air pollution control permit, please contact the Permitting Section of the Clean Air Branch.
- Permit application forms can be found here: https://health.hawaii.gov/cab/permit-application- forms/

Has the potential to generate fugitive dust

- You must reasonably control the generation of all airborne, visible fugitive dust. Note that construction activities that occur near existing residences, businesses, public areas and major thoroughfares exacerbate potential dust concerns. It is recommended that a dust control management plan be developed which identifies and mitigates all activities that may generate airborne, visible fugitive dust. The plan, which does *not* require Department of Health approval, should help you recognize and minimize potential airborne, visible fugitive dust problems.
- Construction activities must comply with the provisions of Hawaii Administrative Rules, §11- 60.1-33 on Fugitive Dust. In addition, for cases involving mixed land use, it is strongly recommended that buffer zones be established, wherever possible, in order to alleviate potential dust concerns.
- You must provide reasonable measures to control airborne, visible fugitive dust from the road areas and during the various phases of construction. These measures include, but are not limited to, the following:
  - Planning the different phases of construction, focusing on minimizing the amount of airborne, visible fugitive dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;
  - Providing an adequate water source at the site prior to start-up of construction activities;
  - Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;
  - Minimizing airborne, visible fugitive dust from shoulders and access roads;
  - Providing reasonable dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
  - Controlling airborne, visible fugitive dust from debris being hauled away from the project site.
- If you have questions about fugitive dust, please contact the Enforcement Section of the Clean Air Branch. Please also see fugitive dust fact sheet at: https://health.hawaii.gov/cab/files/2024/02/Hawaii-Fugitive-Dust-Fact-Sheet-February-2024.pdf.

Includes construction, demolition, or renovation activities that involve potential asbestos and lead containing materials

- Please contact the Indoor and Radiological Health Branch at (808) 586-4700 or visit: https://health.hawaii.gov/irhb/

Increases the population and potential number of vehicles in an area

- The creation of apartment buildings, complexes, and residential communities may increase the overall population in an area. Increasing the population in an area may inadvertently lead to more air pollution via vehicle exhaust. Vehicle exhaust releases pollutants in the air that can negatively impact human health and air quality, including lung irritants, carcinogens, and greenhouse gases.
- Ensure that drivers keep vehicle idling times to three (3) minutes or less.
- Consider and incorporate support for alternative transportation options such as bike racks and/or electric vehicle charging stations where possible.

If you have any questions, please contact the Clean Air Branch at (808) 586-4200 or at cab@doh.hawaii.gov.

PBR HAWAII
& ASSOCIATES, INC.

KIMI MIKAMI YUEN, LEED® AP BD+C
President / Chairperson

VINCENT SHIGEKUNI
Executive Vice-President / Principal

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E-mail: sysadmin@pbrhawaii.com

printed on recycled paper

February 8, 2025

Marianne Rossio, P.E.
State of Hawai'i
Department of Health Clean Air Branch
2827 Waimano Home Rd #130
Pearl City, HI 96782

SUBJECT: CHAPTER 343, HRS DRAFT ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181 (portion), (2) 2-2-002:014 (portion)

Aloha Ms. Rossio,

Thank you for your comments submitted electronically on November 15, 2024, regarding the subject project. We acknowledge the standard comments below and provide the following responses:

All project activities shall comply with Hawaii Administrative Rules (HAR), Chapter 11-59 and 11-60.1.

If your proposed project:

Requires an Air Pollution Control Permit

- *You must obtain an air pollution control permit from the Clean Air Branch and comply with all applicable conditions and requirements. If you do not know if you need an air pollution control permit, please contact the Permitting Section of the Clean Air Branch.*
- *Permit application forms can be found here: https://health.hawaii.gov/cab/permit-application-forms*

The applicant will coordinate with the Department of Health to ensure compliance and obtain the pertinent air pollution control permits prior to construction.

Has the potential to generate fugitive dust

- *You must reasonably control the generation of all airborne, visible fugitive dust. Note that construction activities that occur near existing residences, businesses, public areas and major thoroughfares exacerbate potential dust concerns. It is recommended that a dust control management plan be developed which identifies and mitigates all activities that may generate airborne, visible fugitive dust. The plan, which does not require Department of Health approval, should help you recognize and minimize potential airborne, visible fugitive dust problems.*
- *Construction activities must comply with the provisions of Hawaii Administrative Rules, §11- 60.1-33 on Fugitive Dust. In addition, for cases involving mixed land use, it is strongly recommended that buffer zones be established, wherever possible, in order to alleviate potential dust concerns.*
- *You must provide reasonable measures to control airborne, visible fugitive dust from the road areas and during the various phases of construction. These measures include, but are not limited to, the following:*

- *Planning the different phases of construction, focusing on minimizing the amount of airborne, visible fugitive dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;*
- *Providing an adequate water source at the site prior to start-up of construction activities;*
- *Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;*
- *Minimizing airborne, visible fugitive dust from shoulders and access roads;*
- *Providing reasonable dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and*
- *Controlling airborne, visible fugitive dust from debris being hauled away from the project site.*

- *If you have questions about fugitive dust, please contact the Enforcement Section of the Clean Air Branch. Please also see fugitive dust fact sheet at: https://health.hawaii.gov/cab/files/2024/02/Hawaii-Fugitive-Dust-Fact-Sheet-February-2024.pdf.*

  The proposed project is not anticipated to have a significant impact on air quality locally or in the broader region. There may be some temporary impacts during construction but these are anticipated to be minimal and will be mitigated with best management practices (BMPs). The Applicant will comply with all applicable provisions under HAR §11-60.1-33 related to air quality control and will coordinate with relevant agencies. Mitigation measures related to short term air quality impacts during construction are provided in Section 4.4 of the Draft Environmental Assessment. To minimize fugitive dust impacts during construction, all construction activities will comply with all applicable provisions of HAR Title 11, Chapter 59, related to Ambient Air Quality Standards and HAR §11-60.1-33, related to Fugitive Dust. Long-term negative impacts related to air quality are not anticipated as construction equipment will utilize technology and standards which meet State and Federal air quality requirements.

Includes construction, demolition, or renovation activities that involve potential asbestos and lead containing materials

- *Please contact the Indoor and Radiological Health Branch at (808) 586-4700 or visit: https://health.hawaii.gov/irhb/.*

  The applicant will coordinate with the Department of Health Indoor and Radiological Health Branch to ensure compliance and determination prior to construction. We do not anticipate hazardous materials will be present as the project area is undeveloped vacant land far from any potential land uses that could produce hazardous materials.

Increases the population and potential number of vehicles in an area:

- *The creation of apartment buildings, complexes, and residential communities may increase the overall population in an area. Increasing the population in an area may inadvertently lead to more air pollution via vehicle exhaust. Vehicle exhaust releases pollutants in the air that can negatively impact human health and air quality, including lung irritants, carcinogens, and greenhouse gases.*
- *Ensure that drivers keep vehicle idling times to three (3) minutes or less.*
- *Consider and incorporate support for alternative transportation options such as bike racks and/or electric vehicle charging stations where possible.*

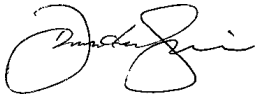
The proposed project has the potential for residential development in the future under the potential full buildout scenario, if desired by the Waiohuli community. The proposed project may result in a moderate population increase for the community by providing new homesteading opportunities for native Hawaiians on the Maui homestead waitlist. However, under a full build out scenario, any increase in air pollution as a result of the proposed project will be negligible. The proposed project includes safe pedestrian pathways throughout the site under the potential full buildout and will consider alternative transportation options during the final design phase for the project. The Final Environmental Assessment (FEA) includes a detailed traffic study to evaluate potential traffic impacts in the surrounding area. See Section 4.7 and Appendix E of the FEA for more information on traffic.

We will include you in future correspondence regarding updates on the proposed project throughout the environmental review process in compliance with Chapter 343, HRS.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Final Environmental Assessment.

Sincerely,

PBR HAWAII



Dave Simpson
Planner

From:	Saito, Tracie
To:	Dave Simpson
Cc:	Balmilero, Diane Orsino
Subject:	RE: Draft Environmental Assessment - Waiohuli Economic Development Opportunities
Date:	Tuesday, November 26, 2024 3:37:46 PM
Attachments:	image001.png SHWB-standard-comments-v4-October-2024-update.pdf

Aloha,

Please see the attached documentation in response to the request for written comments regarding Waiohuli Economic Development Opportunities.
This is on behalf of the Acting Chief, Lene Ichinotsubo.

Thank you,
Tracie Saito
Office Assistant | Solid and Hazardous Waste Branch
Hawai'i State Department of Health | Ka 'Oihana Olakino
2827 Waimano Home Road, #100 | Pearl City, HI 96782
Office: (808) 586-4226

From: Dave Simpson <dsimpson@pbrhawaii.com>
Sent: Friday, November 8, 2024 2:42 PM
Subject: [EXTERNAL] Draft Environmental Assessment - Waiohuli Economic Development Opportunities

Aloha,

Please find the attached letter providing notice of the Draft Environmental Assessment (DEA) for the Waiohuli Economic Development Opportunities pursuant to the State of Hawai'i EIS law (Hawai'i Revised Statutes, Chapter 343) and the State of Hawai'i EIS rules (Hawai'i Administrative Rules, Title 11, Chapter 200.1). The DEA is available online for your review in the November 8, 2024, issue of *The Environmental Notice*, on the State of Hawai'i Environmental Review Program's (ERP's) website at: https://files.hawaii.gov/dbedt/erp/The_Environmental_Notice/2024-11-08-TEN.pdf

Please submit written comments by December 7th, 2024 to the mailing address and/or email address listed below. Submitted comments must be accompanied with a full name and mailing address.

PBR HAWAII & Associates, Inc.
ATTN: Dave Simpson, Planner
1001 Bishop Street, Suite 650
Honolulu, Hawai'i 96813

Phone: (808) 521-5631
Email: dsimpson@pbrhawaii.com

Thank you for participating in the environmental review process.

Mahalo,
Dave Simpson
Planner

PBR HAWAII
Phone: 808-521-5631
Email:dsimpson@pbrhawaii.com

Solid and Hazardous Waste Branch
Standard Comments

October 11, 2024

The Solid and Hazardous Waste Branch administers programs in the areas of:

1) Management of hazardous waste;
2) Management of solid waste; and
3) Regulation of underground storage tanks.

Our general comments on projects are below. For further information about these programs, please contact the Solid and Hazardous Waste Branch at (808) 586-4226. All chapters of the Hawaii Revised Statutes (HRS) are at https://www.capitol.hawaii.gov/hrscurrent/.

Hazardous Waste Program

- The state regulations for hazardous waste and used oil are in chapters 11-260.1 to 11-279.1, Hawaii Administrative Rules (HAR) [https://health.hawaii.gov/shwb/hazwaste/hwrules/]. These rules apply to the identification, handling, transportation, storage and disposal of regulated hazardous waste and used oil. Generators, transporters and treatment, storage, and disposal facilities of hazardous waste and used oil must adhere to these requirements. Violations are subject to penalties under chapter 342J, HRS.

Solid Waste Section

- The Solid Waste Section (SWS) enforces laws and regulations contained in chapters 342H and 342I, HRS, and chapter 11-58.1, HAR, "Solid Waste Management Control" [http://health.hawaii.gov/shwb/solid-waste/].

- The purpose of the rules is to establish minimum standards governing the design, construction, installation, operation, and maintenance of solid waste disposal, recycling, reclamation and transfer systems.

- All facilities that accept solid wastes are required to obtain a solid waste management permit from the SWS. Examples of the types of facilities governed by these regulations include landfills, transfer stations and convenience centers, recycling facilities, composting facilities, and salvage facilities. Medical waste, infectious waste, and foreign waste treatment facilities are also included.

- Generators of solid waste are required to ensure that their wastes are properly delivered to permitted solid waste management facilities. Managers of construction and demolition projects should require their waste contractors to submit disposal receipts and invoices to ensure proper disposal of wastes.

Office of Solid Waste Management

- The Office of Solid Waste Management (OSWM) administers statewide integrated solid waste management planning activities, which apply to the counties, as well as various recycling programs, e.g. the Glass Advance Disposal Fee (ADF) and Deposit Beverage Container (DBC) Programs. Management of the DBC Program is conducted pursuant to chapter 342G, HRS, which contains compliance and enforcement provisions, and chapter 11-282, HAR, "Deposit Beverage Recycling" [http://health.hawaii.gov/hi5/rules-regulations-additional-links/]. OSWM is also responsible for limited enforcement and compliance of solid waste management facilities that operate primarily as certified DBC redemption centers pursuant to chapter 342H, HRS, and chapter 11-58.1, HAR, "Solid Waste Management Control" [http://health.hawaii.gov/shwb/solid-waste/]. Authority for the integrated solid waste management planning and ADF programs is contained in chapter 342G, HRS.

- Glass Advance Disposal Fee Program: Businesses that import glass containers into Hawaii are required to register with the Department of Health and pay a 1.5 cent per container fee. Fee revenue is distributed to the counties for the operation of glass recycling programs.

- Deposit Beverage Container Program: Business that manufacture or import deposit beverage containers into Hawaii are required to register with the Department of Health and pay the five cent deposit and one cent container fee on each deposit container. Deposits and fees are deposited into a special fund and are used to reimburse DBC redemption center refunds paid to consumers; and to pay handling fees to redemption/recycling companies to process and recycle collected deposit beverage containers; and to pay program administrative costs.

- The Department of Health reimburses and pays an associated handling fee for the redemption of deposit beverage containers (DBC). These transactions are conducted only with certified redemption centers. Certification requires obtaining a solid waste management permit from the SWS (which addresses environmental issues) and a certification from the DBC program (which standardizes the redemption process).

- Chapter 342G, HRS, encourages the reduction of waste generation, reuse of discarded materials, and the recycling of solid waste. Businesses, property managers and developers, and government entities are highly encouraged to develop solid waste management plans to ensure proper handling of wastes and divert recyclables from being landfilled.

- Solid waste management plans seek to maximize waste diversion and minimize disposal. Such plans should include designated areas to promote the collection of reusable and recyclable materials.

Underground Storage Tank Program

- The state's underground storage tank (UST) regulations, found in chapter 11-280.1, HAR [http://health.hawaii.gov/shwb/underground-storage-tanks/], include specific requirements that UST owners and operators must meet when installing, operating, and permanently closing their UST systems and addressing releases from USTs. Violations are subject to penalties under chapter 11-280.1, HAR, and chapter 342L, HRS.

- A permit is required prior to the installation and operation of a UST. Any new UST system that will be installed must have secondary containment with interstitial monitoring. Refer to subchapters 2, 3, 4, and 12 of chapter 11-280.1, HAR. The installation permit expires 1 year from the date of issuance. The operation permit expires 5 years from the date of issuance.

- §11-280.1-50, HAR, requires owners and operators of USTs or tank systems to notify DOH within twenty-four (24) hours and follow the procedures in §11-280.1-52, HAR, if any of the following occur, with specific exceptions found in the rules:
  1) The discovery by any person of evidence of regulated substances which may have been released at the UST site or in the surrounding area (such as the presence of free product or vapors in soils, basements, sewer and utility lines, or nearby surface water);
  2) Unusual UST system operating conditions observed or experienced (such as the erratic behavior of product dispensing equipment, the sudden loss of product from the UST, or an unexplained presence of water in the tank); or
  3) Monitoring results from a release detection method required under §§11-280.1-41 or 11-280.1-42 indicate a release may have occurred.

- For release response actions, responsible parties and their consultants and contractors should not only follow the applicable regulations, but also the Department of Health Hazard Evaluation Emergency (HEER) Office Technical Guidance Manual, HEER Environmental Action Level (EAL) guidance, and other guidance documents on the DOH HEER Office website [https://health.hawaii.gov/heer/], including those pertaining to Multi-Increment Sampling of soil, low flow groundwater sampling, soil vapor sampling, and Environmental Hazard Evaluations (EHE)/Environmental Hazard Management Plans (EHMP).

PBR HAWAII
& ASSOCIATES, INC.

KIMI MIKAMI YUEN, LEED® AP BD+C
President / Chairperson

VINCENT SHIGEKUNI
Executive Vice-President / Principal

GRANT T. MURAKAMI, AICP, LEED® AP BD+C
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Tel: (808) 521-5631
Fax: (808) 523-1402
E-mail: sysadmin@pbrhawaii.com

printed on recycled paper

February 8, 2025

Lene Ichinotsubo, Chief
State of Hawai‘i
Department of Health Solid & Hazardous Waste Branch
2827 Waimano Home Rd #100
Pearl City, HI 96782

SUBJECT: CHAPTER 343, HRS DRAFT ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI‘I
TMKs (2) 2-2-028:181 (portion), (2) 2-2-002:014 (portion)

Aloha Ms. Ichinotsubo,

Thank you for your comments submitted electronically on November 26, 2024, regarding the subject project. We acknowledge your comments below and provide the following responses.

Hazardous Waste Program

- *The state regulations for hazardous waste and used oil are in chapters 11-260.1 to 11-279.1, Hawaii Administrative Rules (HAR) [http://health.hawaii.gov/shwb/hwrules/]. These rules apply to the identification, handling, transportation, storage and disposal of regulated hazardous waste and used oil. Generators, transporters and treatment, storage, and disposal facilities of hazardous waste and used oil must adhere to these requirements. Violations are subject to penalties under chapter 342J, HRS.*

  The Applicant will comply with all applicable provisions under HAR §11-260.1 to 11-279.1 related to hazardous waste and will coordinate with relevant agencies.

Solid Waste Section

- *The Solid Waste Section (SWS) enforces laws and regulations contained in chapters 342H and 3421, HRS, and chapter 11-58.1, HAR, "Solid Waste Management Control" [http://health.hawaii .gov/shwb/solid-waste/].*
- *The purpose of the rules is to establish minimum standards governing the design, construction, installation, operation, and maintenance of solid waste disposal, recycling, reclamation, and transfer systems.*
- *All facilities that accept solid wastes are required to obtain a solid waste management permit from the SWS. Examples of the types of facilities governed by these regulations include landfills, transfer stations and convenience centers, recycling facilities, composting facilities, and salvage facilities. Medical waste, infectious waste, and foreign waste treatment facilities are also included.*
- *Generators of solid waste are required to ensure that their wastes are properly delivered to permitted solid waste management facilities. Managers of construction and demolition projects should require their waste contractors to submit disposal receipts and invoices to ensure proper disposal of wastes.*

The proposed project will ensure that any solid waste generated both during construction and after completion will be properly delivered to permitted solid waste management facilities. During construction, all solid waste materials will be properly handled, and contractors will follow all applicable requirements to submit disposal receipts and invoices to ensure proper disposal of wastes. Under the potential full buildout scenario, the project will create adequate accommodations to manage solid waste generated within the site and facilitate disposal in compliance with applicable laws and regulations.

Office of Solid Waste Management

- *The Office of Solid Waste Management (OSWM) administers statewide integrated solid waste management planning activities, which apply to the counties, as well as various recycling programs, e.g., the Glass Advance Disposal Fee (ADF) and Deposit Beverage Container (DBC) Programs. Management of the DBC Program is conducted pursuant to chapter 342G, HRS, which contains compliance and enforcement provisions, and chapter 11-282, HAR, "Deposit Beverage Recycling" [http://hea lth.hawaii.gov/hi5 /rules-regulations-additional- links/]. OSWM is also responsible for limited enforcement and compliance of solid waste management facilities that operate primarily as certified DBC redemption centers pursuant to chapter 342H, HRS, and chapter 11-58.1, HAR, "Solid Waste Management Control" [http://health.hawaii.gov/shwb/solid-waste/]. Authority for the integrated solid waste management planning and ADF programs is contained in chapter 342G, HRS*
- *Glass Advance Disposal Fee Program: Businesses that import glass containers into Hawaii are required to register with the Department of Health (DOH) and pay a 1.5 cent per container fee. Fee revenue is distributed to the counties for the operation of glass recycling programs.*
- *Deposit Beverage Container Program: Business that manufacture or import deposit beverage containers into Hawaii are required to register with the DOH and pay the five-cent deposit and one cent container fee on each deposit container. Deposits and fees are deposited into a special fund and are used to reimburse DBC redemption center refunds paid to consumers; and to pay handling fees to redemption/recycling companies to process and recycle collected deposit beverage containers; and to pay program administrative costs.*
- *The Department of Health reimburses and pays an associated handling fee for the redemption of deposit beverage containers (DBC). These transactions are conducted only with certified redemption centers. Certification requires obtaining a solid waste management permit from the SWS (which addresses environmental issues) and a certification from the DBC program(which standardizes the redemption process).*
- *Chapter 342G, HRS, encourages the reduction of waste generation, reuse of discarded materials, and the recycling of solid waste. Businesses, property managers and developers, and government entities are highly encouraged to develop solid waste management plans to ensure proper handling of wastes and divert recyclables from being landfilled.*
- *Solid waste management plans seek to maximize waste diversion and minimize disposal. Such plans should include designated areas to promote the collection of reusable and recyclable materials.*

We acknowledge your comments on solid waste management planning activities and the information on various recycling programs. Under the potential full buildout scenario, the project will encourage the reduction of waste generation, reuse of discarded materials, and the recycling of solid waste within the site and will evaluate opportunities to integrate participation in waste diversion programs.

Underground Storage Tank Program

- *The state's underground storage tank (UST) regulations, found in chapter 11-280.1, HAR [http://health.hawaii.gov/shwb/underg round-storage-tanks /], include specific requirements that UST owners and operators must meet when installing, operating, and permanently closing their UST systems and addressing releases from USTs. Violations are subject to penalties under chapter 11-280.1, HAR, and chapter 342L, HRS.*
- *A permit is required prior to the installation and operation of a UST. Any new UST system that will be installed must have secondary containment with interstitial monitoring. Refer to subchapters 2, 3, 4, and 12 of chapter 11-280.1, HAR. The installation permit expires 1 year from the date of issuance. The operation permit expires 5 years from the date of issuance.*
- *§11-280.1-50, HAR, requires owners and operators of USTs or tank systems to notify DOH within 24) hours and follow the procedures in §11-280.1-52, HAR, if any of the following occur, with specific exceptions found in the rules:*
  1. *The discovery by any person of evidence of regulated substances which may have been released at the UST site or in the surrounding area (such as the presence of free product or vapors in soils, basements, sewer and utility lines, or nearby surface water);*
  2. *Unusual UST system operating conditions observed or experienced (such as the erratic behavior of product dispensing equipment, the sudden loss of product from the UST, or an unexplained presence of water in the tank); or*
  3. *Monitoring results from a release detection method required under §§11-280.1-41 or 11-280 .1-42 indicate a release may have occurred*
- *For release response actions, responsible parties and their consultants and contractors should follow the applicable guidance in the DOH, Hazard Evaluation Emergency (HEER) Office Technical Guidance Manual, HEER Environmental Action Level (EAL) guidance, and other guidance documents on the DOH HEER Office website [http://ehaweb.doh.hawaii.gov /eha-cma/Org/HEER/], including those pertaining to Multi-Increment Sampling of soil, low flow groundwater sampling, soil vapor sampling, and Environmental Hazard Evaluations /Environmental Hazard Management Plans.*

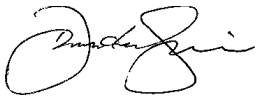
  The Applicant will comply with all applicable provisions under HAR §11-280.1 related to underground storage tanks that may be implemented under the potential full buildout scenario and will coordinate with relevant agencies.

We will include you in future correspondence regarding updates on the proposed project throughout the environmental review process in compliance with Chapter 343, HRS.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Final Environmental Assessment.

Sincerely,

PBR HAWAII



Dave Simpson
Planner

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES | KA ʻOIHANA KUMUWAIWAI ʻĀINA
COMMISSION ON WATER RESOURCE MANAGEMENT | KE KAHUWAI PONO
P.O. BOX 621
HONOLULU, HAWAII 96809

Nov 22, 2024

REF: RFD.6171.6

TO: Mr. Russell Tsuji, Administrator
Land Division

FROM: Ciara W.K. Kahahane, Deputy Director
Commission on Water Resource Management

SUBJECT: Waiohuli Economic Development Opportunities, Makawao

FILE NO.: RFD.6171.6
TMK NO.: (2) 2-2-002:014, (2) 2-2-028:181

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

Our comments related to water resources are checked off below.

- [X] 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.
- [X] 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.
- [ ] 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.
- [X] 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EAP as having high water efficiency can be found at http://www.epa.gov/watersense.
- [X] 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://planning.hawaii.gov/czm/initiatives/low-impact-development/
- [X] 6. We recommend the use of alternative water sources, wherever practicable.
- [X] 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program.
- [X] 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf.

- [X] 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.
- [ ] 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.
- [ ] 11. The Hawaii Water Plan is directed toward the achievement of the utilization of reclaimed water for uses other than drinking and for potable water needs in one hundred per cent of State and County facilities by December 31, 2045 (§174C-31(g)(6), Hawaii Revised Statutes). We strongly recommend that this project consider using reclaimed water for its non-potable water needs, such as irrigation. Reclaimed water may include, but is not limited to, recycled wastewater, gray water, and captured rainwater/stormwater. Please contact the Hawai'i Department of Health, Wastewater Branch, for more information on their reuse guidelines and the availability of reclaimed water in the project area.
- [X] 12. A Well Construction Permit(s) is (are) are required before the commencement of any well construction work.
- [X] 13. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.
- [ ] 14. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.
- [ ] 15. Ground-water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.
- [ ] 16. A Stream Channel Alteration Permit(s) is (are) required before any alteration can be made to the bed and/or banks of a steam channel.
- [ ] 17. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is constructed or altered.
- [ ] 18. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.
- [ ] 19. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

- [X] OTHER: Planning Branch -
The proposed project is within the Keokea/Waiohuli tract of the State Water Projects Plan (SWPP). At the time of the 2017 SWPP report non-potable water allocation for agricultural areas was 0.578 MGD. It is recommended to check the SWPP and remaining allocations for potable water demand.

If you have any questions, please contact Ryan Imata of the Groundwater Regulation Branch at (808) 587-0225 or Katie Roth of the Planning Branch (808) 587-0216.

PBR HAWAII
& ASSOCIATES, INC.

KIMI MIKAMI YUEN, LEED® AP BD+C
President / Chairperson

VINCENT SHIGEKUNI
Executive Vice-President / Principal

GRANT T. MURAKAMI, AICP, LEED® AP BD+C
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CATIE CULLISON, AICP
Senior Vice-President / Principal

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Cultural Sustainability Planner

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E-mail: sysadmin@pbrhawaii.com

printed on recycled paper

February 8, 2025

Ciara W.K. Kahahane, Deputy Director
State of Hawai'i
DLNR – Commission on Water Resource Management
P.O. Box 621
Honolulu HI 96809

SUBJECT: CHAPTER 343, HRS DRAFT ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181 (portion), (2) 2-2-002:014 (portion)

Aloha Ms. Kahahane,

Thank you for your comment letter dated November 22, 2024, regarding the subject project (File No. RFD.6171.6). We acknowledge your comments below and provide the following responses.

1. *We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.*

   The applicant will coordinate with the County Department of Planning and Department of Water Supply to incorporate the proposed project into the County's Water Use and Development Plan.

2. *We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.*

   The applicant will coordinate with the State Department of Land and Natural Resources – Engineering Division to incorporate the proposed project into the State Water Projects Plan. We note that the Engineering Division responded to the Draft EA with no additional comments.

4. *We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EAP as having high water efficiency can be found at http://www.epa.gov/watersense.*

   We acknowledge the recommendations to install water efficient fixtures and implement water conservation practices into the design of the proposed project. The proposed project is anticipated to utilize best practices for water conservation throughout the site. Various water conservation technologies and design are being proposed such as rainwater catchment systems, non-potable water use, water-efficient fixtures and monitoring systems to track water use. See Section 4.8.1 of the Final Environmental Assessment for more details on the proposed water system for the project.

5. *We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://planning.hawaii.gov/czm/initiatives/low-impact-development/*

   We acknowledge the recommendations to use best management practices for stormwater management within the project site. The proposed project includes drainage improvements which will retain runoff volume generated by the project and reduce stormwater runoff. The proposed retention basins will help mitigate the potential for sediments contained in the runoff from impacting downstream properties. The proposed project also includes a drainage system with a series of grated drain inlets and drain lines to collect and convey surface stormwater into the gulches surrounding the site. A contiguous natural green space corridor will also be incorporated into the Project that is designed to follow existing land contours. The green space buffer abutting the gulches will provide ecosystem services by maintaining natural drainage to minimize erosion, facilitate flood control, and preserve natural habitat corridors.

6. *We recommend the use of alternative water sources, wherever practicable.*

   We acknowledge the recommendations to use alternative water sources. While specific water reuse strategies are not named in the plans at this time, water reuse may be considered as plans are being finalized.

7. *We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program.*

   We acknowledge the recommendation for the project to participate in the Hawaii Green Business Program. The proposed project aligns with the principles of the program and the applicant will evaluate how elements of the project could participate in the program.

8. *We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf.*

   The project is anticipated to utilize best practices for water conservation throughout the site, including landscaping that incorporates drought-tolerant native plants and other water efficient landscape design techniques. Various water conservation technologies and design should be implemented in the development and construction of community support training facilities such as rainwater catchment systems, non-potable water use, water-efficient fixtures and monitoring systems to track water use.

9. *There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.*

   The applicant will coordinate with the State Department of Health to ensure that water quality standards are maintained throughout the project site and appropriate mitigation measures are implemented to prevent water degradation and/or contamination.

12. *A Well Construction Permit(s) is (are) are required before the commencement of any well construction work. We will include you in future correspondence regarding updates on the proposed project throughout the environmental review process in compliance with HRS Chapter 343.*

    The applicant will comply with requirements to acquire a well construction permit prior to the construction of the proposed groundwater well to serve the project under the potential full buildout scenario.

13. *A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.*

    The applicant will comply with requirements to acquire a pump installation permit prior to the construction of the proposed groundwater well to serve the project under the potential full buildout scenario

The proposed project is within the Keokea/Waiohuli tract of the State Water Projects Plan (SWPP). At the time of the 2017 SWPP report non-potable water allocation for agricultural areas was 0.578 MGD. It is recommended to check the SWPP and remaining allocations for potable water demand.

We acknowledge the comments regarding the non-potable water allocation for agricultural areas under the State Water Projects Plan (SWPP). We have reviewed the SWPP Update (2020) as well as the SWPP Update focused on DHHL prepared in 2017. The 2017 State Water Projects Plan, which focuses on DHHL demand notes that an agricultural water system was in the process of construction, but that the Department of Agriculture did not have sufficient funds to provide transmission to DHHL tracts, including Waiohuli. The State's Agricultural Water Use and Development Plan (AWUDP), most recently updated in 2021 notes that the Upcountry Maui Irrigation System will eventually serve the agricultural lands including DHHL's lands (State of Hawai'i, Commission on Water Resource Management, 2021). Although this Environmental Assessment evaluates a potential full buildout scenario, a calculation of potential non potable water demands is provided, should the areas designated for Agricultural Development Training Sites (42 acres) be utilized exclusively for agriculture. Based on the County's Water System Standards, the proposed water demand for non-potable water if 42 acres of land were developed for agricultural uses is estimated at an average of 210,000 gallons per day (gpd). In this case, the anticipated non-potable water demand for the Site would remain within the allocation for agricultural areas within the Kēōkea/Waiohuli tract of the State Water Projects Plan. With funding for a non-potable transmission line uncertain, DHHL may need to

prioritize development of residential and community uses ahead of agricultural uses, or utilize more traditional means of water collection and distribution to serve agriculture.

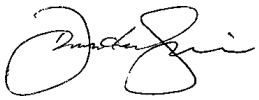
The project is also anticipated to utilize best practices for water conservation throughout the site including potential water reuse systems, water monitoring devices and other technology to conserve water. See Section 4.8.1 of the Final EA for more details on the proposed water system.

We will include you in future correspondence regarding updates on the proposed project throughout the environmental review process in compliance with Chapter 343, HRS.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Final Environmental Assessment.

Sincerely,

PBR HAWAII



Dave Simpson
Planner

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA

DAWN N. S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA 'OIHANA KUMUWAIWAI 'ĀINA
LAND DIVISION

P.O. BOX 621
HONOLULU, HAWAII 96809

November 8, 2024

MEMORANDUM

FROM: ~~TO:~~ **DLNR Agencies:**
___Div. of Aquatic Resources
___Div. of Boating & Ocean Recreation
_X_ Engineering Division (DLNR.ENGR@hawaii.gov)
_X_ Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
___Div. of State Parks
_X_ Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
___Office of Conservation & Coastal Lands
_X_ Land Division – Maui District (dlnr.land.maui@hawaii.gov)
_X_ Aha Moku Advisory Committee (leimana.k.damate@hawaii.gov)

TO: ~~FROM:~~ Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Draft Environmental Assessment for **Waiohuli Economic Development Opportunities**
LOCATION: Makawao, Island of Maui; TMKs: (2) 2-2-028:181 por.; & (2) 2-2-002:014 por.
APPLICANT: PBR Hawaii & Associates, Inc. on behalf of State Department of Hawaiian Home Lands

Transmitted for your review and comment is information on the above-referenced subject matter. The DEA was published on November 8, 2024, by the State Environmental Review Program (formerly the Office of Environmental Quality Control) at the Office of Planning and Sustainable Development in the periodic bulletin, The Environmental Notice, available at the following link:

https://files.hawaii.gov/dbedt/erp/The_Environmental_Notice/2024-11-08-TEN.pdf

Please submit any comments by **December 6, 2024**. If no response is received by this date, we will assume your agency has no comments. Should you have any questions, please contact Darlene Nakamura directly via email at darlene.k.nakamura@hawaii.gov. Thank you.

BRIEF COMMENTS:

( ) We have no objections.
( ) We have no comments.
(✓) We have no additional comments.
( ) Comments are included/attached.

Signed: *[signature]*
Print Name: Carty S. Chang, Chief Engineer
Division: Engineering Division
Date: Dec 5, 2024

Attachments

PBR HAWAII
& ASSOCIATES, INC.

KIMI MIKAMI YUEN, LEED® AP BD+C
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THOMAS S. WITTEN, FASLA
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W. FRANK BRANDT, FASLA
Founding Partner

February 8, 2025

Carty Chang, Chief Engineer
State of Hawai'i
DLNR - Engineering Division
P.O. Box 373
Honolulu HI 96809

SUBJECT: HRS CHAPTER 343 DRAFT ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181 (portion), (2) 2-2-002:014 (portion)

Aloha Mr. Chang,

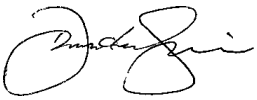
Thank you for your comment letter dated December 5, 2024, regarding the subject project. We acknowledge that the Department of Land and Natural Resources – Engineering Division has no further comments to add to the initial comments provided during the pre-consultation process.

We will include you in future correspondence regarding updates on the proposed project throughout the environmental review process in compliance with Chapter 343, HRS.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Final Environmental Assessment.

Sincerely,

PBR HAWAII



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Planner

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DEPARTMENT OF TRANSPORTATION | KA 'OIHANA ALAKAU
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

STP 00638.24
STP 8.3860

November 26, 2024

VIA EMAIL: dsimpson@pbrhawaii.com

Mr. Dave Simpson, Planner
PBR Hawaii & Associates, Inc.
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813

Dear Mr. Simpson:

Subject: Draft Environmental Assessment (DEA)
Waiohuli Economic Development Opportunities
Waiohuli, Maui, Hawaii
Tax Map Keys: (2) 2-2-028: 181 (portion); 2-2-002: 014 (portion)

Thank you for your letter, dated November 8, 2024, requesting the Hawaii Department of Transportation's (HDOT) review and comments on the subject DEA. HDOT understands that Waiohuli Hawaiian Homesteaders Association, Inc., in partnership with Pueo Development, is proposing to develop an approximately 150-acre site on the Department of Hawaiian Home Lands property in Waiohuli, Maui. The project is proposed to provide facilities to develop community-based job opportunities in infrastructure, agricultural cultivation, renewable energy, water source development, and community support.

HDOT has the following comments:

1. Thank you for addressing our early consultation comments in STP 8.3684, dated December 1, 2023, in the DEA.

2. HDOT concurs with the findings and recommendations in the Traffic Impact Assessment Report (TIAR) dated April 30, 2024. The report identifies potential adverse impacts on the traffic conditions of Kula Highway. The applicant shall mitigate the transportation impacts as recommended in the TIAR, subject to HDOT's approval.

   Mitigation for direct impacts to state roadways shall be provided at no cost to the HDOT. The applicant shall dedicate right-of-way for recommended transportation mitigation improvements, as required and approved by the HDOT.

3. The HDOT appreciates the strategies proposed in Section 3.6 of the DEA that would reduce carbon emissions such as the use of alternative energy sources with renewable solar technologies.

   The HDOT suggests the following carbon emissions reduction strategies:

   - Incorporate elements that encourage and enhance the use of multiple types of transportation to reduce carbon emissions.
   - Implement the use of energy-efficient technologies and practices, such as light-emitting diode lighting.
   - Use sustainable, recycled, or low-emission materials in construction and manufacturing.

Please submit any subsequent land use entitlement-related requests for review or correspondence to the HDOT Land Use Intake email address at DOT.LandUse@hawaii.gov.

If there are any questions, please contact Mr. Blayne Nikaido, Planner, Land Use Section of the HDOT Statewide Transportation Planning Office at (808) 831-7979 or via email at blayne.h.nikaido@hawaii.gov.

Sincerely,

EDWIN H. SNIFFEN
Director of Transportation

PBR HAWAII
& ASSOCIATES, INC.

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President / Chairperson

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February 8, 2025

Ed Sniffen, Director
State of Hawai'i
Department of Transportation
Ali'iaimoku Hale
869 Punchbowl Street Room 509
Honolulu HI 96813

SUBJECT: CHAPTER 343, HRS DRAFT ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I
TMKs (2) 2-2-028:181 (portion), (2) 2-2-002:014 (portion)

Aloha Mr. Sniffen,

Thank you for your comment letter dated November 26, 2023, regarding the subject project (File No. STP 00638.24, STP 8.3860). We acknowledge your comments below and provide the following responses.

1. *Thank you for addressing our early consultation comments in STP 8.3684, dated December 1, 2023, in the DEA.*

   We acknowledge that the Draft Environmental Assessment addressed the initial comments provided during the pre-consultation process.

2. *HDOT concurs with the findings and recommendations in the Traffic Impact Assessment Report (TIAR) dated April 30, 2024. The report identifies potential adverse impacts on the traffic conditions of Kula Highway. The applicant shall mitigate the transportation impacts as recommended in the TIAR, subject to HDOT's approval.*

   Mitigation for direct impacts to state roadways shall be provided at no cost to the HDOT. The applicant shall dedicate right-of-way for recommended transportation mitigation improvements, as required and approved by the HDOT

   We acknowledge that HDOT concurs with the findings and recommendations in the Traffic Impact Assessment Report (TIAR) provided in the Draft Environmental Assessment. The applicant will mitigate the transportation impacts identified in the TIAR and will coordinate with HDOT for approval of the planned mitigation measures recommended. The mitigation measures with direct impacts on state roadways will not require HDOT to incur any costs. The applicant will coordinate with HDOT for relevant approval and dedication of right-of-way improvements necessary to accommodate the proposed project.

3. *The HDOT appreciates the strategies proposed in Section 3.6 of the DEA that would reduce carbon emissions such as the use of alternative energy sources with renewable solar technologies.*

   The HDOT suggests the following carbon emissions reduction strategies:

   - *Incorporate elements that encourage and enhance the use of multiple types of transportation to reduce carbon emissions.*
   - *Implement the use of energy-efficient technologies and practices, such as light-emitting diode lighting.*

- *Use sustainable, recycled, or low-emission materials in construction and manufacturing.*

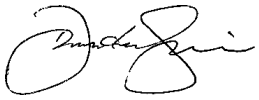
We acknowledge the suggestion to incorporate carbon emission reduction strategies into the proposed project. Under the potential full buildout scenario, the proposed project will offer pedestrian pathways throughout the site as a means to encourage alternative transportation modes. The project will include Complete Streets Design elements for a safe pedestrian network such as wide sidewalks, crosswalks, green buffers, speed bumps, pedestrian refuge islands, curb extensions, and walkway trails within the proposed greenways as an alternative transportation mode to reduce carbon emissions. The applicant will consider additional elements to encourage multi modal transportation opportunities during the final design of the project. The applicant will also evaluate implementing energy-efficient technologies and practices as well as use of sustainable, recycled and/or low-emission materials for construction of the project.

We will include you in future correspondence regarding updates on the proposed project throughout the environmental review process in compliance with Chapter 343, HRS.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Final Environmental Assessment.

Sincerely,

PBR HAWAII



Dave Simpson
Planner

RICHARD T. BISSEN, JR.
Mayor

SHAYNE R. AGAWA, P.E.
Director

ROBERT SCHMIDT
Deputy Director

MICHAEL KEHANO, P.E.
Solid Waste Division

ERIC A. NAKAGAWA, P.E.
Wastewater Reclamation Division

Environmental Protection &
Sustainability Division

COUNTY OF MAUI
DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
2145 KAOHU STREET, SUITE 102
WAILUKU, MAUI, HAWAI'I 96793

November 27, 2024

Dave Simpson, Planner
PBR HAWAII & Associates, Inc.
via email: dsimpson@pbrhawaii.com

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (EA)
WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES
TMK: (2) 2-2-028:181 (POR) AND (2) 2-2-002:014 (POR),
MAKAWAO, MAUI

Dear Dave Simpson:

Thank you for the opportunity to comment on the Draft EA for the Waiohuli Economic Development Opportunities. Since the project does not involve the County's sewer service area or system and proposes to construct a new Wastewater Treatment Facility (WWTF) that will be regulated by a private entity, the Department of Environmental Management's Wastewater Reclamation Division has no comments on the Draft EA.

Sincerely,

for ERIC A. NAKAGAWA, P.E.
Division Chief

PBR HAWAII
& ASSOCIATES, INC.

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February 8, 2025

Scott Rollins, Division Chief
County of Maui
Department of Environmental Management
2145 Kaohu Street, Suite 102
Wailuku HI 96793

SUBJECT: CHAPTER 343, HRS DRAFT ENVIRONMENTAL ASSESSMENT – WAIOHULI ECONOMIC DEVELOPMENT OPPORTUNITIES, MAKAWAO DISTRICT, ISLAND OF MAUI, HAWAI'I TMKs (2) 2-2-028:181 (portion), (2) 2-2-002:014 (portion)

Aloha Mr. Rollins,

Thank you for your comment letter dated November 27, 2024, regarding the subject project. We acknowledge your comments below and provide the following responses.

Since the project does not involve the County's sewer service area or system and proposes to construct a new Wastewater Treatment Facility (WWTF) that will be regulated by a private entity, the Department of Environmental Management's Wastewater Reclamation Division has no comments on the Draft EA

We acknowledge that the Department of Environmental Management does not have any comments on the Draft EA.

We will include you in future correspondence regarding updates on the proposed project throughout the environmental review process in compliance with Chapter 343, HRS.

We value your participation in the environmental review process. Your letter and this response will be reproduced in the forthcoming Final Environmental Assessment.

Sincerely,

PBR HAWAII

Dave Simpson
Planner