DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
COUNTY OF MAUI

FILE COPY

AUG 08 2014

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July 28, 2014

Ms. Jessica Wooley, Director
Office of Environmental Quality Control
Department of Health, State of Hawaii
235 South Beretania Street, Room 702
Honolulu, Hawaii 96813

Dear Ms. Wooley:

RE: Draft Environmental Assessment (DEA) for the 100% Affordable Kenolio Apartments located at TMKs (2) 3-9-01: 157 & 158 in Kihei, Maui, Hawaii

In our previous July 9, 2014 submittal of the Kenolio Apartments DEA to the OEQC, the publication form listed the incorrect Approving Agency. **The correct Approving Agency is the Department of Housing and Human Concerns (Department).** The Department has reviewed the Draft EA and anticipates a finding of no significant impact (FONSI) determination. We respectfully request the publication of the Draft Environmental Assessment for the subject project in the next available issue of *The Environmental Notice*.

Enclosed please find the following:

1. OEQC Publication Form w/ Project Summary Description;
2. Distribution List
3. One Copy of the DEA

In addition, a CD-ROM with the DEA, Publication Form, and Distribution List is enclosed for your convenience. Should you require clarification or further assistance, please contact Wayde Oshiro of our Housing Division at (808) 270-7351.

Sincerely,

JO-ANN T. RIDAO
Director of Housing and Human Concerns

Enclosures
cc: Mr. Brett Davis (w/o enclosures)
Housing Division

APPLICANT ACTIONS
SECTION 343-5(C), HRS
PUBLICATION FORM (JULY 2012 REVISION)

Project Name: Kenolio Apartments DEA
Island: Maui
District: Makawao
TMK: TMK's (2) 3-9-001: 157 & 158
Permits: HRS Chapter 343 Compliance, Draft Environmental Assessment, Final Environmental Assessment, Maui County 201H Afforbale Housing Application permit, Special Management Area (SMA) Permit Application, Building Permit, Wastewater Discharge (Hookup) Permit, Grading and Grubbing Permit, NPDES Permit, Air Pollution Control Permit, Community Noise Permit, Easements for Utilities, Drainage Approval

Approving Agency:

	Maui County Department of Housing and Human Concerns
Address	2200 Main St. Suite 546 Wailuku, Hawaii 96793
Contact & Phone	Mrs. JoAnne Ridao, Director (808) 270-7805

Applicant:

	Pacific West Communities
Address	430 East State Street, Suite 100 Eagle, Idaho 83616
Contact & Phone	Shellan Rodriguez, Project Manager (406-531-0401)

Consultant:

	Chris Hart and Partners, Inc.
Address	115 N. Market St. Wailuku, HI 96793
Contact & Phone	Mr. Jordan E. Hart, President, (808) 242-1955

Status (check one only):

√__DEA-AFNSI	Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov; a 30-day comment period ensues upon publication in the periodic bulletin.
__FEA-FONSI	Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and a PDF copy (send both summary and PDF to oeqchawaii@doh.hawaii.gov; no comment period ensues upon publication in the periodic bulletin.
__FEA-EISPN	Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov; a 30-day consultation period ensues upon publication in the periodic bulletin.
__Act 172-12 EISPN	Submit the approving agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to oeqchawaii@doh.hawaii.gov. NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin.
__DEIS	The applicant simultaneously transmits to both the OEQC and the approving agency, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to oeqc@doh.hawaii.gov); a 45-day comment period ensues upon publication in the periodic bulletin.
__FEIS	The applicant simultaneously transmits to both the OEQC and the approving agency, a hard copy of the FEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the FEIS (you may send both the summary and PDF to oeqc@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.
__ Section 11-200-23 Determination	The approving agency simultaneous transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the applicant. No comment period ensues upon publication in the periodic bulletin.
__Statutory hammer	

Acceptance	The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it failed to timely make a determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and that the applicant's FEIS is deemed accepted as a matter of law.
__Section 11-200-27 Determination	The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is not required. No EA is required and no comment period ensues upon publication in the periodic bulletin.
__Withdrawal (explain)	

Summary (Provide proposed action and purpose/need in less than 200 words. Please keep the summary brief and on this one page):

The proposed project is a 100% affordable multi-family apartments. The residential development will include construction of a total of 186 units with necessary supporting infrastructure. The development will result in 63, 1-bedroom units, 100, 2-bedroom units and 23, 3-bedroom units. Onsite amenities will include a swimming pool, covered picnic area, and community building with laundry facility.

Associated infrastructure improvements include paved roadways; concrete curbs, gutters and sidewalks; onsite parking, drainage systems, water system, sewer system, underground utilities, irrigation well for landscape planting, and offsite roadway improvements along Kenolio Road fronting the project site.

In early consultation with the Department of Housing and Human Concerns it was made clear that affordable rental units are needed in Kihei. As previously stated the proposed project will provide 186 affordable rental units for Maui residents.

Draft Environmental Assessment

For the proposed

Kenolio Apartments
100% Affordable Rental Project

TMK's (2) 3-9-01: 157 & 158

Kihei, Maui, Hawaii

May 2014

Prepared for:
Pacific West Communities
430 east State Street, Suite 100
Eagle, ID 83616
208/461-0022

Prepared by:
Chris Hart & Partners, Inc.
115 N. Market Street
Wailuku, Maui, Hawaii 96793
808/242-1955

June 10, 2013

Mr. William Spence, Director
Department of Planning
County of Maui
250 South High Street
Wailuku, Maui, Hawaii 96793

AND

Other Governmental Officials

Re: Environmental Assessment, Special Management Area Permit and 201H Applications for the proposed affordable rental housing project at the intersection of Kaonoulu and Kenolio Roads at, TMK's: (2) 3-9-001:157 & 158, Kihei, Maui, Hawaii.

Dear Mr. Spence and Other Government Officials:

As the Special Project Manger for Pacific West Communities, I hereby authorize Chris Hart & Partners, Inc. to sign as the Applicant for all necessary permits and approvals, including but not limited to the Environmental Assessment, Special Management Area Permit and 201H Applications for the proposed affordable rental housing project, at the intersection of Kaonoulu and Kenolio Roads at, TMK's: (2) 3-9-001:157 & 158, Kihei, Maui, Hawaii.

Very truly yours,

Shellan Rodriguez, Special Project Manager
Pacific West Communities

Cc. Mr. Jordan E. Hart, President, Chris Hart & Partners, Inc.

Subscribed and sworn to before me this

10th day of JUNE, 2013

Notary Public, Second Judicial Circuit
State of Idaho

My commission expires: 7/26/2017

PETER VAN DORNE
NOTARY
PUBLIC
STATE OF IDAHO

DRAFT EA

TABLE OF CONTENTS

I. PROJECT INFORMATION 1

A. PURPOSE OF THE REQUEST 1
B. PROJECT PROFILE 1
C. IDENTIFICATION OF THE APPLICANT/OWNER 2
D. CONSULTANTS 2
E. ACCEPTING AGENCY 4
F. MAJOR LAND USE, DEVELOPMENT AND CONSTRUCTION APPROVALS 4
G. PRE-CONSULTED AGENCIES& PRIVATE INTERESTS 4

II. DESCRIPTION OF THE PROPERTY AND PROPOSED ACTION 6

A. PROPERTY LOCATION 6
B. EXISTING LAND USE 6
C. LAND USE DESIGNATIONS 6
D. ALTERNATIVES 7
E. DESCRIPTION OF PROPOSED ACTION (PREFERED ALTERNATIVE) 8

III. DESCRIPTION OF THE EXISTING ENVIRONMENT, POTENTIAL IMPACTS AND MITIGATION MEASURES 9

A. PHYSICAL ENVIRONMENT 9
1. Land Use 9
2. Topography and Soils 11
3. Flood and Tsunami Zone 12
4. Terrestrial Biota (Flora and Fauna) 13
5. Air Quality 15
6. Noise Characteristics 15
7. Archaeological/Historical/Cultural Resources 16
8. Visual Resources 17
B. SOCIO-ECONOMIC ENVIRONMENT 18
C. PUBLIC SERVICES 19
D. INFRASTRUCTURE 23
1. Water 23
2. Sewer 24
3. Drainage 25
4. Roadway 27
5. Electrical, Telephone, Cable and Data Systems 30

IV. RELATIONSHIP TO GOVERNMENTAL PLANS, POLICIES, AND CONTROLS 31

A. STATE LAND USE LAW 31
B. MAUI COUNTY ZONING 34
C. GENERAL PLAN OF THE COUNTY 34
D. KIHEI-MAKENA COMMUNITY PLAN 37

V. HRS CHAPTER 343 SIGNIFICANCE CRITERIA 41

VI. SPECIAL MANAGEMENT AREA OBJECTIVES AND POLICIES 44

A. RECREATIONAL RESOURCES 44
B. HISTORICAL/CULTURAL RESOURCES 45
C. SCENIC AND OPEN SPACE RESOURCES 46
D. COASTAL ECOSYSTEMS 46
E. ECONOMIC USES 47
F. COASTAL HAZARDS 48
G. MANAGING DEVELOPMENT 48
H. PUBLIC PARTICIPATION 49
I. BEACH PROTECTION 49
J. MARINE RESOURCES 50

VII. FINDINGS AND CONCLUSIONS 51

VIII. REFERENCES 52

ATTACHMENTS

FIGURES

Figure No. 1	Location Map
Figure No. 2	Tax Map Key Map
Figure No. 3	State Land Use Map
Figure No. 4	Kihei-Makena Community Plan
Figure No. 5	Maui County Zoning Map
Figure No. 6	Flood Hazard Assessment Report Map
Figure No. 7	Special Management Area Map
Figure No. 8	Landscape Site Plan
Figure No. 9	Soils Map
Figure Nos. 10.1-10.2	Site Photographs
Figure No. 11	Maui Coastal Scenic Resources Study Map

APPENDICES

Appendix A	Early Consultation Letters and Responses
Appendix B	Botanical Flora and Fauna Report
Appendix C	Preliminary Engineering and Drainage Report
Appendix D	Early Consultation with USFWS
Appendix E	Archaeological Field Inspection
Appendix F	Cultural Impact Assessment
Appendix G	Traffic Impact Analysis Report
Appendix H	Architectural Drawings

I. PROJECT INFORMATION

A. PURPOSE OF THE REQUEST

The purpose of this Environmental Assessment (EA) is to analyze the potential impacts related to the construction of the Kenolio Apartments, a 186- unit 100% affordable Multi-family development. The proposed 8.2-acre project site consists of 2 parcels and is located in Kihei, adjacent to the Piilani Highway at the intersection of Kaonoulu Road and Kenolio Road. (**See:** Figure No. 1 "Location Map")Kenolio Road will provide access to the project site. In addition to the EA, the applicant is requesting a 201H approval and a Special Management Area (SMA) Use Permit approval. This Environmental Assessment is triggered by the Applicant's use of federal, state or county funds or tax credits for development of the proposed project.

B. PROJECT PROFILE

Proposed Project:	Kenolio Apartments 201H 100% Affordable Rental Project
Project Address:	Kenolio Road Kihei, Maui, Hawaii
Project TMK:	(2) 3-9-01:157, 158
Parcel Size:	8.2 acres combined
Existing Land Use:	Temporary Offices of Betsill Brothers Construction, Inc. & Materials Storage site.
Access:	Kenolio Road

C. IDENTIFICATION OF THE APPLICANT/OWNER

Land Owner:	Pacific West Communities, Inc.
Address:	430 East State Street, Suite 100 Eagle, ID 83616
Phone:	Business: (208) 461-0022 Facsimile: (208) 461-3267
Contact:	Mr. Don Slattery, Project Manager

Since 1998, The Pacific Companies has successfully completed more than 125 multifamily and charter school projects in the western states, with a special focus on California. The Pacific Companies works with residents, local governments and other stakeholders to build communities and schools.

The Pacific Companies has more than 90 workforce housing or mixed-income developments in it's portfolio, comprising more than 5,000 units across eight western states. The Kenolio Apartments project will be the first project in the State of Hawaii for the Applicant. More information can be found at the Applicants website: http://www.tpchousing.com/

D. CONSULTANTS

Land Use Planner & Landscape Architect:	Chris Hart & Partners, Inc. 115 N. Market St. Wailuku, Maui, Hawaii 96793-1706
Phone:	Voice: (808) 242-1955 Facsimile: (808) 242-1956
Contact:	Mr. Jordan E. Hart, President
Architect:	Douglas L. Gibson, A.I.A. 430 East State Street, Suite 100 Eagle, ID 83616
Phone:	Voice: (208) 908-4871
Contact:	Mr. Douglas L. Gibson, A.I.A.

Civil Engineer:	Otomo Engineering, Inc. 305 S. High St., Ste. 102 Wailuku, HI 96793
Phone:	Voice: (808) 242-0032 Facsimile: (808) 242-5779
Contact:	Mr. Stacy A. Otomo, P.E.
Archaeologist:	Erik Fredericksen P.O. Box 880131 Pukalani HI 96788
Phone:	Voice: (808) 572-6118 Facsimile: (808) 572-6118
Contact:	Mr. Erik Fredericksen
Botanist:	Bob Hobdy 871 Kolu Street, Suite 201 Wailuku, HI 96793
Phone:	Voice: (808) 573-8029
Contact:	Mr. Bob Hobdy
Traffic Engineer:	Phillip Rowell and Associates 47-273 "D" Hui Iwa Street Kaneohe, HI 96744
Phone:	Voice: (808) 239-8206 Facsimile: (808) 239-4175
Contact:	Mr. Phillip Rowell, P.E.
Cultural Consultant:	Gillian Engledow 1715 Vineyard Street Wailuku, HI 96793
Phone:	Voice: (808) 242-5459 Facsimile: (808) 242-5874
Contact:	Ms. Gillian Engledow

E. ACCEPTING AGENCY

Agency: Department of Housing and Human Concerns
2200 Main Street
Wailuku, Maui, Hawaii 96793

Phone: Voice: (808) 270-7805
Facsimile: (808) 270-7165

Contact: Ms. Jo-Ann Ridao, Director

F. MAJOR LAND USE, DEVELOPMENT AND CONSTRUCTION APPROVALS

1. 201H Application approval from the Maui County Council.
2. Special Management Area Use Permit by the Maui Planning Commission, via the Department of Planning.
3. Subdivision approval from the Department of Public Works (DPW), County of Maui.
4. Grading/Grubbing Permit approval from the DPW.
5. Building, Electrical, and Plumbing Permits for future structures from the DPW.
6. Wastewater Discharge (Hookup) Permit approval from Maui County, Department of Environmental Management, Wastewater Division
7. NPDES Permit approval from the State of Hawaii, DOH
8. Driveway Permit, Maui County, Public Works, Development Services Division

G. PRE-CONSULTED AGENCIES& PRIVATE INTERESTS

Chris Hart and Partners, Inc. (CH&P) distributed Early Consultation Letters to various Federal, State, and County agencies requesting comments on the proposed project. The

Agencies with an asterisk * provided early consultation comments. (**See**: Appendix A "Early Consultation letters with responses")

Federal Agencies

U.S. Department of Agriculture, Natural Resources Conservation Service
U.S. Army Corp of Engineer Division
U.S. Fish and Wildlife Service*

State Agencies

Department of Accounting and General Services*
Department of Business, Economic Development & Tourism, Office of Planning
Department of Education
Department of Hawaiian Home Lands
Department of Health (multiple branches)*
Department of Human Services
Department of Labor and Industrial Relations
Department of Land and Natural Resources (DLNR)*
DLNR – State Historic Preservation Division (SHPD)
Department of Transportation*
Hawaii Housing Financing and Development Corporation
Office of Hawaiian Affairs
University of Hawaii, Environmental Center

Maui County Agencies

Department of Environmental Management
Department of Fire and Public Safety
Department of Housing and Human Concerns
Department of Parks and Recreation*
Department of Planning*
Department of Public Works*
Department of Transportation
Department of Water Supply*
Police Department

Others

Kihei Community Association*
Hawaiian Telcom
Maui Electric Company
Oceanic Time Warner

II. DESCRIPTION OF THE PROPERTY AND PROPOSED ACTION

A. PROPERTY LOCATION

The project site is located makai of the Piilani Highway in Kihei at TMK's: (2) 3-9-01: 157, 158 in Kihei, Maui Hawaii. Combined Parcel 157 (5.171 acres) and Parcel 158 (3.103 acres) are approximately 8.274 acres in area. The project site is bound by the Piilani highway, Kaonoulu Street, and Kenolio Street. The Kulanihakoi Gulch is located in the neighboring property to the south. (**See:** Figure No. 2 "Tax Map Key")

B. EXISTING LAND USE

The project site is primarily vacant with boulders, trees, shrubs and grasses. A portion of the project site is being used for Betsill Brothers Construction, Inc. temporary office buildings and permitted construction material storage.

C. LAND USE DESIGNATIONS

State Land Use Classification:	Urban (Parcel 157,158) (**See**: Figure No. 3 "State Land Use Map")
Kihei-Makena Community Plan:	"B" Business/ Commercial (Parcel 157) "MF" Multi-Family (Parcel 158) (**See**: Figure No. 4 "Kihei-Makena Community Plan Map")
County Zoning:	R-1 Residential District and A-1 Apartment District (Parcel 157) A-1 Apartment District (Parcel 158) (**See**: Figure No. 5 "Maui County Zoning Map")
Flood Zone Designation:	A, AE, XS and X Minimal flooding (**See**: Figure No. 6 "Flood Hazard Assessment Report Map")

Special Designations: Special Management Area (SMA)
(**See**: Figure No. 7 "SMA Map")

D. ALTERNATIVES

The following alternatives were considered in preparation of this Draft Environmental Assessment:

1. **No Action:** This alternative would forego improvements to the project.

Positive Impacts: By leaving the property in its existing undeveloped state, the short-term impacts associated with construction would be avoided. Maintaining the site as undeveloped would reduce energy consumption, and the number of automobiles in the immediate area.

Negative Impacts: The County would not realize higher tax revenues associated with residential development of the property. Businesses and services in the Kihei area and on the island would not benefit from spending by occupants of the development on the property, if the "No Action" plan were followed. The residents of Kihei will be limited in their options for affordable housing. The high carrying costs of the property would be a burden for the landowner to absorb for an indefinite period of time and likely result in the sale of the property.

2. **Deferred Action:** This alternative would delay development to a later time.

Positive Impacts: There would be no immediate construction-related impacts associated with development.

Negative Impacts: A delay in commencing development would result in uncertainties related to market conditions, interest rates, construction costs, and availability of infrastructure. These considerations along with the carrying costs of the property would be financially burdensome for the landowner.

3. **Alternative Site:** This option would require that the owner/applicant find and develop another multi-family residential parcel.

Positive Impacts: The short term and peripheral impacts associated with construction would be avoided.

Negative Impacts: The community of Kihei would loose an opportunity for new affordable multi-family housing. The applicant does not own another suitable site and the land costs involved in acquiring a suitable site could be high.

3A. Alternative Use: The development of Parcel 157 as "B" Business/Commercial was proposed by the previous owner and the community opposed the use. The community strongly felt that the "B" Business/Commercial use was not compatible with the existing, adjacent residential land use. Therefore the Multi-family designation is proposed.

E. DESCRIPTION OF PROPOSED ACTION (PREFERED ALTERNATIVE)

The proposed project is a multi-family; residential development that will include construction of a total of 186 units with necessary supporting infrastructure. The development will result in 63, 1-bedroom units, 100, 2-bedroom units and 23, 3-bedroom units. Onsite amenities will include a swimming pool, covered picnic area, and community building with laundry facility. (**See:** Figure No. 8 "Landscape Site Plan" and Appendix H "Architectural Drawings")

Associated infrastructure improvements include paved roadways; concrete curbs, gutters and sidewalks; onsite parking, drainage systems, water system, sewer system, underground utilities, irrigation well for landscape planting, and offsite roadway improvements along Kenolio Road fronting the project site.

The proposed project will be 100% affordable and a 201H application will be submitted concluding this environmental review process and anticipated finding of no significant impact (FONSI). The proposed project will comply with the Residential Workforce Housing Ordinance by providing more than the required amount of units at an affordable price.

III. DESCRIPTION OF THE EXISTING ENVIRONMENT, POTENTIAL IMPACTS AND MITIGATION MEASURES

A. PHYSICAL ENVIRONMENT

1. Land Use

Existing Conditions. The proposed project site is located makai of the Piilani Highway in Kihei, Maui, Hawaii, TMK's: (2) 3-9-01:157, 158. The Kulanihakoi gulch is south of Parcel 158, and continues to the coast. (**See:** Figures No. 1 "Regional Location Map" & No. 2 "Tax Map Key").

Parcel 157 is currently in the Urban State Land Use District, and is County Zoned R-1 Residential District and A-1 Apartment District. The Kihei-Makena Community Plan designates the parcel as "B", Business/Commercial.

Parcel 158 is currently in the Urban State Land Use District, and is County Zoned A-1 Apartment District. The Kihei-Makena Community Plan designates the parcel as MF, Multi-Family. (**See:** Figure Nos. 3 "State Land Use Map", 4 "Kihei-Makena Community Plan", and 5 "Maui County Zoning Map")

The following is a description of zoning, community plan designations, and existing land uses adjacent and in close proximity to the subject property:

North:

Zoning: R-1 Residential
Community Plan: Single Family (SF)
State Land Use: Urban District
Existing uses. Single-Family Residences

South:	Zoning: Open Space (Kulanihakoi gulch) Community Plan: Multi-Family (MF) State Land Use: Agricultural District **Existing uses**. Open Space
East:	Zoning: M-1 Light Industrial Community Plan: Agricultural (A) and Light Industrial (LI) State Land Use: Agricultural District **Existing uses.** Piilani Highway
West:	Zoning: R-1 Residential Community Plan: Single-Family (SF) State Land Use: Urban District **Existing uses.** Single-Family residences

Potential Impacts and Mitigation Measures. The proposed project is appropriate for the Urban State Land Use designation. As part of the forthcoming 201H application the owner will ask for an exemption from various chapters of the Maui County Code including but not limited to obtaining a Change in Zoning (CIZ) from R-1 Residential to A-1 Apartment for Parcel 157 and Community Plan Amendment (CPA) from "B", Business/Commercial to "MF", Multi-Family which will result in consistent land use designations. Parcel 158 does not require a CIZ or CPA for multi family development.

2. Topography and Soils

Existing Conditions. The project site elevation ranges from 47 feet above mean sea level at the northeastern corner of the site to 16 feet at the southwestern corner, averaging approximately 2.8%. There are two gulches, which affect the project site. The first is an unnamed gulch, which conveys runoff across Piilani Highway from double 102-inch culverts. This gulch starts near the intersection of Kaonoulu Street and Piilani Highway and traverses diagonally across the site and the North-South Collector Road and discharging into Kulanihakoi Gulch.

The second gulch is Kulanihakoi Gulch, which is a major drainage way. It flows south of the southern boundary of the site from an existing bridge at Piilani Highway consisting of four existing 6'-0" x 4'0" concrete box culverts at its crossing on South Kihei Road. As part of the Kaonoulu Estates- Phase 4 Subdivision, a portion of Kulanihakoi Gulch was improved with a boulder lining and geotextile invert.

According to the *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii,* prepared by the United States Department of Agriculture, Soil Conservation Service, August 1972, the soil classification found on the project site are Alae sandy loam (AaB) and the Waiakoa extremely stony silty clay loam (WID2). (**See:** Figure No. 9 "Soils Map")

> **AaB**: This soil is contains slopes from 0 to 3 percent. Runoff is slow and the erosion hazard is slight. Most of this soil is used for sugar cane and pasture.
>
> **WID2**: This soil contains slopes from 3 to 7 percent. Runoff erosion is medium and the erosion hazard is severe. This soil is often eroded and stones cover 3 to 15 percent of the surface. This soil is used for pasture and wildlife habitat.

Potential Impacts and Mitigation Measures. The proposed project will require installation of a concrete box culvert from the outlet of the double 102-inch culverts at Piilani Highway, through the project site and connect to the existing 16'-0" x6'-6" concrete box culvert on the site. The proposed concrete box culvert will meander through the site to avoid conflicts with any structures or improvements.

As mentioned, previous construction of Kaonoulu Phase 4 resulted in a detention basin with the capacity of 60,000 cubic feet to be used by this proposed Multi-family project. The post development runoff from the project site is estimated to be 23.16 cfs, with an increase of 15.57 cfs over existing conditions. Onsite runoff will be collected by catch

basins located at appropriate intervals along the interior roadways and landscaped areas. Drain lines from the catch basins will convey the runoff to an outlet in Kulanihakoi Gulch. As previously noted there is sufficient storage volume within the existing detention basin for this project. Additional onsite detention basins will be constructed within the landscaped areas, which will provide additional storm water detention for the project. (**See:** Appendix C "Preliminary Engineering and Drainage Report")

The soil types present at the project site have low slope and are adequate for development. Therefore the current soil conditions found at the project site are adequate for the proposed Multi-family development.

3. Flood and Tsunami Zone

Existing Conditions. According to Panel Number 1500030586F of the Flood Insurance Rate Map (FIRM) prepared by the United States Federal Emergency Management Agency with a revised date of September 19, 2012, the project site is situated in Flood Zones A, AE, XS and X. (**See**: Figure No. 6 "Flood Hazard Assessment Report Map"). Flood Zone A is designated as a special flood hazard area subject to inundation by the 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. No base flood elevations have been determined. Flood Zone AE is designated as a special flood hazard area subject to inundation by the 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The base flood elevations have been determined to be between 23 feet and 28 feet.

Flood Zone XS is designated as areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths less than one (1) foot or with drainage area is less than one square mile; and areas protected by levees from 1% annual chance flood. Flood Zone X is designated as areas outside the 0.2% annual chance flood plain.

Potential Impacts and Mitigation Measures. Any structures which are located within a flood zone other than Zone XS or Zone X will be required to meet County, State and Federal requirements for development within a flood zone. A Best Management Practices plan will be submitted as part of the grading permit. In addition, an NPDES permit for construction activities will be required since the area of grading is greater than one acre.

4. Terrestrial Biota (Flora and Fauna)

Existing Conditions. A Botanical and Fauna Survey was conducted in January 2014 for the proposed project by Mr. Robert W. Hobdy. The vegetation of the project area consists primarily of grasses and herbaceous plants with a few scattered trees and shrubs. The vegetation was green and growing vigorously in response to recent rains. The most abundant species found was buffelgrass (*Cenchrus ciliaris*) which was everywhere on the property. Also common were Carolina lovegrass (*Eragrostis pectinacea*), spiny amaranth (*Amaranthus spinosus*), hairy merremia (*Merremia aegyptia*) and ʻuhaloa (*Waltheria indica*).

A total of 80 plant species were recorded during the course of the survey. Of these five species were indigenous native plants: ʻakulikuli (*Sesuvium portulacastrum*), kipukai (*Heliotropium curassavicum*), pohuehue (*Ipomoea pes-caprae* subsp. *brasiliensis*), ʻilima (*Sida fallax*) and ʻuhaloa. The remaining 75 species were non-native, including 9 ornamentals and 66 common weedy species.

Most of the project area has been heavily impacted by grazing animals, fires and human disturbances and is currently dominated by hardy non-native plants. The five native plant species are all common throughout Hawaii as well as on numerous other Pacific islands and are of no special conservation concern. No special native plant habitats occur on or near this property.

A walk-through Fauna survey was conducted in conjunction with the botanical survey. All parts of the project area were covered. Field observations were made with the aid of binoculars and by listening to vocalizations. In addition an evening visit was made to record crepuscular activities and vocalizations and to see if there was any evidence of occurrence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) in the area.

Four non-native mammal species were recorded within the project area during two site visits. Most common were axis deer (*Axis axis*), domestic cats (*Felis catus*), mice (*Mus domesticus*) and domestic dogs (*Canis familiaris*). Other mammals likely to utilize this property, but which were not observed include rats (*Rattus* spp.) and mongoose (*Herpestes auropunctatus*).

A special effort was made to look for the native Hawaiian hoary bat which is listed as an Endangered species. No evidence of such activity was observed though visibility was excellent. In addition a bat detection device (Batbox IIID) was employed, set to the frequencies of 27,000 to 28,000 hertz which this species is known to use. No bats were detected using this device.

Birdlife was modest both in species present and in total numbers. Most common were zebra dove (*Geopelia striata*) and common myna (*Acridotheres tristis*). Less common were gray francolin (*Francolinus pondicerianus*), Java sparrow (*Padda oryzivora*) and African silverbill (*Lonchura cantans*). This habitat is not suitable for Hawaii's native forest birds that are restricted to higher elevation native forests that are beyond the range of mosquitoes and the deadly avian diseases they carry and transmit. This dry property also has no habitat for Hawaii's Endangered water birds or the Endangered nēnē, and none were seen.

The survey was conducted in January during the rainy season which produced a spike in insect activity, and a total of 21 species were recorded. Two insect species were abundant throughout the project area: beet Webworm moth (*Spladea recurvalis*) and short-horned grasshopper (*Oedaleus abruptus*). Also common were: longtail blue butterfly (*Lampides boeticus*), painted lady butterfly (*Vanessa cardui*) and dungfly (*Musca sorbens*). Just one native insect species, Blackburn's hawk moth (*Manduca blackburni*) was observed. Blackburn's hawk moth is federally listed as an Endangered species. One mature larva (4 inches long x ¾ inch diameter) was found during the evening survey feeding on a non-native jimson weed plant (*Datura stramonium*), which is one of its known host plants.

Potential Impacts and Mitigation Measures.

The animal species recorded during this survey were almost entirely non-native in character. The only native species found was a larva of the Blackburn's hawk moth, and this moth is federally listed as an Endangered species. Its specific host species are some members of the nightshade family including the native 'aiea tree *(Nothocestrum* spp.) and non-native representatives such as tree tobacco (*Nicotiana glauca*), jimson weed and tomato (*Solanum lycopersicum*). No 'aiea occur on or near this property but eleven tree tobacco shrubs, one wild tomato plant and a few dozen jimson weed plants were found in the project area. These were each examined during the daytime without result, but during the evening survey one mature larva was found on a jimsom weed plant.

This finding triggered consultation with the U.S. Fish and Wildlife Service (USFWS) which administers and adjudicates actions that affect listed species. The Applicant submitted Mr. Hobdy's report to the USFWS on April 1, 2014 for review and had a conference call on Monday April 28, 2014 with the USFWS and DLNR staff to discuss mitigation measures. As a result of the conference call Mr. Hobdy surveyed the site again on May 12, 2014 and no larva were identified. Since no larva were identified the applicant will hand clear the low lying brush around the site. (**See:** Appendix D "Early Consultation with USFWS")

The Applicant will continue to coordinate with the USFWS throughout the EA process to reduce impacts to any future blackburn sphinx moth larva or other endangered species encountered at the project site.

5. Air Quality

Existing Conditions. Air quality refers to the presence or absence of pollutants in the atmosphere. It is the combined result of the natural background and emissions from many pollution sources. In general, air quality in Kihei and Maui in general is considered relatively good. Non-point source emissions (automobile) are not significant to generate a high concentration of pollutants. The relatively high quality of air can also be attributed to the region's exposure to wind, which quickly disperses concentrations of emissions.

Potential Impacts and Mitigation Measures. The impact of land development activities on air quality in a proposed development's locale differs by project phase (site preparation, construction, occupancy) and project type. Air quality impacts attributed to the proposed project could include dust generated by the short-term construction related activities. Site work such as grading and building construction, for example, could generate airborne particulate. Adequate dust control measures that comply with the provisions of Hawaii Administrative Rules, Chapter 11-60.1, "Air Pollution Control," Section 11-60.1-33, Fugitive Dust, will be implemented during all phases of construction. Mitigation measures will include but are not limited to:

- Providing adequate water source on site prior to start-up of construction activities.
- Landscape planting and rapid covering of bare areas, including slopes, beginning with the initial grading phase.
- Controlling of dust from shoulders, project entrances, and access roads.
- Providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities.
- Controlling of dust from debris hauled away from project site.

6. Noise Characteristics

Existing Conditions. In an urban environment, noise is due primarily to vehicular traffic, air traffic, heavy machinery, and heating, ventilation, and air-conditioning

equipment. Noise levels in the vicinity of the project area are generally low. Traffic noise from the adjacent Piilani Highway is the predominant source of background noise in the vicinity of the subject property.

Potential Impacts and Mitigation Measures. In the short-term, the proposed project could generate some adverse impacts during construction. Noise from heavy construction equipment, such as material-carrying trucks and trailers, would be the dominant source of noise during the construction period. To minimize construction related impacts to the surrounding neighbors, the developer will limit construction activities to normal daylight hours, and adhere to the Department of Health's Administrative Rules, Chapter 11-46, Community Noise Control." In the longer-term, the proposed project should not significantly impact existing noise conditions in the area due to the existing Piilani Highway traffic noises.

7. Archaeological/Historical/Cultural Resources

Existing Conditions. The project area has been previously disturbed and is currently a temporary office building for Betsill Brothers construction. Xamanek Researchers, LLC, conducted an Archaeological Assessment Survey on the project site in 2013. The assessment utilized a pedestrian surface survey and eight (8) backhoe trenches to assess subsurface conditions. There were no significant material cultural remains located during the walkover or subsurface testing. (**See:** Appendix E "Archaeological Assessment Survey")

Ms. Jill Engledow conducted a Cultural Impact Assessment of the project site and surrounding area in April 2007 and January 2013. The primary cultural feature in the area is the Ko'ie'ie Fishpond, one-half mile makai of the project site. The Ko'ie'ie Fishpond's initial construction date is unknown, but has been rebuilt several times over the last few centuries. The Fishpond is currently under re-construction. The cultural study of the site found no signs of permanent habitation or agriculture on the project site. (**See:** Appendix F "Cultural Impact Assessment")

Potential Impacts and Mitigation Measures.
No cultural resources were encountered during testing on this heavily disturbed project site, and as a result no further archaeological work is recommended for the project area at this time. However, should significant material cultural remains be encountered during construction activities, work will cease in the find location and the SHPD Maui office will be contact for necessary mitigation procedures. (**See:** Appendix E "Archaeological Assessment Survey")

The Ko'ie'ie Fishpond is currently being restored and offers a cultural and environmental education opportunity to interested people. The proposed action on the subject parcels will not interfere with this restoration effort. Therefore the proposed project will have no adverse impact on any cultural activities or significant historic sites. (**See:** Appendix F "Cultural Impact Assessment")

8. Visual Resources

Existing Conditions. The project site is located adjacent to the Piilani Highway in Kihei. The project site lacks ocean views because existing topography of the site and residential structures to the west. Views from Piilani Highway to the summit of Haleakala will not be impacted. Views from individual units will vary due to the building orientation and location on the site.

Scenic resources have been identified in Kihei, which are identified and discussed in the *Maui Scenic Coastal Resources Study*, by Environmental Planning Associates Inc., August 1990. The resource/ inventory map in this report identifies that no significant scenic resources will be affected by the development of the subject parcel. (**See:** Figure No. 11 "Maui Scenic Coastal Resources Study Map")

Potential Impacts and Mitigation Measures. No unique public scenic resources or adjacent views are anticipated to be impacted by the proposed development as identified in the *Maui Scenic Coastal Resources Study*, 1990. The proposed three (3) story building is permitted in the A-1 zoning district and is not anticipated to significantly impact public view corridors, or the visual character of the site and its immediate environs.

B. SOCIO-ECONOMIC ENVIRONMENT

1. Population

Existing Conditions.

The population of the County of Maui has exhibited relatively strong growth over the past decade with a 2010 population of 155,214, a 16.8% increase over 2000 population of 129,078. Maui Island population is expected to increase to 181,000 in 2020 and 207,300 in 2030. (*"Table 1.1 Resident Population by County 1980-2040" DBEDT 2040 Series, March 2012*)

Potential Impacts and Mitigation Measures.

The proposed subdivision will consist of 186 apartment units and will slightly increase the population in the immediate area. The subject parcel is located in the Kihei Census Designated Place (CDP). The Kihei CDP identifies the average household size as 2.59 people. (U.S. Census Bureau, 2010) The proposed project could increase the immediate population by approximately 482 people. (Methodology: Multiply the average household size by the proposed number of proposed units. (186 units * 2.59= 482 people)

2. Affordable Housing

Existing Conditions. In December 2006 the County of Maui passed a Residential Workforce Housing Policy (RWHP), Chapter 2.96, Maui County Code. Any residential project that results in the creation of 5 or more units would trigger the requirements of the RWHP. The Applicant will comply with the RWHP and in early consultation with the Department of Housing and Human Concerns it was made clear that affordable rental units are needed in Kihei. The proposed project will provide 186 affordable rental units for Maui residents.

Potential Impacts and Mitigation Measures. The applicant has experience in constructing and managing affordable housing rental developments and is committed to building the proposed affordable residential units. The development will positively impact the Kihei community by providing much needed affordable rental units in Kihei.

3. Economy

Existing Conditions.

The Kihei-Makena economy is based primarily upon the visitor industry. Visitor accommodations are located along the shoreline with various support facilities, multi-family, and single-family residential developments. Kihei and Wailea have developed

into important visitor destination anchors. Makena is significantly less developed. Much of the region's economic activity is derived directly or indirectly from the visitor industry. In addition to visitors, high technology promises to be an increasingly important component of the Kihei-Makena economy. Most existing and projected employment in high technology will occur at the Maui Research and Technology (R&T) Park located in central Kihei, which is being re-visioned and is likely to become a major employment center. The establishment of a Kihei High School adjacent to the R&T Park will create additional employment within South Maui.

Potential Impacts and Mitigation Measures. The project will generate construction-phase economic impacts that are generally short-term effects. They include employment, income, and expenditure impacts that are created by on-site and off-site construction employment, on-site and off-site trade/transportation/service employment, and manufacturing employment in support of construction. The proposed project will produce a limited number of full and part-time jobs during the construction phase of the development.

Short-term construction related impacts. Total direct construction phase job creation is anticipated to be approximately 350 individual tradesmen, employed for a duration of approximately 16 months.

Longer-term economic related impacts. Permanent employment for onsite maintenance, staff, and building engineering are anticipated to total approximately 6 jobs. The project will also require long term facility maintenance and improvements over time which will have a positive impact on building trades and landscape contractors. An offsite property management firm will also be hired to oversee onsite maintenance staff, manage maintenance contracts and proved administrative support to a future resident owner's association.

The project will generate long-term economic benefits to the local community including additional tax revenue to the County of Maui. The additional households will utilize and support many of the local goods and services within the immediate area.

C. PUBLIC SERVICES

Recreational Facilities

Existing Conditions. The Kihei-Wailea-Makena region has a wide reputation as a recreational destination, particularly for golf and ocean related activities. Ocean sports

and recreation available in the region include golfing, swimming, fishing, surfing, scuba diving, snorkeling, sailing, and kayaking. State and County beach parks in close proximity to the project area include the South Maui Regional Park, Keawakapu Beach Park, Mokapu Beach Park, Wailea Beach Park, Polo Beach Park and several other beach parks along the Kihei-Wailea- Makena coastline.

Potential Impacts and Mitigation Measures.

The proposed Multi-family development is located in Kihei, adjacent to Piilani Highway and will not directly interfere with recreational beach activities or access. The proposed project is not expected to adversely impact existing recreational facilities and services in the region. The proposed project site plan is designed with a centralized swimming pool, walking paths and common open space providing on site recreation space. The Applicant has consulted with the County of Maui Department of Parks & Recreation and has informed the Department that the proposed project is going to submit a 201H application for a 100% affordable project therefore the project will ask for exemption from the parks and playground assessment requirements pursuant to Section 18.16.320, Maui County Code. (**See**: Appendix A "Agency comment letters with responses"). Upon completion, the project will provide real property tax revenues to the County of Maui that is used to support various recreational services and programs.

Police and Fire Protection

Existing Conditions.

There are two fire stations serving the South Maui region. The first fire station is located at 11 Waimahaihai Street at Kalama Park, approximately 2.5 miles from the subject parcels. The second fire station is located in Wailea at the intersection of Kilohana Street and Kapili Street, approximately 4 miles from the subject parcels. The Wailea Fire Station provides coverage in the northern portion of the Kihei-Wailea-Makena area.

The proposed project is located in the Maui Police Department District VI. Patrol officers on assignment provide police services for the Kihei-Makena district from a new police station at the intersection of Piilani Highway and Kanai Road.

Potential Impacts and Mitigation Measures.

The proposed project is not expected to produce a significant increase in the resident population of the immediate area and the new South Maui Police facility is complete and was designed to accommodate existing and future needs of South Maui, including this project, therefore it is anticipated that current police protection services are adequate.

The Applicant will submit fire flow calculations to the Fire Department and the Department of Water Supply during the building permit review process to determine the required system improvements.

Medical Facilities

Existing Conditions. The Wailuku based Maui Memorial Medical Center (MMMC) provides centralized medical services for the Island with 251 beds. Medical and dental offices are located in Kihei and Wailea to serve the Makena region's residents.

According to County of Maui's Public Facilities Assessment, last updated in March of 2007, the Kihei-Makena area is currently served by two (2) ambulances.

Potential Impacts and Mitigation Measures. The proposed project will not significantly increase the resident population in the immediate area and therefore is not anticipated to produce a significant increase in demand for physicians, dentists, nurses, mental health personnel and hospital beds.

Solid Waste

Existing Conditions.

The Central Maui Landfill, which is located in the Puunene, receives residential solid waste from the area. Green waste is collected by Eko Compost, which is located at the Central Maui Landfill. Construction and demolition (C&D) waste is accepted at the privately operated C&D Landfill in Maalaea.

Plastic, glass, metal, cardboard, and newspaper can be recycled when left at various drop-boxes throughout the County. Green waste recycling is provided by several private organizations.

Potential Impacts and Mitigation Measures.

The proposed project will consist of Multi-Family uses therefore the owners are required to contract a private refuse company to handle solid waste generated at the project site. In 2009 the Integrated Solid Waste Management Plan (ISWMP) for Maui County was updated and projected that the Central Maui Landfill will have adequate capacity to accommodate Residential and Commercial waste through the year 2026. This estimate does not take into account future increases in source reduction and waste diversion. Increases in waste diversion achieved through education, recycling, composting, and reuse programs are expected to decrease demand for landfill space and extend the life of the Central Maui Landfill beyond the currently projected closure year. The County's Department of Environmental Management, Solid Waste Division, anticipates that

additional phases of the Central Maui Landfill will be developed as needed to accommodate future waste. In addition the project will provide on-site recycling opportunities for residents in an effort to reduce solid waste entering the landfill.

Waste generated by site preparation will primarily consist of rocks, and debris from clearing, grubbing, and grading. Very little demolition material is expected, as the site is essentially vacant.

During the short term, construction activities will require the disposal of the existing onsite waste, as well as cleared vegetation and construction-related solid waste. The applicants will work with the contractor to minimize the amount of solid waste generated during the construction of the project.

Schools

Existing Conditions.

Kihei-Makena has three schools serving 2,275 students, including two elementary schools and one intermediate school. There is also a charter school serving grades 6- 12. The need for an additional intermediate school is already evident, since Lokelani Intermediate was at 118% of rate capacity 2005. This region's proposed high school could be complete in 2015. *Maui County Public Facilities Assessment Update, March 9, 2007.*

Potential Impacts and Mitigation Measures.

Resident population projections for the South Maui area suggest a significant increase in student population for this period. For the period 2010 to 2030, resident population is expected to increase from 28,114 to 38,757, a gain of 37%. Given the population projections, and considering the amount of development occurring in this region and the opportunity for continued development, the need for additional schools is pronounced. The DOE is currently addressing the lack of a high school and funds have been allocated for design. The DOE's target operating date for Kihei High School is 2015. A new elementary school and intermediate school will also be warranted by 2030. *Maui County Public Facilities Assessment Update, March 9, 2007.*

In 2007, the Hawaii Legislature enacted Act 245 as Section 302A, Hawaii Revised Statutes (HRS), "School Impact Fees". Based upon this legislation, the DOE has enacted impact fees for residential developments that occur within indentified school impact districts. The project is within the boundaries of the Central Maui Impact District. The applicant will contact the DOE to enter into an impact fee agreement during the SMA review process.

D. INFRASTRUCTURE

1. Water

Existing Conditions.

Domestic water fire flow will be provided by the County's water system. There is an existing 18-inch waterline, which runs diagonally across the northwest corner of the project site and along the North-South Collector Road. The 36-inch Central Maui Waterline runs diagonally across the southeast corner of the project site, then along the North-South Collector Road.

A 2.0 million gallon reservoir, located approximately a mile above Piilani Highway provides storage for the area. The source for this water system is from the Central Maui Source. (**See:** Appendix C "Preliminary Engineering and Drainage Report")

Potential Impacts and Mitigation Measures.

In accordance with the Department of Water Supply's Domestic Consumption Guidelines for multi-family residential development, the average daily demand for the 186-unit project is approximately 104,160 gallons per day (**See:** Appendix C "Preliminary Engineering and Drainage Report") Fire flow demand for multi-family residential development is 2,000 gallons per minute for a 2-hour duration. Fire hydrants will be installed with a maximum spacing of 250 feet.

The project will connect to the existing 18-inch waterline along the North-South Collector Road, which is capable of providing water service and fireflow for the project. The required water meter size will be determined at the time the building permit is applied for. The Department of Water Supply (DWS) cannot guarantee water for the project. A water meter can be applied for and secured after the required improvements are installed, inspected and accepted by the DWS.

Low flow fixtures, drought tolerant plants, and efficient irrigation, such as drip, will be implemented in order to conserve water. The Applicant will drill an on-site well for landscape irrigation. This water source will also be used for dust control during construction.

2. Sewer

Existing Conditions.

There is an existing 8-inch sewer line on Ho'opili Akau Street, which terminates with an 8-inch stubout at the northwest corner of the property. The 8-inch stubout connects to an 8-inch sewer main on Ho'opili Akau Street, then to a 10-inch sewer line on Alulike Street, to a 10-inch sewer line on Kaonoulu Street, and to a 27-inch sewer main on South Kihei Road.

As part of the Kaonoulu Estates Phase 4 Subdivision, a 10-inch sewer stubout was provided within a utility easement on Lot 51 for the proposed project. The existing 10-inch sewer line connects to an existing 10-inch sewer line mentioned above.

Sewer from the project site will flow to a series of collection systems and pump stations along South Kihei Road, which transports the wastewater collected from the Kihei area is transported to the Kihei Wastewater Reclamation Facility located above Piilani Highway and south of Elleair Golf Course. (**See:** Appendix C "Preliminary Engineering and Drainage Report")

Potential Impacts and Mitigation Measures.

The proposed 186-unit multi-family development will generate approximately 47,430 gallons per day of wastewater. The onsite sewerage collection system will be designed to accommodate this flow. The existing collection and transmission systems, pumping facilities and treatment plant have the capacity to handle the anticipated wastewater generated by the development.

According to the Wastewater Reclamation Division, County of Maui, the Kihei Wastewater Reclamation Facility has a capacity of 8.0 million gallons a day (mgd). As of August 27, 2013, the average flow in the KWRF is 3.5 mgd and the allocated capacity is 6.805 mgd. The remaining wastewater capacity at the KWRF is approximately 1.2 mgd.

The onsite sewer system shall consist of a gravity flow system, which will connect to the existing 8-inch sewer line on Ho'opili Akau Street and the existing 10-inch sewer line at the east end of Alulike Street. The gravity system will eventually connect to the existing sewer system on South Kihei Road.

According to the Wastewater Assessment areas and fees set by the County of Maui, the subject project is located within the Kihei Assessment Area 3. At the present time, the County is assessing sewer fees of $1,743.00 per unit for the collection system upgrade

and $1,185.75 per unit for the treatment plant facility expansion for multi-family development.

3. Drainage

Existing Conditions.
The elevation on the site ranges from 47 feet above mean sea level at the northeastern corner of the site to 16 feet at the southwestern corner, averaging approximately 2.8% slope.

There are two gulches, which traverse through the project site. The first is an unnamed gulch, which conveys runoff across Piilani Highway from double 102-inch culverts. This gulch starts near the intersection of Kaonoulu Street and Piilani Highway and traverses diagonally across the project site. As part of Kaonoulu Estates Phase IV Subdivision, a 16′-0″ x 6′6″ Concrete box culvert was installed to convey runoff from the unnamed gulch, across the North-South Collector Road and discharging into Kulanihakoi gulch.

The second gulch is Kulanihakoi Gulch, which is a major drainage way. It traverses near the southern boundary of the site from an existing bridge at Piilani Highway to the four existing 6′-0″ x 4′0″ concrete box culverts at its crossing on South Kihei Road. As part of the Kaonoulu Estates- Phase IV Subdivision, a portion of Kulanihakoi Gulch was improved with a boulder lining and geotextile invert.

According to a previous report "Drainage and Soil Erosion Control Report for Kaonoulu Estates Phase I," revised July 1990 by Warren S. Unemori Engineering Inc., the 100 year storm runoff in the unnamed gulch is 1,109 cfs and 10,860 cfs in the Kulanihakoi Gulch. Presently, runoff from the project site sheet flows in an east to west direction and into the unnamed gulch or onto the North South collector Road. The onsite runoff eventually flows into Kulanihakoi Gulch and ultimately flows into the ocean. It is estimated that the present 50-year, 1-hour runoff from the project site is 7.59 cfs. The resulting storage volume is 8,652 cubic feet. (**See:** Appendix C "Preliminary Engineering and Drainage Report")

Potential Impacts and Mitigation Measures. A concrete box culvert will be installed from the outlet of the double 102-inch culverts at Piilani Highway, through the project site and connect to the existing 16′-0″ x 6′-6″ concrete box culvert on the site. The proposed concrete box culvert will meander through the site to avoid conflicts with any structures or improvements.

As part of the Kaonoulu Estates- Phase IV Subdivision, Lot 6 and portions of Lots 4 and 5 of Kaonoulu Estates Phase 3 was used for the construction of a detention basin. According to the "Drainage and Soil Erosion Control Report for Kaonoulu Estates – Phase IV." Prepared by Otomo Engineering, Inc., with a revision date of August 2001, the detention basin was designed to accommodate the increase in runoff from Phase IV project site, the then-proposed 140-unit multi-family site and commercial development is now the site of the current proposed project. The report also states that the detention basin was sized to accommodate 198,700 cubic feet of storage, of which 60,000 cubic feet of storage was provided for this project. (**See:** Appendix C "Preliminary Engineering and Drainage Report")

The post development runoff from the project site is estimated to be 23.16 cfs, with an increase of 15.57 cfs over existing conditions. The resulting storage volume for developed conditions is 22,925 cubic feet. Accordingly the project is required to provide mitigation for 15.57 cfs with a corresponding storage volume of 14,273 cubic feet. As mentioned, 60,000 cubic feet of existing storage capacity is allotted for this project.

Onsite runoff will be collected by catch basins located at appropriate intervals along the interior roadways and landscaped area. Drain lines from the catch basins will convey the runoff to an outlet in Kulanihakoi Gulch. As noted herein, there is storage volume within the existing detention basin, which was created for this project.

Any structures located within a flood zone other than Zone XS of Zone X will be required to meet the County, State and Federal requirements for development within a flood zone. Additionally, a Best Management Practices plan will be submitted as part of the grading permit. In addition a NPDES permit for construction activities will be required since the area of grading is greater than one acre. The NPDES permit will be secured before the issuance of the grading permit.

The proposed drainage system will be designed in accordance with Chapter 4, "Rules for the Design of Storm Drainage Facilities in the County of Maui."

4. Roadway

Existing Conditions. Phillip Rowell and Associates prepared a Traffic Impact Assessment Report (TIAR) for the proposed Multi-family project. (**See:** Appendix G Traffic Impact Assessment Report) The project area includes the following intersections and roadways:

a) Piilani Highway at Ohukai Street
b) Piilani Highway at Kaiwahine Street and Uwapo Road
c) Piilani Highway at Kaonoulu Street
d) South Kihei Road at Kaonoulu Street
e) Piilani Highway at Kulanihakoi Street
f) Kaonoulu Street at Kenolio Road
g) Kaonoulu Street at Alulike Street

Piilani Highway is the primary arterial for South Maui. It is a four-lane state highway. South Kihei Road is a two-lane roadway, which parallels Piilani Highway along the coastline and serves most of the commercial and residential communities in the Kihei area. Piilani Highway intersects with Kaonoulu Street.

Kaonoulu Street will provide access to Piilani Highway for the proposed project. There is no direct access to Piilani Highway from the proposed project. Future residents will turn left from Kaonoulu onto an improved Kenolio Road to provide access to the Kenolio Apartments.

Kenolio Road is an unpaved segment of the proposed North-South Collector Road. It is a two-lane roadway, which is owned by the County, located between Piilani Highway and South Kihei Road. Portions of this roadway are improved and the County of Maui is in the planning stages of improving additional sections of the North-South Collector Road. It is located between Uwapo Road to Kaonoulu Street, and extends south past Kaonoulu Street as a short paved section to the Northwest edge of the project site.

Uwapo Road, Ohukai Road, Kaiwahine Street, Alulike Street and Kulanihakoi Street are the surrounding roadways in the vicinity of the project site. Uwapo Road and Ohukai Road are signalized at its intersection with Piilani Highway. The County owns these roadways.

The TIAR included a Level-of-Service (LOS) analysis for existing traffic conditions. LOS is a qualitative measure of the effect of a number of factors, which include space, speed,

travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience.

There are six levels-of-service, A through F, which relate to the driving conditions from best to worst, respectively. LOS A represents free-flow conditions with no congestion. LOS F, on the other hand, represents severe congestion with stop-and-go conditions. LOS D is typically considered acceptable for peak hour conditions in urban areas.

The existing traffic conditions at the intersections in close proximity to the project site are listed below:

- Kaonoulu Street at Piilani Highway are a LOS B during the morning peak hour and a LOS A during the afternoon peak hour.

- Kaonoulu Street and South Kihei Road operates at a LOS A during both peak hours. The westbound left turn operates at a LOS D during the morning peak hour and LOS E during the afternoon peak hour. The westbound right turn operates at LOS B during both peak hours and the south bound left turn operates at LOS A during both peak hours.

- At the intersection of Kaonoulu Street at Kenolio Road, (which will provide access to the project) operates at a Level-of-Service A or better at both the AM and PM Peak Hour. All lane groups operates at a LOS A or B.

For **signalized** intersection, LOS D is the minimum acceptable LOS to overall intersection and major through movements. Using this standard no deficiencies were identified at **signalized** intersections within the study area.

For **unsignalized** intersections there is no standard, therefore a LOS D is considered the standard. The following deficiencies were identified:

- Left turns from eastbound Kaonoulu Street to northbound Piilani Highway operate at LOS F during the morning and afternoon peak hours.
- Right turns from eastbound Kaonoulu Street at southbound Piilani Highway operate at LOS F during the morning peak hour and LOS E during the afternoon peak hour.
- Left turns from eastbound Kulanihakoi Road to northbound Piilani Highway operate at LOS F during both peak hours.

The TIAR concludes that none of the deficiencies are significant enough to impact overall intersections LOS. The intersections operate at LOS A to B. It should also be noted that both intersections will signalized in the future. The intersections of Piilani

Highway at Kaonoulu Street will be signalized as part of the Maui Lu redevelopment and the intersection of Piilani Highway at Kulanihakoi Street will be signalized as part of the Kihei High School project.

Potential Impacts and Mitigation Measures.

The TIAR identified existing and projected traffic conditions and analyzed potential mitigation measures. Access to and egress from the project site will be via two (2) driveways along the east side of Kenolio Road (North-South Collector Road). The adjoining half of the North-South Collector Road will be improved to County standards for roadways within the urban district. It has an existing right of way width of 68 feet. The improvements will be coordinated with the County's preliminary design of the North-South Collector Road project.

According to the TIAR, the proposed project will generate 103 trips during the morning peak hour. During the afternoon peak hour, the project will generate 127 trips.

The level-of-service analysis of the signalized intersections along Piilani Highway concluded that project generated traffic has a negligible impact on intersection. **There is no change in the level-of-service of the overall intersections or any lane groups as a result of project generated traffic.** Several of the side street approach and/or left turn from Piilani Highway will operate at Level-of-Service E or F, but these movements will have low volume-to-capacity ratios. Adding green time to these movements did not change the levels-of-service, indicating that the low levels-of-service are the result of the traffic signal cycle length.

The level-of-service analysis of the intersection of South Kihei Road at Kaonoulu Street concluded that project generated traffic has a negligible impact on this intersection. There is no change in the level-of-service of the overall intersection or any lane groups as a result of project generated traffic. All lane groups will operate at Level-of-Service C, or better, without and with project traffic.

The level-of-service analysis of the unsignalized intersections of Kaonoulu Street at Kenolio Road and Kaonoulu Street at Alulike Street concluded that all lane groups will operate at Level-of-Service C, or better, without and with project traffic. No mitigation is recommended for the unsignalized study intersections.

A level-of-service analysis of the project's driveways along Kenolio Road concluded that all lane groups will operate at Level-of-Service A as unsignalized intersections. No separate left turn lanes will be required at the driveways.

The traffic study for Piilani Promenade, which will be located along the east side of Piilani Highway and across from the study project, will not be completed for several months, and then there will be the delay while the report is being reviewed by State of Hawaii Department of Transportation. Piilani Promenade will not be completed before 2018, one year after the design year for Kenolio Apartments. Primary access to and egress from Piilani Promenade will be via the intersection of Piilani Highway at Kaonoulu Street. Attachment Y of the TIAR is a schematic drawing of this intersection as currently planned to accommodate traffic generated by Piilani Promenade. (**See:** Appendix G, Traffic Impact Assessment Report)

In response to comments from the Department of Transportation (DOT) the developer/landowner will coordinate with the DOT Highways Division, Maui District Office, if there is a need to transport oversized and or overweight materials and equipment on State Highway facilities in order to construct the project.

In conclusion the TIAR has determined that the proposed affordable housing project is relatively small in scale and with signalization of Kaonoulu Street at the intersections with South Kihei Road and Piilani Highway, the project is not anticipated to have a significant impact on traffic conditions in the region.

5. Electrical, Telephone, Cable and Data Systems

Existing Conditions.

There are existing overhead and telephone lines which are located along the North-South Collector Road. The surrounding Kaonoulu Estates and Piilani Village Subdivisions have existing underground electrical distribution systems, which can be extended to serve the project site.

Potential Impacts and Mitigation Measures.

The proposed electrical, telephone and cable TV distribution systems for the subject project will be installed underground from the existing facilities along the North-South Collector Road or from the adjacent developments. Streetlights will be within the project site at intervals to be determined by an electrical engineer. All lighting will be shielded and faced downward.

IV. RELATIONSHIP TO GOVERNMENTAL PLANS, POLICIES, AND CONTROLS

A. STATE LAND USE LAW

Chapter 205, Hawaii Revised Statutes, relating to the Land Use Commission, establishes four major land use districts into which all lands in the State are placed. These districts are designated Urban, Rural, Agricultural, and Conservation. The subject property is within the Urban District. The proposed Multi-family residential development is permitted within the Urban District.

Pursuant to § 15-15-18, Land Use Commission Rules, Subchapter 2, Standards for Determining "U" Urban District Boundaries, the proposed request is consistent with the following standard:

> *1. It shall include lands characterized by "city-like" concentrations of people, structures, streets, urban level services and other related land uses;*

Analysis: The proposed Multi-family residential development is located along the west (makai) side of Piilani Highway at Ka'ono'ulu Street, east of Kenolio Road, and south of Ka'ono'ulu Street. Existing residential neighborhoods to the north, south and east and the Piilani Highway to the west surround the project site.

> *2a. Proximity to centers of trading and employment except where the development would generate new centers of trading and employment.*

Analysis: The proposed Multi-family residential development is <u>not</u> expected to generate new centers of trading and employment. The proposed development is contiguous with other residential urban lands to the North and West. The site is located within a mile of existing regional scale trading and employment. Additional residents would help support existing trade and provide real property taxes to the County.

2b. Availability of basic services such as schools, parks, wastewater systems, solid waste disposal, drainage, water, transportation systems, public utilities, and police and fire protection: and

Analysis: As mentioned previously in section III the proposed development will have the availability of basic services such as: schools, parks, wastewater systems, solid waste disposal, drainage, water, transportation systems, public utilities, and police and fire protection. Most public services are within 2 miles of the project site and most utilities are adjacent to the project site.

2c. Sufficient reserve areas for foreseeable urban growth:

Analysis: Kihei has a sufficient inventory of undeveloped parcels that will provide areas for future urban growth in the Kihei area. The Kihei-Makena Community Plan, states, "The significant amount of vacant land mauka of Pi'ilani Highway will, in the future, provide opportunities to expand public facilities, parks and housing". (Page 13, Kihei-Makena Community Plan March 6, 1998). Further more the proposed project site is within the Maui Island Plan Urban growth boundaries for Kihei.

3. It shall include lands with satisfactory topography, drainage, and reasonably free for the danger of any flood, tsunami, unstable soil condition, and other adverse environmental effects;

Analysis: The project parcels include lands with satisfactory topography and drainage (**See:** Appendix C "Preliminary Engineering Report"). The project parcels are located adjacent to the Piilani Highway and due to its location, the project site is reasonably free from the danger of flood, tsunami, and other environmental effects.

4. Land contiguous with existing urban areas shall be given more consideration than non-contiguous land, and particularly when indicated for future urban use on state or county general plans.

Analysis: The subject parcel is contiguous to other residential lands with the "Urban" land use classification. (**See:** Figure No. 3 "State Land Use Map"). The project site is bound by existing residential uses on the north and west sides of the project site. In addition land across Pi'ilani Highway is designated as Urban.

5. It shall include lands in appropriate locations for new urban concentrations and shall give consideration to area of urban growth as shown on the state and county general plans;

Analysis: According to the State Land Use District Map Parcel 157 and Parcel 158 are in the Urban district. The project site is in an appropriate location for new urban concentrations because it is contiguous to other pre-existing residential areas. (**See:** Figure No. 3, "State Land Use Map")

> *6. A) It may include lands which do not conform to the standards in paragraphs (1) to (5): When surrounded by or adjacent to existing urban development; and*
> *B) Only when those lands represent a minor portion of this district;*

Analysis: The proposed multi-family residential development conforms to the standards in paragraphs 1 through 5 and therefore this standard is not applicable.

> *7. It shall not include lands, the urbanization of which will contribute toward scattered spot urban development, necessitating unreasonable investment in public infrastructure or support services; and*

Analysis: The proposed Kenolio Apartments project can be categorized as an urban "infill" project and will not contribute toward scattered spot urban development. This development is contiguous to other existing urban development, and the proposed project is appropriately located in a manner to complete a cohesive neighborhood in Kihei.

> *8. It may include lands with a general slope of twenty per cent or more if the commission finds that those lands are desirable and suitable for urban purposes and that the design and construction controls, as adopted by any federal, state, or county agency, are adequate to protect the public health, welfare, safety and the public's interests in the aesthetic quality of the landscape.*

Analysis: The elevation on the site ranges from 47 feet above mean sea level at the northeastern corner of the site to 16 feet at the southwestern corner, averaging approximately 2.8% slope. The design and construction controls, as adopted by any federal, state, or county agency will be adequate to protect the public health welfare and safety. Additionally, a licensed Landscape Architect has been retained to provide an aesthetically pleasing street tree landscape planting design for the project.

B. MAUI COUNTY ZONING

As previously stated the proposed project site comprises of 2 parcels. Parcel 157 is County zoned A-1 Apartment District and R-1 Residential District. Parcel 158 is County zoned A-1 Apartment District. The project will pursue a 201H application and exemption from a Change in Zoning on Parcel 157 from R-1 Residential District to A-1 Apartment District. Parcel 158 does not require a change in zoning. (**See**: Figure No. 5 "Zoning Map")

C. GENERAL PLAN OF THE COUNTY

The General Plan of the County of Maui refers to a hierarchy of planning documents that together set forth future growth and policy direction in the County. The General Plan is comprised of the following documents: 1) County-wide Policy Plan; 2) Maui Island Plan; and 3) nine community plans.

The County-wide Policy Plan was adopted in March 2010 and is a broad policy document that identifies a vision for the future of Maui County. It establishes a set of guiding principles and provides comprehensive goals, objectives, policies and implementing actions that portray the desired direction of the County's future. The County-wide Policy Plan provides the policy framework for the development of the Maui Island Plan and nine Community Plans. The County-wide Policy Plan key strategies that are supported by the proposed project are:

A. Protect the Natural Environment The proposed Multi-family residential project is an urban infill project in Kihei in close proximity to existing infrastructure systems, public facilities and urban services. The proposed project will not impact natural features such as Kulanihakoi gulch and the proposed project will incorporate a drainage system to reduce stormwater runoff from entering the marine environment.

E. Expand Housing Opportunities for Residents The proposed project will provide 186 100% affordable rental units for Maui residents in Kihei, therefore supporting the goal to expand housing opportunities for residents.

F. Strengthen the Local Economy, The proposed project supports will support the local economy in both the short and long term. Total direct construction phase job creation is anticipated to be approximately 350 individual tradesmen, employed for a duration of approximately 16 months.

Permanent employment for onsite maintenance, staff, and building engineering are anticipated to total approximately 6 jobs. The project will also require long term facility maintenance and improvements over time which will have a positive impact on building trades and landscape contractors. An offsite property management firm will also be hired to oversee onsite maintenance staff, manage maintenance contracts and proved administrative support to a future resident owner's association.

G. Improve Parks and Public Facilities The Applicant has consulted with the County of Maui Department of Parks & Recreation and has informed the Department that the proposed project is going to submit a 201H application for a 100% affordable project therefore the project will ask for exemption from the parks and playground assessment requirements pursuant to Section 18.16.320, Maui County Code. However, upon completion, the project will provide real property tax revenues to the County of Maui that is used to support various recreational services and programs.

I. Improve Physical Infrastructure, The Project is an urban infill project located within the Urban Growth Boundary of the Maui Island Plan. Therefore the Project supports the goal of improving infrastructure. Specifically Objective 4, which supports "directing growth in a way that makes efficient use of existing infrastructure and to areas where there is available infrastructure capacity".

J. Promote Sustainable Land Use and Growth Management, The Project is located within the Maui Island Plan urban growth boundary therefore the Project is supported by Objective 1 "Improve land use management and implement a directed-growth strategy". The Project supports Objective 3 Policies a, b, c, and f. The project will incorporate green building practices and technologies to the extent practicable. The project will be reviewed by the Urban Design Review Board (UDRB) to ensure the architecture is appropriate for the Kihei area. Finally the project will incorporate

extensive landscaping to provide shade, beauty, urban-heat reduction. The project supports Objective 4, Policy d by incorporating pedestrian and bicycle safety into the site plan.

The Maui Island Plan was adopted in December 2012 and functions as a regional plan and addresses the policies and issued that are not confined to just one community plan area, including regional systems such as transportation, utilities and growth management, for the Island of Maui. Together, the Island and Community Plans develop strategies with respect to population density, land use maps, land use regulations, transportation systems, public and community facility locations, water and sewage systems, visitor destinations, urban design and other matters related to development.

The Maui Island Plan is used to guide the growth and development of Maui County. As indicated by the Plan's Directed Growth Maps, the Project lies within the limits of the proposed Urban Growth Boundary for Kihei.

Chapters 5 and 7 of the Maui Island Plan (MIP) are applicable to the development of the Project.

Chapter 5. Housing, the MIP states that Maui residents, by almost any measure, face a critical housing situation. The proposed project will provide 186 affordable rental units for Maui residents, therefore directly satisfying the goals, objectives and policies of Chapter 5. A brief analysis of the Housing Section of the Maui Island Plan, in the context of this proposed Kenolio Apartments is as follows:

5.1. Maui will have safe, decent, appropriate, and affordable housing for all residents developed in a way that contributes to strong neighborhoods and a thriving island community.

Analysis. The proposed project will provide affordable rental units that will be designed to compliment the existing neighborhood. The project will include pedestrian sidewalks establishing a physical connection and becoming part of the existing neighborhood.

5.1.3 Provide affordable housing, rental or in fee, to the broad spectrum of our island community.

Analysis. The proposed project will provide 186 affordable rental units for Maui residents, therefore directly satisfying this objective.

Chapter 7. Land Uses, The Project supports the goal 7.3. "Maui will have livable human scale urban communities, an efficient and sustainable land use pattern, and sufficient housing and services for Maui residents. A brief analysis of the Land Use Section of the Maui Island Plan, in the context of this proposed affordable housing project is as follows:

7.3.1.a Ensure higher-density compact urban communities, infill, and redevelopment of underutilized urban lots within Urban Growth Boundaries.

7.3.2.d Ensure, where appropriate, that affordable employee housing and multi-modal transportation opportunities are located near major employment centers.

7.3.2.h Encourage the placement of rental housing projects in the same areas as for-sale housing to facilitate mixed income communities.

Analysis. The proposed 100% affordable rental project that qualifies as an urban infill development, and is within the MIP Urban Growth Boundary therefore the proposed project is appropriate for this site.

D. KIHEI-MAKENA COMMUNITY PLAN

Nine community plan regions have been established in Maui County. Each region's growth and development is guided by a community plan, which contains objectives and policies in accordance with the Maui County General Plan. The purpose of the community plan is to outline a relatively detailed agenda for carrying out these objectives.

The project parcels are located within the Kihei-Makena Community Plan region. Parcel 157 is "B" Business/Commercial and Parcel 158 is "MF" Multi-Family (**See**: Figure No. 4 "Kihei-Makena Community Plan Map"). The Kihei-Makena Community Plan was adopted by Ordinance No. 2641 on March 6, 1998.

The following Kihei-Makena Community Plan goals, objectives, and policies are applicable to the proposed action:

Goal: ***Land Use.*** *A well-planned community with land use and development patterns designed to achieve the efficient and timely provision of infrastructural and community needs while preserving and enhancing the unique character of Ma'alaea, Kihei, Wailea and Makena as well as the region's natural environment, marine resources and traditional shoreline uses.*

Objectives and Policies

c. Upon adoption of this plan, allow no further development unless infrastructure, public facilities, and services needed to service new development are available prior to or concurrent with the impacts of new development.

Analysis. The proposed Multi-family residential project is an urban infill project in Kihei in close proximity to existing infrastructure systems, public facilities and urban services. The proposed project will have infrastructure available prior to or concurrent with the impacts of new development.

g. Encourage the establishment of Single-family and Multi-family land use designations, which provide affordable housing opportunities for areas, which are in close proximity to infrastructure systems and urban services.

Analysis. The proposed Multi-family residential project will provide affordable housing opportunities to the Kihei area as required by the Residential Workforce Housing Policy, Ordinance No. 3418. The proposed project is in close proximity to infrastructure systems and urban services. The proposed affordable residential units will satisfy the community need for affordable housing options in the Kihei-Makena region.

Goal: ***Environment.*** *Preservation, protection, and enhancement of Kihei-Makena's unique and fragile environmental resources.*

Analysis: As described in Section III of this report, the Kihei-Makena Community Plan region's unique and fragile environmental resources, including its shoreline, near and offshore water quality, drinking water, visual resources, archeological resources, and endangered species of flora and fauna, will not be significantly impacted by this project.

Goal: ***Housing and Urban Design.*** *A variety of attractive, sanitary, safe and affordable homes for Kihei's residents, especially for families earning less than the median income*

for families within the County. Also, a built environment, which provides complementary and aesthetically pleasing physical and visual linkages with the natural environment.

Objectives and Policies:

a. Provide adequate variety of housing choices and range of prices for the needs of Kihei's residents, especially for families earning less than the median income for families within the County, through the project district approach and other related programs. Choices can be increased through public/private sector cooperation and coordinated development of necessary support facilities and services.

b. Require a mix of affordable and market-priced housing in all major residential projects, unless the project is to be developed exclusively as an affordable housing project.

Analysis: The County of Maui passed a Residential Workforce Housing Policy (RWHP), Chapter 2.96, Maui County Code. Any residential project that results in the creation of 5 or more units would trigger the requirements of the RWHP.

The applicant is committed to building the proposed 100% affordable residential units and will enter into a Residential Workforce Housing Policy agreement with the County of Maui as part of the proposed project. The development will positively impact the Kihei community by providing much needed affordable housing.

e. Implement landscape setbacks for future multi-family and commercial areas. Developments shall provide space for landscape pedestrian ways and bikeways.

f. Incorporate the principles of xeriscaping in all future landscaping.

g. Encourage, the use of native plants in landscaping in the spirit of Act 73, Session Laws of Hawaii, 1992.

Analysis: The proposed Multi-family residential development provides landscaped open space and a pronounced walkway system that will provide a pedestrian oriented environment with the capability to connect with the existing sidewalk on Kaonoulu

Road. The Landscape plan will incorporate the principles of xeriscaping and use of native plants when possible. (**See:** Figure No. 8 "Landscape Site Plan")

Goal: ***Physical and Social Infrastructure.*** *Provision of facility systems, public services and capital improvement projects in an efficient, reliable, cost effective, and environmentally sensitive manner which accommodates the needs of the Kihei-Makena community, and fully support present and planned land uses, especially in the case of project district implementation.*

Allow no development for which infrastructure may not be available concurrent with the development's impacts.

Analysis: Section III of this report addresses the impact that the proposed Multi-family residential project will have upon existing public infrastructure, facilities, and service systems. Based upon the analysis, the necessary infrastructure, public facilities, and services will be available prior to and/or concurrent with development of the site.

V. HRS CHAPTER 343 SIGNIFICANCE CRITERIA

A finding of no significant impact (FONSI) is anticipated and therefore an Environmental Impact Statement will not be required for the proposed action. This determination has been made in accordance with the following significance criteria specified in Section 11-200-12 of the Department of Health rules relating to Environmental Impact Statements:

A. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.*

The project area has been previously disturbed and is currently a temporary office building for Betsill Brothers construction. Xamanek Researchers, LLC, conducted an Archaeological Assessment Survey on the project site in 2013. The assessment utilized a pedestrian surface survey and eight (8) backhoe trenches to assess subsurface conditions. There were no significant material cultural remains located during the walkover or subsurface testing. (**See:** Appendix E "Archaeological Assessment Survey")

B. *Curtails the range of beneficial uses of the environment.*

The neighboring properties are in residential use and the proposed Multi-family residential development does <u>not</u> introduce a new use to the area. The project will <u>not</u> curtail the range of beneficial uses of the environment in the project vicinity.

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

The proposed Multi-family residential project is being developed in compliance with the State of Hawaii's long-term environmental goals. As documented in this Draft EA report, adequate mitigation measures will be implemented to minimize the potential for negative impacts to the environment.

D. *Substantially affects the economic or social welfare of the community or state.*

In the short term, the proposed project will result in increased construction employment and business opportunities. As documented in this report, there will be no significant negative long-term impacts to the socio-economic environment.

In the long term, the proposed project will provide affordable rental housing in Kihei, an area in critical need of an affordable housing supply.

E. *Substantially affects public health.*

There are no special or unique aspects of the project, which will have an impact on public health.

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

The proposed project will not lead to a substantial impact on population levels due to its relatively small scale. Additionally, as documented in this report, the project will not result in a significant negative impact on public facilities.

G. *Involves a substantial degradation of environmental quality.*

Mitigation measures will be implemented during construction to minimize negative short-term impacts such as soil erosion and sedimentation. The project design will incorporate a drainage system that will minimize degradation of the environmental quality. (**See:** Appendix C "Preliminary Engineering Report")

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

The project does not involve a commitment for larger actions on behalf of the applicant or any public agency. In terms of cumulative impacts, the project site is situated within the State Urban District and adjacent to existing residential areas. Infrastructure and utilities are adequate to service the proposed project. Therefore, the project is not expected to result in cumulative negative impacts on the immediate environment.

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

The Applicant is coordinating with the USFWS throughout the EA process to reduce impacts to any future Blackburn sphinx moth larva or other endangered species encountered at the project site. (**See:** Appendix D "Early Consultation with USFWS")

J. *Detrimentally affects air or water quality or ambient noise levels.*

As documented, there will be short-term impacts on air and water quality and ambient noise levels during construction; however, mitigation measures will be employed to minimize these impacts. Adverse long-term impacts are not anticipated.

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

Any structures which are located within a flood zone other than Zone XS or Zone X will be required to meet County, State and Federal requirements for development within a flood zone. A Best Management Practices plan will be submitted as part of the grading permit. In addition, an NPDES permit for construction activities will be required since the area of grading is greater than one acre.

L. *Substantially affects scenic vistas and view planes identified in county or state plans or studies.*

The proposed project is located adjacent to the Piilani Highway and approximately 5-6 feet below the Piilani Highway. The buildings are limited to 39- feet in height and are not expected to obstruct major view corridors as identified by the Maui Coastal Resources Study. (**See:** Figure No. 11 "Maui Coastal Resources Study Map")

M. *Requires substantial energy consumption.*

Construction of proposed Multi-family project will comply with Chapter 16.26.1300, "Energy Conservation", Maui County Code. Where practical and economically feasible, the proposed structure will meet or exceed the building efficiency standard for the State of Hawaii.

VI. SPECIAL MANAGEMENT AREA OBJECTIVES AND POLICIES

The subject project is located within the Special Management Area (SMA). As such, the proposed improvements will require an SMA Use Permit. Pursuant to Chapter 205A, Hawaii Revised Statutes, and the Rules and Regulations of the Planning Commission of the County of Maui, projects located within the SMA are evaluated with respect to SMA objectives, policies, and guidelines. This section addresses the project's relationship to applicable coastal zone management considerations, as set forth in Chapter 205A and the Rules and Regulations of the Planning Commission.

A. RECREATIONAL RESOURCES

Objective: Provide coastal recreational resources accessible to the public.

Policies:

(A) Improve coordination and funding of coastal recreation planning and management; and

(B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

- *(i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;*
- *(ii) Requiring placement of coastal resources having significant recreational value, including but not limited to surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or require reasonable monetary compensation to the state for recreation when replacement is not feasible or desirable;*
- *(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*
- *(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;*
- *(v) Ensuring public recreational use of county, state, and federally owned or controlled shoreline lands and waters having standards and conservation of natural resources;*
- *(vi) Adopting water quality standards and regulating point and non-point sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;*
- *(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing;*

(viii) *Encourage 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, county planning commissions; and crediting such dedication against the requirements of Section 46-6, HRS.*

Analysis. The project site is adjacent to the Piilani Highway, approximately ½ mile from the ocean. Therefore the project will not have a direct impact on the public's use or access to the shoreline area.

B. HISTORICAL/CULTURAL RESOURCES

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

Policies:

(a) Identify and analyze significant archeological resources;

(b) Maximize information retention through preservation of remains and artifacts or salvage operations; and

(c) Support state goals for protection, restoration, interpretation, and display of historic structures.

Analysis.

Xamanek Researchers, LLC, conducted an Archaeological Field Inspection on the project site in October 2006. There were no significant material cultural remains or intact cultural layers noted during the surface inspection and subsurface testing of this previously disturbed parcel. Fill in tested portions of the study area ranged from 50 to over 100 cm in thickness. (**See:** Appendix E "Archaeological Assessment Survey")

Jillian Engledow conducted a Cultural Impact Assessment of the project site and surrounding area in April 2007. The primary cultural feature in the area is the Ko'ie'ie Fishpond, one-half mile makai of the project site. The Ko'ie'ie Fishpond's initial construction date is unknown, but has been rebuilt several times over the last few centuries. The Fishpond is currently collapsed. The cultural study of the site found no signs of permanent habitation or agriculture on the project site. (**See:** Appendix F "Cultural Impact Assessment")

Potential Impacts and Mitigation Measures.

Given the level of surface disturbance to the general 8.2 acre Kaonoulu Phase VI study area, as well as the subsurface evidence of previous impact, no further archaeological

work appears to warrant for this property at this point in time. (**See:** Appendix E "Archaeological Assessment Survey")

The Ko'ie'ie Fishpond is currently being restored and offers a cultural and environmental education opportunity to interested people. The proposed action on the subject parcels will not interfere with this restoration effort. Therefore the proposed project will have no adverse impact on any significant historic sites. (**See:** Appendix F "Cultural Impact Assessment")

C. SCENIC AND OPEN SPACE RESOURCES

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

Policies:

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

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

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

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

Analysis. As discussed in Section III of this report, numerous scenic resources have been identified in Kihei/Makena area, which are identified and discussed in the Maui Coastal Scenic Resources Study, August 1990 (**See**: Figure 11, "Maui Scenic Coastal Resources Study Map"). The proposed Kaonoulu Phase VI Multi-family Residential project is located adjacent to the Piilani Highway in South Maui and offers views of Haleakala. According to the Maui Coastal Scenic Resources Study Map the proposed development is not located in an area that would significantly impact public view corridors, or the visual character of the site and its immediate environs.

D. COASTAL ECOSYSTEMS

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

Policies:

(a) Improve the technical basis for natural resource management;

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

(c) 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

(d) Promote water quantity and quality planning and management practices, which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses, which violate state water quality standards.

Analysis. As noted previously, the proposed project site is adjacent to the Piilani Highway, approximately ½ mile from the coast. Therefore, the proposed project is not anticipated to have a significant impact on the coastal ecosystem. Furthermore, the incorporation of mitigation measures during construction as identified in Section III.D.3 of this report will minimize the potential for short-term adverse impacts.

E. ECONOMIC USES

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

Policies:

(a) Concentrate coastal dependent development in appropriate areas;

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

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

- *(i) Use of presently designated locations is not feasible;*
- *(ii) Adverse environmental impacts are minimized; and*
- *(iii) The development is important to the State's economy.*

Analysis. The proposed Multi-family Residential use of the property is consistent with the State's Urban land use designation, and the County's zoning. As such, the proposed project is within an area that has been planned for growth and development and will provide the supporting infrastructure and services required to service this growth.

F. COASTAL HAZARDS

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

Policies:

(a) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and non-point source pollution hazards;

(b) Control development in areas subject to storm wave, tsunami, flood, erosion, subsidence, and point and non-point pollution hazards;

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

(d) Prevent coastal flooding from inland projects; and

(e) Develop a coastal point and nonpoint source pollution control program.

Analysis. As discussed in Section III of this report, the project site is located approximately ½ mile from the Ocean and is situated in Flood Zones A, AE, XS and X. (**See:** Figure No. 6 "Flood Insurance Rate Map") Thus, hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence and pollution is not expected to be significant. The proposed subdivision has retained a licensed civil engineer to develop a drainage plan to mitigate potential flooding conditions to surrounding neighbors. (**See:** Appendix C "Preliminary Engineering and Drainage Report")

G. MANAGING DEVELOPMENT

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

Policies:

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

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

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

Analysis. The proposed Multi-family residential project will be conducted in accordance with applicable State and County requirements. Opportunity for review of

the proposed action is provided through the County's SMA permitting process and the State's EA review process.

H. PUBLIC PARTICIPATION

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

Policies:

(a) Maintain a public advisory body to identify coastal management problems and to provide policy advise and assistance to the coastal zone management program.

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

(c) Organize workshops, policy dialogues, and site-specific medications to respond to coastal issues and conflicts.

Analysis. In conjunction with the submittal of the SMA application, a notice of application will be mailed to property owners within 500 feet. The mail-out describes the proposed project and solicits any issues or concerns that need to be addressed through the permitting process. A number of governmental agencies have also been consulted and copies of this application will be circulated to various agencies by the Department of Planning. During the scheduled public hearings, the public will have an opportunity to review and comment on the proposed project. Landowners located within 500 feet of the project will be notified of the scheduled public hearing dates. Public hearing dates and location maps will also be published in the Maui News on two separate occasions. The public will be allowed to participate in the public hearing portion of the Maui Planning Commission's review process. The EA process also provides an opportunity for public comment.

I. BEACH PROTECTION

Objective: Protect beaches for public use and recreation.

Policies:

(a) Locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion;

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

Analysis. As noted previously, the project site is adjacent to the Piilani Highway. The project site is situated approximately ½ mile from the coast. Therefore, the proposed project is not anticipated to have a significant impact on the coastal ecosystem. The construction of the proposed project on the subject property will not have a direct physical impact upon any coast.

J. MARINE RESOURCES

Objective: Implement the State's ocean resources management plan.

Policies:

(a) *Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*
(b) *Assure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;*
(c) *Coordinate the management of marine and coastal resources and activities management to improve effectiveness and efficiency;*
(d) *Assert and articulate the interest of the state as a partner with federal agencies in the sound management of the ocean resources within the United States exclusive economic zone;*
(e) *Promote research, study, and understanding of ocean processes, marine life, and other ocean development activities relate to and impact upon the ocean and coastal resources; and*
(f) *Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

Analysis. The proposed project does not involve the direct use or development of marine resources. In addition, with the incorporation of erosion and drainage control measures during construction and after construction as identified in the infrastructure section of this report, there should not be significant adverse impacts to nearshore waters from point and non-point sources of pollution. Therefore, the subject project will not produce any significant impacts on any coastal or marine resources.

VII. FINDINGS AND CONCLUSIONS

Based on the foregoing analysis and conclusion, the proposed project will not result in significant impacts to the environment and is consistent with the requirements of HRS Chapter 343, and a Finding of No Significant Impact (FONSI) is warranted.

The proposed project is a multi-family; residential development that will include construction of a total of 186 units with necessary supporting infrastructure. The development will result in 63, 1-bedroom units, 100, 2-bedroom units and 23, 3-bedroom units. Onsite amenities will include a swimming pool, covered picnic area, and community building with laundry facility. (**See:** Figure No. 8 "Site Plan").

Associated infrastructure improvements include paved roadways; concrete curbs, gutters and sidewalks; onsite parking, drainage systems, water system, sewer system, underground utilities, irrigated landscape planting, and offsite roadway improvements along Kenolio Road fronting the project site.

The proposed project will be 100% affordable and a forthcoming 201H application and Special Management Area (SMA) application will be submitted concluding this environmental review process and anticipated finding of no significant impact (FONSI). The proposed project complies with the Residential Workforce Housing Ordinance by providing more than the required amount of units at an affordable price.

There is existing infrastructure for the project site. Currently, all on-site drainage will be retained in a previously installed detention basin. An 18-inch waterline along the North-South Collector Road is capable of providing water service and fireflow for the project. The additional required infrastructure will be built prior to and or concurrently with the project.

As noted previously, the project site is adjacent to Piilani Highway. The project site is situated approximately ½ mile from the coast. Therefore, the proposed project is not anticipated to have a significant impact on the coastal ecosystem. The construction of the proposed project on the subject property will not have a direct physical impact upon any coastal shoreline processes.

VIII. REFERENCES

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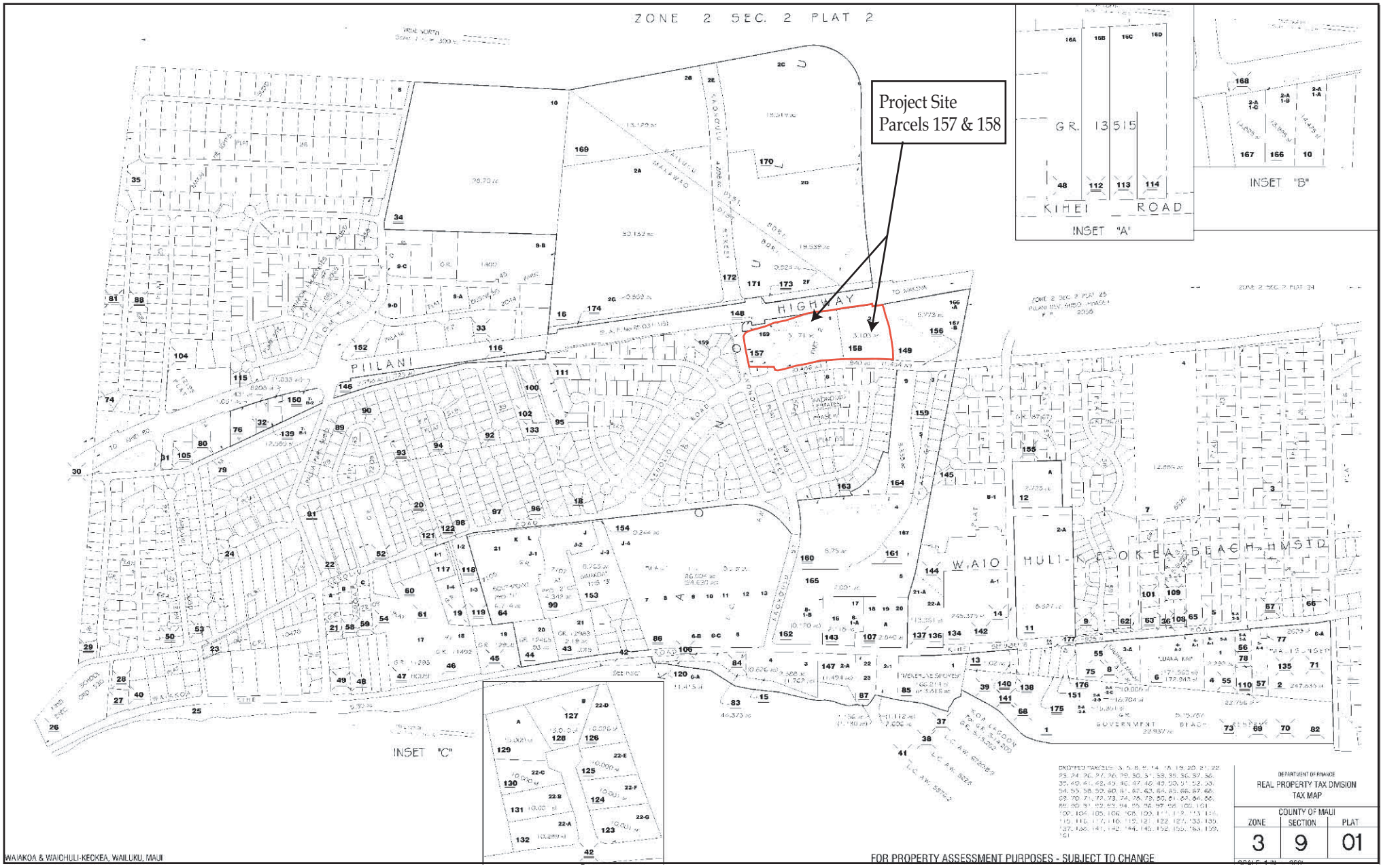
FIGURES

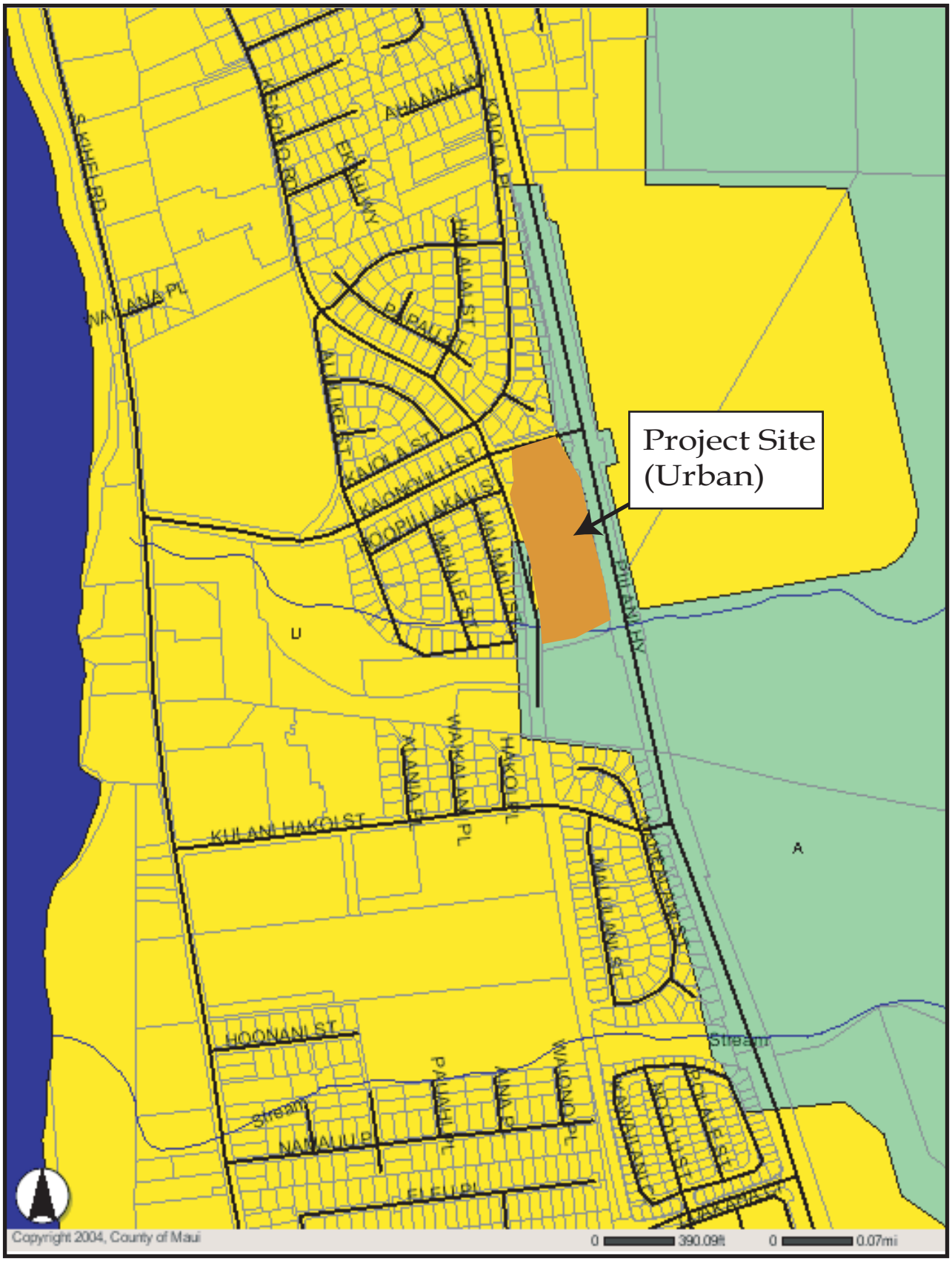
Kenolio Apartments Figure No. 1	CHRIS HART & PARTNERS, INC.
Location Map	



Kenolio Apartments
Figure No. 2

Tax Map Key

CHRIS HART & PARTNERS, INC.

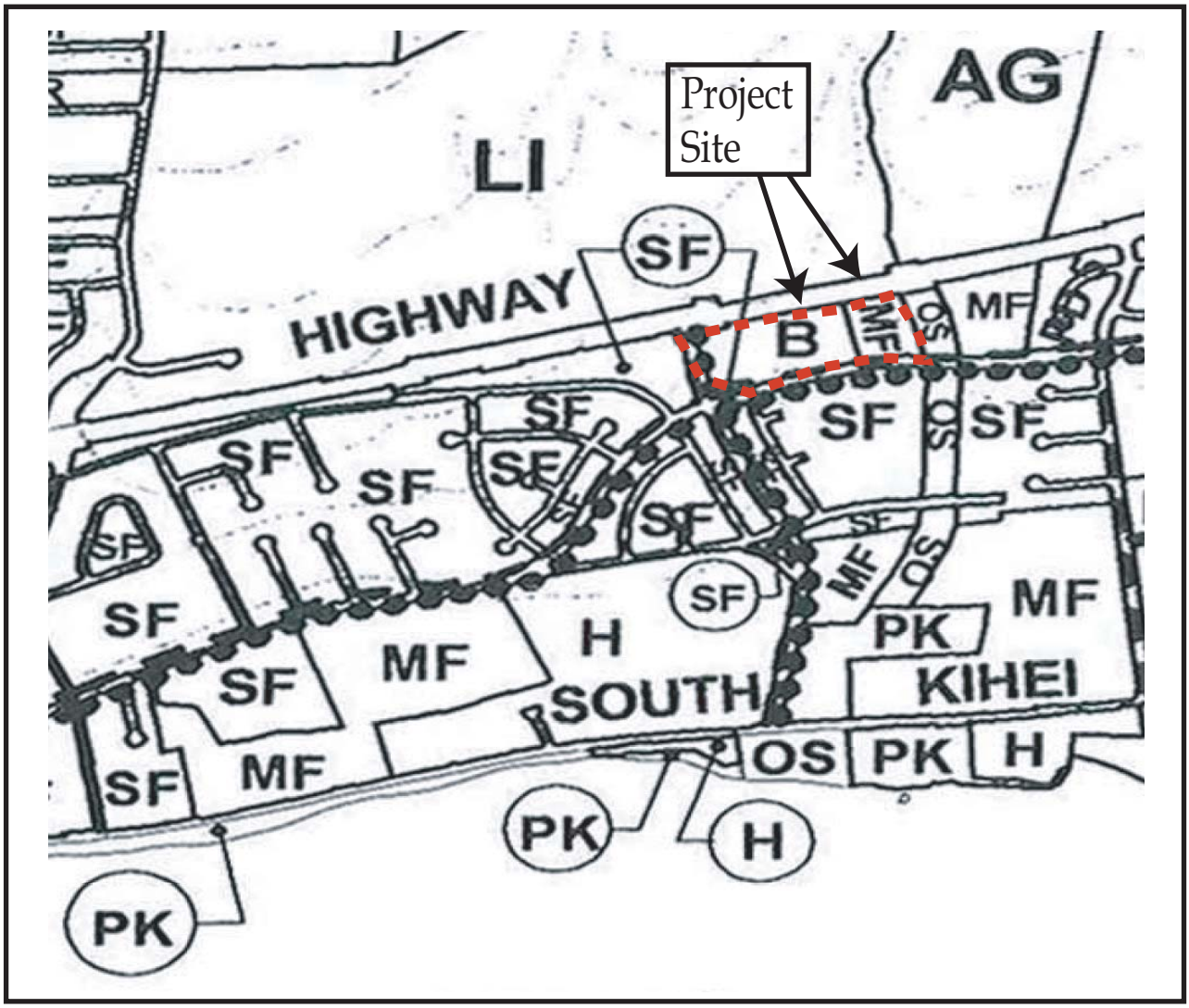


Source: County of Maui, 2014

Kenolio Apartments
Figure No. 3

State Land Use Map

CHRIS HART & PARTNERS, INC.



Source: County of Maui, Kihei-Makena Community Plan Map

Kenolio Apartments
Figure No. 4

Kihei-Makena Community Plan Map

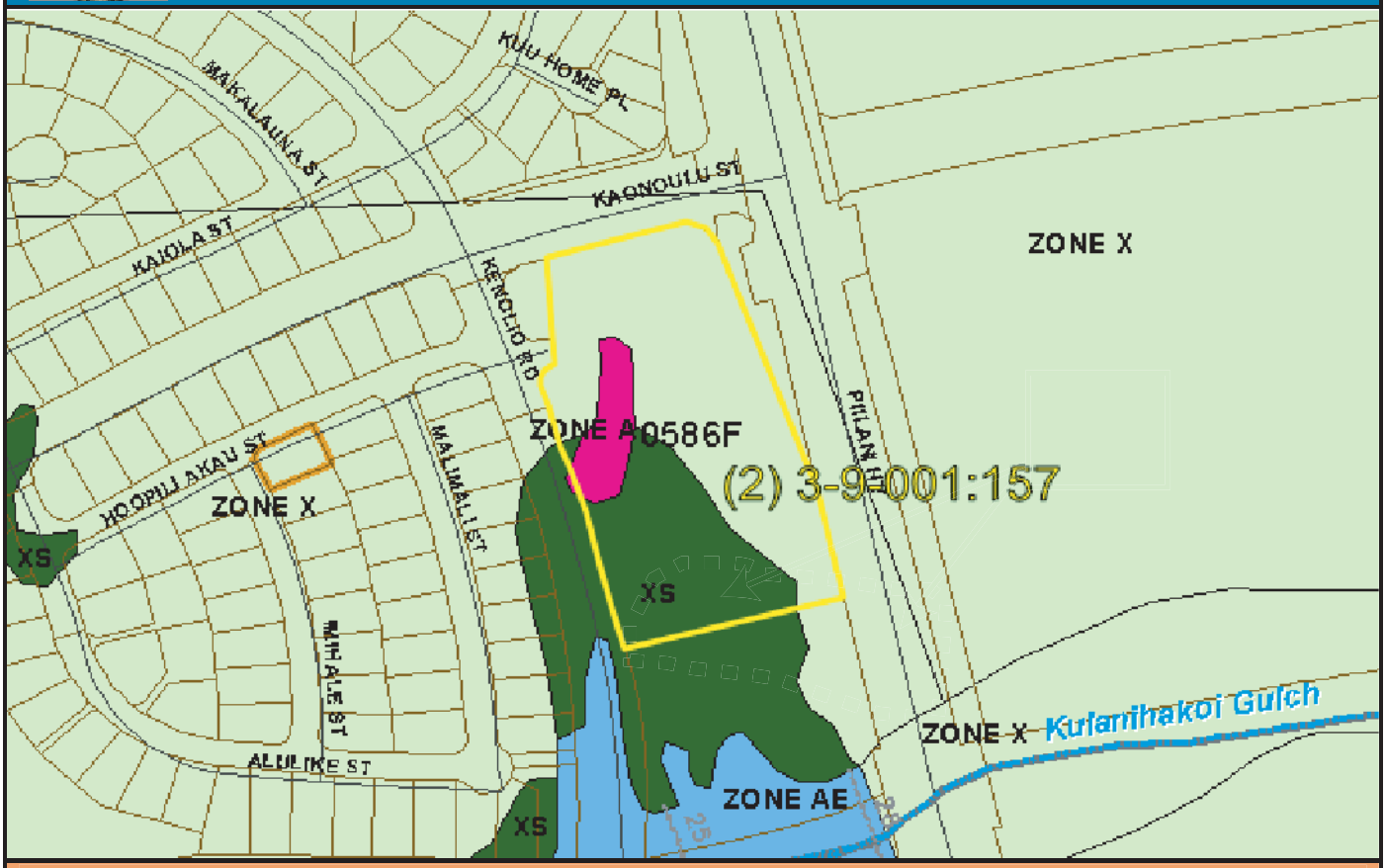
CHRIS HART & PARTNERS, INC.

Source: County of Maui, Kihei Land Zoning Map 5

Kenolio Apartments Figure No. 5	CHRIS HART & PARTNERS, INC.
Maui County Zoning Map	

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD – The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- Zone A: No BFE determined.
- Zone AE: BFE determined.
- Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
- Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
- Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

Source: County of Maui, Kihei Land Zoning Map

NON-SPECIAL FLOOD HAZARD AREA – An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

PROPERTY INFORMATION

COUNTY:	MAUI
TMK NO:	(2) 3-9-001-157
PARCEL ADDRESS:	635 KENOLIO RD KIHEI, HI 96753
FIRM INDEX DATE:	SEPTEMBER 19, 2012
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1500030586F
PANEL EFFECTIVE DATE:	SEPTEMBER 19, 2012

PARCEL DATA FROM:	JULY 2013
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

County NFIP Coordinator	
County of Maui	
Carolyn Cortez	(808) 270-7253
State NFIP Coordinator	
Carol Tyau-Beam, P.E., CFM	(808) 587-0267

*Disclaimer: The Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use of the information contained in
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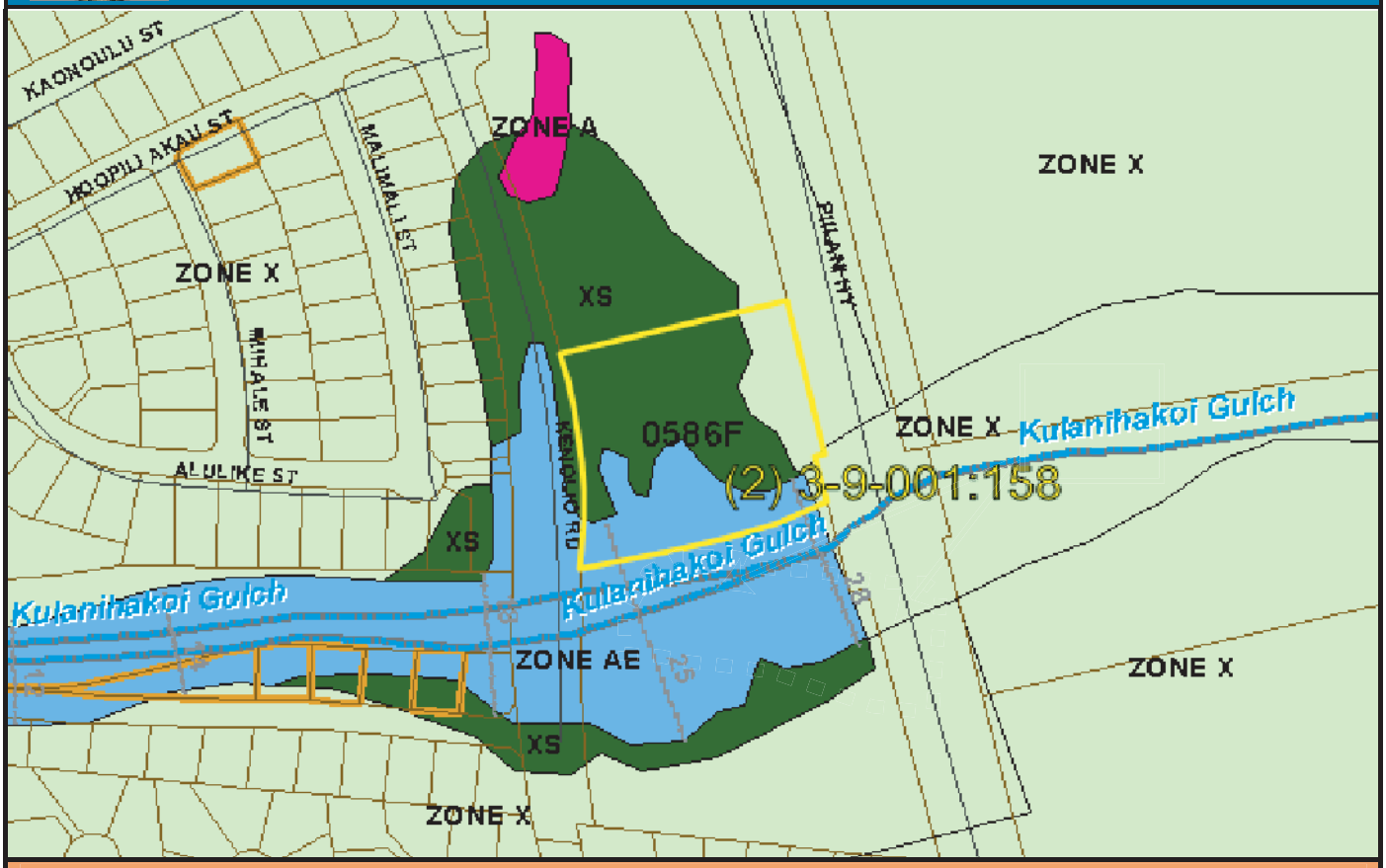
Kenolio Apartments
Figure No. 6.1

Flood Hazard Assessment Report
Parcel 157

CHRIS HART & PARTNERS, INC.

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



Source: County of Maui - Kihei Land Zoning Map 5

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD– The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- Zone A: No BFE determined.
- Zone AE: BFE determined.
- Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
- Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
- Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA – An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

PROPERTY INFORMATION

COUNTY:	MAUI
TMK NO:	(2) 3-9-001-158
PARCEL ADDRESS:	KENOLIO RD KIHEI, HI 96753
FIRM INDEX DATE:	SEPTEMBER 19, 2012
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1500030586F
PANEL EFFECTIVE DATE:	SEPTEMBER 19, 2012

PARCEL DATA FROM:	JULY 2013
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

County NFIP Coordinator	
County of Maui	
Carolyn Cortez	(808) 270-7253
State NFIP Coordinator	
Carol Tyau-Beam, P.E., CFM	(808) 587-0267

Disclaimer: The Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use of the information contained in accuracy of liability, whic

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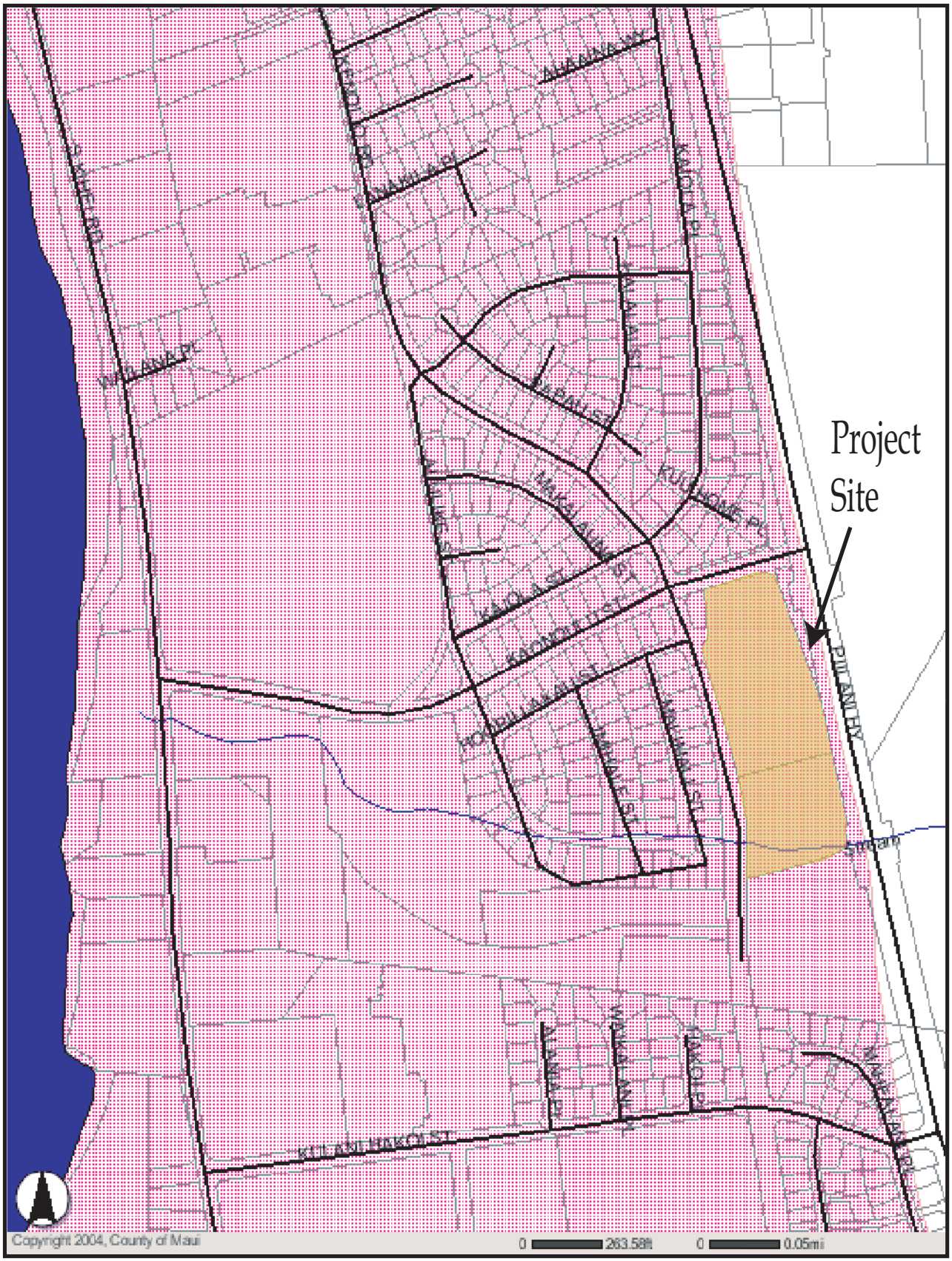
Kenolio Apartments

Figure No. 6.2

Flood Hazard Assessment Report

Parcel 158

CHRIS HART & PARTNERS, INC.



Source: County of Maui, 2014

Kenolio Apartments
Figure No. 7

Special Management Area Map

CHRIS HART & PARTNERS, INC.

TMK: (2) 3-9-001: 157 & 158

CHRIS HART & PARTNERS

LANDSCAPE PLAN

KENOLIO APARTMENTS

KIHEI, MAUI, HAWAII

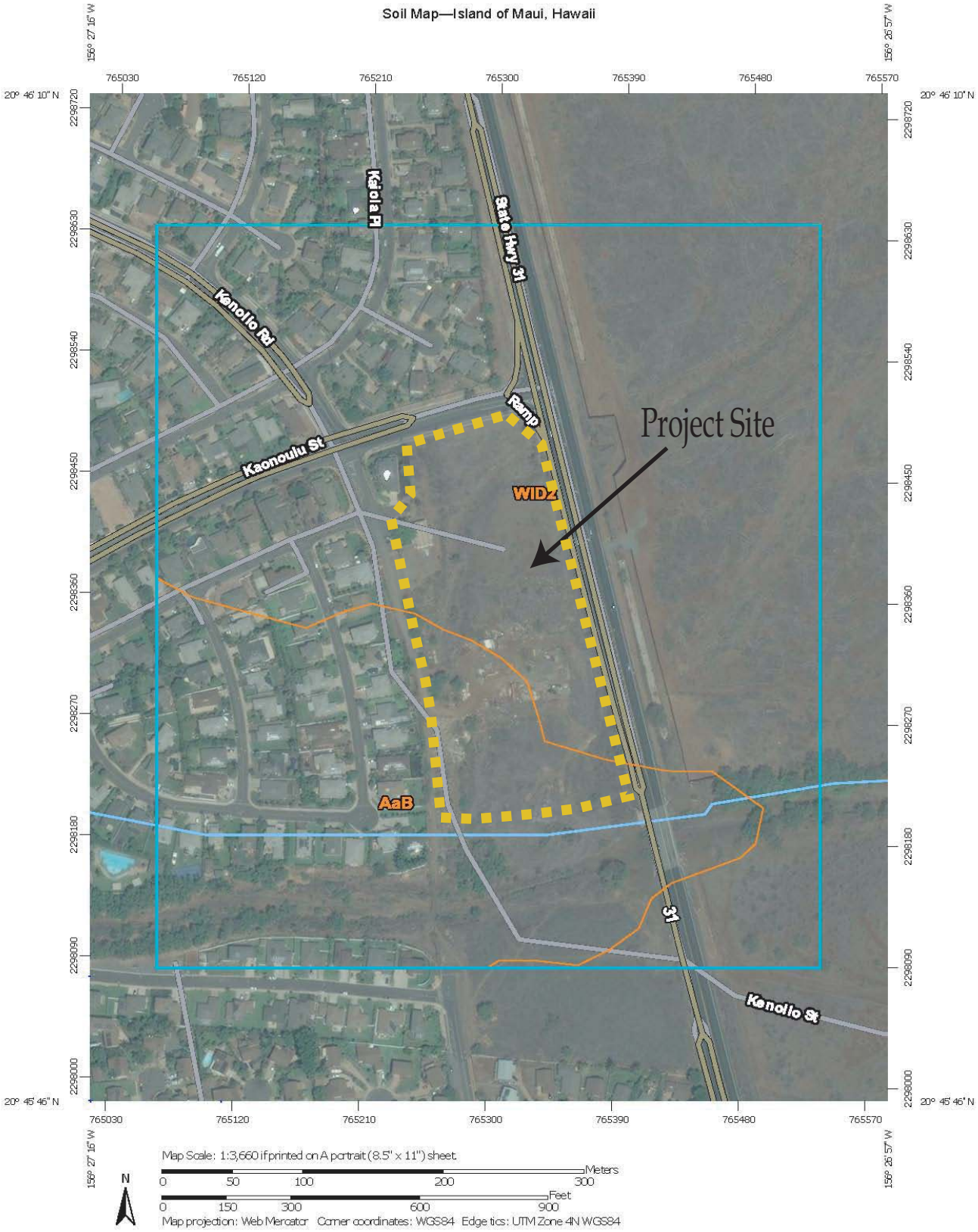
0 ft. 40 80 120

SCALE: 1"=40'-0"
PROJECT: 12-114
DATE: 5/23/14

Kenolio Apartments
Figure No. 8

Conceptual Landscape Site Plan

CHRIS HART & PARTNERS, INC.



USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

5/14/2014
Page 1 of 3

Kenolio Apartments
Figure No. 9

Soils Map

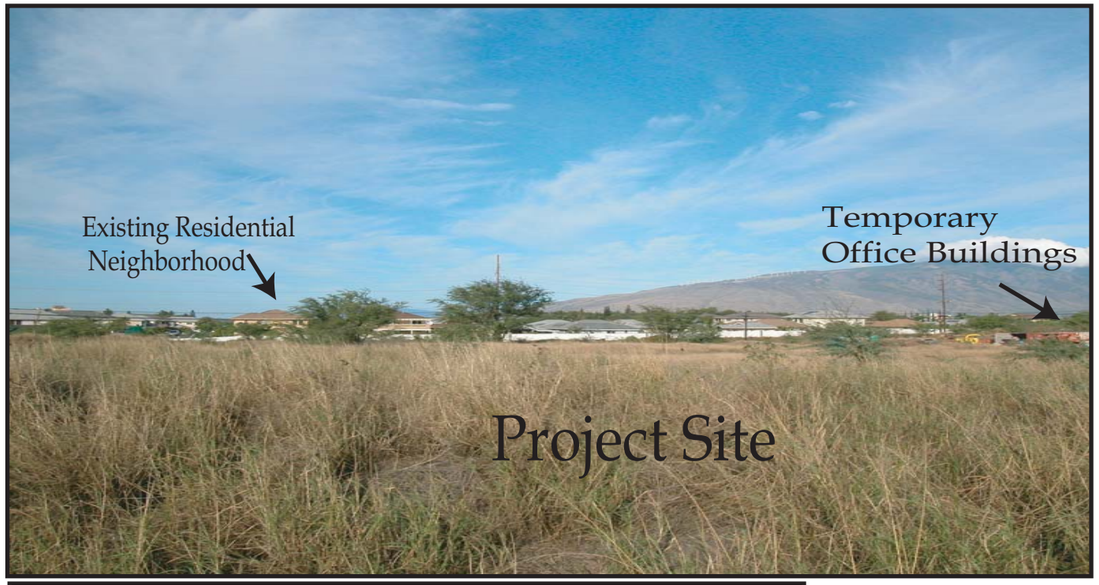
CHRIS HART & PARTNERS, INC.

Looking North at the Intersection of Kaonoulu Street and Piiliani Highway

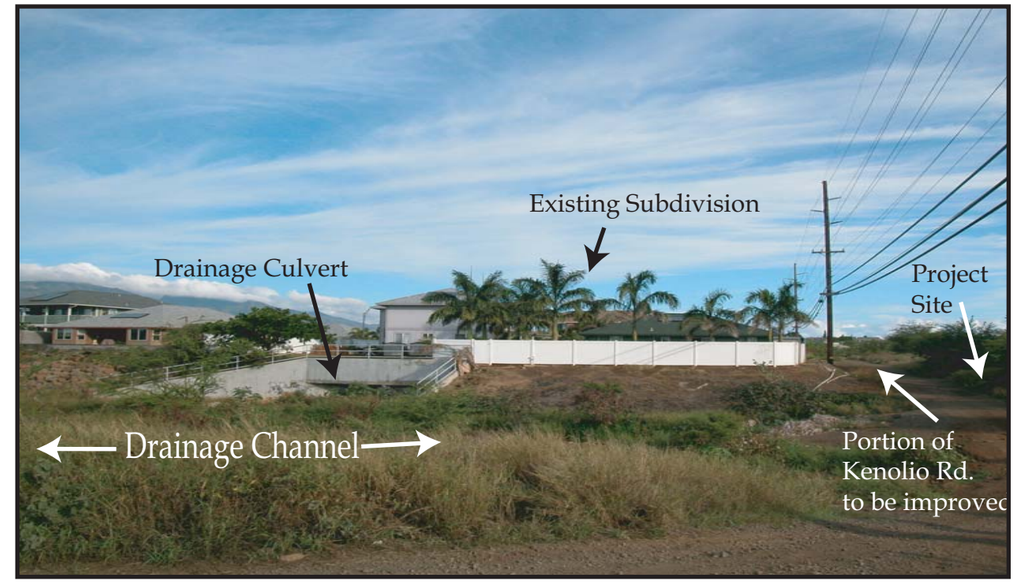
Facing South, looking at the unimproved portion of Kenolio Road that will provide access to project

Intersection of Kaonoulu Street and Kenolio Road (Kenolio will provide access to the proposed project)

Kenolio Apartments Figure No. 10.1	CHRIS HART & PARTNERS, INC.
Site Photographs	



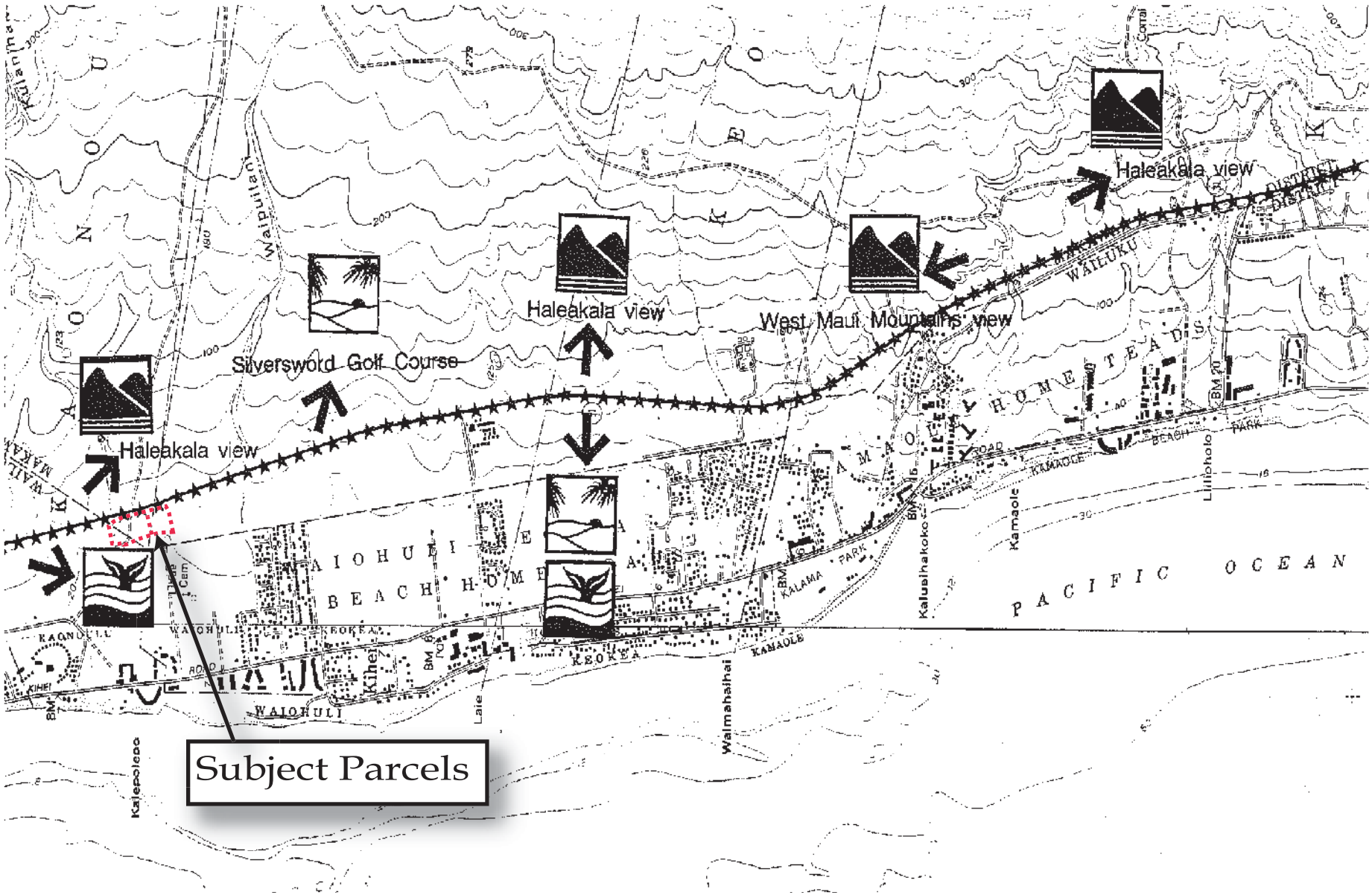
Photograph of Project Site taken from Piilani Highway facing West with West Maui Moutains in background.



North View of Drainage Channel that serves existing Single-Family Homes (Note: The drainage infrastructure constructed was previously engineered to accommodate the proposed Kenolio Apartments.)

South View, looking at the Project Site from the intersection of Kaonoulu Street and Piilani Highway.

Kenolio Apartments Figure No. 10.2	CHRIS HART & PARTNERS, INC.
Site Photographs	



Kenolio Apartments

Figure No. 11

May 2014

Maui Coastal Scenic Resources Study Map

(Not to Scale)

CHRIS HART & PARTNERS, INC.

APPENDICES

APPENDIX A
Early Consultation Letters

From: Ian Bordenave [mailto:ian_bordenave@fws.gov]
Sent: Monday, April 21, 2014 8:52 AM
To: Brett Davis
Subject: RE: 2014-TA-0242 Kenolio Apartments Housing Project, Maui

In Reply Refer To:
2014-TA-0242

Mr. Brett Davis
Staff Planner
Chris Hart and Partners, Inc.
115 North Market Street
Wailuku, Hawaii 96793-1717

Subject: Technical Assistance for the Proposed Kenolio Apartments Multi-Family Housing Project, Maui

Dear Mr. Davis:

The U.S. Fish and Wildlife Service (Service) received your letter on March 26, 2014, requesting comment on the proposed construction of a 186-unit apartment complex located southwest of the intersection of the Piilani Highway and Kaonoulu Street in Kihei, Hawaii [TMK: (2) 3-9-001:157 & 158].

Project Description
The applicant proposes to construct a 186-unit apartment complex, with 100% of the proposed project dedicated to providing affordable, rent-only housing in the North Kihei neighborhood of Maui. The proposed project also includes required on-site parking and infrastructure, as well as a pool, playground, and community building.

Species Affected
Based on information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program, five species protected by the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.), may occur within, or transit through, the proposed action area and could be impacted by the proposed action: the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), Blackburn's sphinx moth (*Manduca blackburni*), Hawaiian goose (*Branta sandvicensis*), Hawaiian petrel (*Pterodroma sandwichensis*), the threatened Newell's shearwater (*Puffinus auricularis newelli*).

To help you minimize potential impacts to listed species, the Service is providing you the following avoidance and minimization measures. Please note that implementation of these measures does not ensure that impacts to listed species can be avoided, and further coordination with the Service on compliance with the ESA may be required.

- The Hawaiian hoary bat is known to occur throughout the island of Maui. This bat roosts in both exotic and native woody vegetation and, while foraging, leaves young unattended in "nursery" trees and shrubs. If trees or shrubs suitable

for bat roosting are cleared during the hoary bat breeding season (June 1 to September 15), there is a risk that young bats could inadvertently be harmed or killed. As a result, the Service recommends that woody plants greater than 15 feet tall should not be removed or trimmed during the Hawaiian hoary bat breeding season.

- The Blackburn's sphinx moth may presently breed and feed within the proposed action area. Adult moths feed on nectar from native plants, including beach morning glory (*Ipomoea pes-caprae*), iliee (*Plumbago zeylanica*), and maiapilo (*Capparis sandwichiana*); larvae feed upon non-native tree tobacco (*Nicotiana glauca*) and native aiea (*Nothocestrum latifolium*). According to the Botanical and Fauna Survey Report written by Robert Hobdy, a lone fourth instar Blackburn's Sphinx moth larvae was found on a *Datura stramonium* (Family Solanaceae) plant located on the project parcel. The Service recommends that the applicant contact us as soon as possible to discuss project timelines, as well as avoidance and minimization measures pertaining to the conservation of this listed species.

- Due to its range and foraging behavior, the Hawaiian goose may be present in the vicinity of the proposed action at any time of the year. If a Hawaiian goose appears within 100 feet of ongoing construction work, all activity shall be temporarily suspended until the bird moves off to a safe distance of its own volition. Moreover, if any number of Hawaiian geese are observed loafing or foraging within the area of the proposed project during the Hawaiian goose breeding season (October through April), a biologist familiar with the nesting behavior of the Hawaiian goose should survey in and around the proposed construction footprint prior to the resumption of any work, or after any subsequent delay of work of three or more days (during which the birds may attempt to nest). If a nest is discovered within a radius of 150 feet of proposed construction work, or a previously undiscovered nest is found within said radius after work begins, all work must cease immediately and the Service contacted for further guidance.

- The Hawaiian petrel and Newell's shearwater, collectively referred to as seabirds, may transit through the proposed action area while flying between the ocean and nesting sites in the mountains during their respective breeding seasons (typically March through December). Seabird fatalities resulting from collisions with artificial structures that extend above the surrounding vegetation have been documented in Hawaii where high densities of transiting seabirds occur. Additionally, outdoor artificial lighting such as flood lighting for construction work, security, and outdoor illumination can adversely impact seabirds by causing disorientation which may result in collision with utility lines, buildings, fences, and vehicles. Fledging seabirds are especially affected by artificial lighting and have a tendency to exhaust themselves while circling the light sources and become grounded. Too weak to fly, these birds become vulnerable to depredation by feral predators such as dogs, cats, and mongoose. Accordingly, all project-

related overhead lighting should be shielded so that the bulb is not visible at or above bulb-height.

If you have any questions concerning the recommendations or comments provided, please feel free to contact me during regular business hours using the information provided below:

Mahalo nui loa,

Ian Bordenave
Biologist
U.S. Fish and Wildlife Service
Maui Nui Field Station
Milepost 6 Mokulele Highway
Kihei, HI. 96793
Phone: (808) 270-1432
E-Mail: ian_bordenave@fws.gov

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 15, 2014

Ian Bordenave, Biologist
U.S. Fish and Wildlife Service
Maui Nui Field Station
Milepost 6 Mokulele Highway
Kihei, HI. 96793

Dear Mr Bordenave,

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your email of April 21, 2014. Chris Hart and Partners, Inc. (CH&P) has prepared the following responses to your comments:

Project Description
The applicant proposes to construct a 186-unit apartment complex, with 100% of the proposed project dedicated to providing affordable, rent-only housing in the North Kihei neighborhood of Maui. The proposed project also includes required on-site parking and infrastructure, as well as a pool, playground, and community building.

Species Affected
Based on information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program, five species protected by the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), may occur within, or transit through, the proposed action area and could be impacted by the proposed action: the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), Blackburn's sphinx moth (*Manduca blackburni*), Hawaiian goose (*Branta sandvicensis*), Hawaiian petrel (*Pterodroma sandwichensis*), the threatened Newell's shearwater (*Puffinus auricularis newelli*).

To help you minimize potential impacts to listed species, the Service is providing you the following avoidance and minimization measures. Please note that implementation of these measures does not ensure that impacts to listed species can be avoided, and further coordination with the Service on compliance with the ESA may be required.

115 N. Market Street, Wailuku, Maui, Hawaii 96793-1717 • Ph 808-242-1955 • Fax 808-242-1956
www.chpmaui.com

Comment 1: The Hawaiian hoary bat is known to occur throughout the island of Maui. This bat roosts in both exotic and native woody vegetation and, while foraging, leaves young unattended in "nursery" trees and shrubs. If trees or shrubs suitable for bat roosting are cleared during the hoary bat breeding season (June 1 to September 15), there is a risk that young bats could inadvertently be harmed or killed. As a result, the Service recommends that woody plants greater than 15 feet tall should not be removed or trimmed during the Hawaiian hoary bat breeding season.

Response 1: The Applicant will comply with the recommendation that woody plants greater than 15 feet tall should not be removed or trimmed during the Hawaiian hoary bat breeding season.

Comment 2: The Blackburn's sphinx moth may presently breed and feed within the proposed action area. Adult moths feed on nectar from native plants, including beach morning glory (*Ipomoea pes-caprae*), iliee (*Plumbago zeylanica*), and maiapilo (*Capparis sandwichiana*); larvae feed upon non-native tree tobacco (*Nicotiana glauca*) and native aiea (*Nothocestrum latifolium*). According to the Botanical and Fauna Survey Report written by Robert Hobdy, a lone fourth instar Blackburn's Sphinx moth larvae was found on a *Datura stramonium* (Family Solanaceae) plant located on the project parcel. The Service recommends that the applicant contact us as soon as possible to discuss project timelines, as well as avoidance and minimization measures pertaining to the conservation of this listed species.

Response 2: The project team had a Conference call with USFWS and DLNR staff on 4/28/2014 as recommended by the USFWS to discuss comments and mitigation measures. As a result of the conference call, Mr. Bob Hobdy surveyed the site again and no larva were identified. As a result, of the second survey The Applicant will begin hand clearing small shrubs on the project site. The applicant will continue to coordinate with the USFWS during the environmental review process.

Comment 3: Due to its range and foraging behavior, the Hawaiian goose may be present in the vicinity of the proposed action at any time of the year. If a Hawaiian goose appears within 100 feet of ongoing construction work, all activity shall be temporarily suspended until the bird moves off to a safe distance of its own volition. Moreover, if any number of Hawaiian geese are observed loafing or foraging within the area of the proposed project during the Hawaiian goose breeding season (October through April), a biologist familiar with the nesting behavior of the Hawaiian goose should survey in and around the proposed construction footprint prior to the resumption of any work, or after any subsequent delay of work of three or more days (during which the birds may attempt to nest). If a nest is discovered within a radius of 150 feet of proposed construction work, or a previously undiscovered nest is found within said radius after work begins, all work must cease immediately and the Service contacted for further guidance.

Response 3: The Applicant will comply with the request that if a Hawaiian goose appears within 100 feet of ongoing construction work; all activity shall be temporarily suspended until the bird moves off to a safe distance.

Comment 4: The Hawaiian petrel and Newell's shearwater, collectively referred to as seabirds, may transit through the proposed action area while flying between the ocean and nesting sites in the mountains during their respective breeding seasons (typically March through December). Seabird fatalities resulting from collisions with artificial structures that extend above the surrounding vegetation have been documented in Hawaii where high densities of transiting seabirds occur. Additionally, outdoor artificial lighting such as flood lighting for construction work, security, and outdoor illumination can adversely impact seabirds by causing disorientation which may result in collision with utility lines, buildings, fences, and vehicles. Fledging seabirds are especially affected by artificial lighting and have a tendency to exhaust themselves while circling the light sources and become grounded. Too weak to fly, these birds become vulnerable to depredation by feral predators such as dogs, cats, and mongoose. Accordingly, all project-related overhead lighting should be shielded so that the bulb is not visible at or above bulb-height.

Response 4: The Applicant will provide shielded lighting on all project-related overhead lighting.

Thank you participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or email Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
U.S. Fish and Wildlife Comment Letter

CC: Mr. Don Slattery, Project Manager
Mr. Paul Fasi, Planning Department, Current Division
Project File 12-114

NEIL ABERCROMBIE
GOVERNOR

Dean H. Seki
Comptroller

Maria E. Zielinski
Deputy Comptroller

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES

P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)1120.4

RECEIVED
APR 07 2014
CHRIS HART & PARTNERS, INC.
Landscape Architecture and Planning

APR - 4 2014

CC: Brett 12/14

Mr. Jordan E. Hart, President
Chris Hart and Partners, Inc.
115 N. Market Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Hart:

Subject: Early Consultation Letter for the Proposed Kenolio Apartment Multi-family Project located at Kenolio Street
Kihei, Maui, Hawaii
TMK: (2) 3-9-001:157 and 158

Thank you for the opportunity to provide comments for the subject project. This project does not impact any of the Department of Accounting and General Services' projects or existing facilities in this area and we have no comments to offer at this time.

If you have any questions, your staff may call Mr. Alva Nakamura of the Public Works Division at 586-0488.

Sincerely,

DEAN H. SEKI
Comptroller

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 9, 2014

Mr. Dean H. Seki, State Comptroller
State of Hawaii
Department of Accounting and General Services
P.O. Box 119
Honolulu, HI 96810-0119

Dear Mr. Seki,

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your comment letter of April 4, 2014 which indicates that the proposed project will not have any effect upon your Department's projects or facilities in the area and that you have no further comments to offer at this time.

Thank you for participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or e-mail Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
DAGS Comment Letter

CC: Mr. Don Slattery, Project Manager
Project File 12-114

115 N. Market Street, Wailuku, Maui, Hawaii 96793-1717 • Ph 808-242-1955 • Fax 808-242-1956
www.chpmaui.com

OFFICE OF PLANNING
STATE OF HAWAII

NEIL ABERCROMBIE
GOVERNOR

LEO R. ASUNCION
ACTING DIRECTOR
OFFICE OF PLANNING

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: http://planning.hawaii.gov/

Ref. No. P-14332

April 7, 2014

RECEIVED
APR 09 2014
CHRIS HART & PARTNERS, INC.
Landscape Architecture and Planning

CC: Brett 12/14

Mr. Jordan E. Hart, President
Chris Hart & Partners, Inc.
115 N. Market Street
Wailuku, Hawaii 96793

Dear Mr. Hart:

Subject: Early Consultation for the Proposed Kenolio Apartments Multi-Family Project Located at Kenolio Street, Kihei, Maui, Hawaii, Tax Map Key: (2) 3-9-001: 157 and 158

The Office of Planning has reviewed your request, dated March 24, 2014, for early consultation on a Draft Environmental Assessment (EA) for the subject project, and has the following comments to offer:

1. The applicant should address the trigger(s) of the EA for the proposed project.

2. The planning departments of the various counties are charged with assessing Special Management Area (SMA) permit applications and shoreline setbacks. Please contact the Department of Planning, County of Maui, for the SMA use requirements for the subject project.

3. Hawaii Revised Statutes (HRS) Chapter 205A requires all state and county agencies to enforce the coastal zone management (CZM) objectives and policies. The subject EA should include an assessment as to how the proposed action conforms to the CZM objectives and its supporting policies set forth in HRS § 205A-2.

4. The SMA guidelines, articulated in HRS § 205A-26, apply specifically to the SMA permit process. As the subject EA will be consolidated with an SMA use permit application, the EA should assess the compliance of the proposed project to the SMA guidelines.

If you have any questions regarding this comment letter, please contact Shichao Li of our CZM Program at (808) 587-2841.

Sincerely,

Leo R. Asuncion
Acting Director

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 9, 2014

Mr. Leo Asuncion, Jr., Acting Director
Office of Planning
State of Hawaii, DBEDT
235 South Beretania Street, 6th Floor
Honolulu, HI 96813

Dear Mr. Asuncion,

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your letter of April 7, 2014. Our responses to your numerated comments are as follows:

Comment 1: *The applicant should address the trigger(s) of the EA for the proposed project.*

Response 1: The Draft EA will identify the trigger for the EA.

Comment 2: *The planning departments of the various counties are charged with assessing Special Management Area (SMA) permit applications and shoreline setbacks. Please contact the Department of Planning, County of Maui, for the SMA use requirements for the subject project.*

Response 2: The Applicant has consulted with the Maui County Planning Department and is aware of the SMA use requirement for the proposed project.

Comment 3: *Hawaii Revised Statutes (HRS) Chapter 205A requires all state and county agencies to enforce the coastal zone management (CZM) objectives and policies. The subject EA should include an assessment as to how the proposed action conforms to the CZM objectives and its supporting policies set forth in HRS 205A-2.*

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Response 3: The Draft EA will include a section that will assess the compliance of the proposed project to the CZM objectives and its supporting policies set forth in HRS 205A-2.

Comment 4: *The SMA guidelines, articulated in HRS 205A-26, apply specifically to the SMA permit process. As the subject EA will be consolidated with an SMA use permit application, the EA should assess the compliance of the proposed project to the SMA guidelines.*

Response 4: The Draft EA will include a section that will assess the compliance of the proposed project to the SMA guidelines.

Thank you for participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or e-mail Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
Office of Planning Comment Letter

CC: Mr. Don Slattery, Project Manager
Project File 12-114

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LINDA ROSEN, M.D., M.P.H.
DIRECTOR OF HEALTH

LORRIN W. PANG, M.D., M.P.H.
DISTRICT HEALTH OFFICER

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU HI 96793

April 17, 2014

Mr. Jordon E. Hart
President
Chris Hart & Partners, Inc.
115 North Market Street
Wailuku, Hawai`i 96793

Dear Mr. Hart:

Subject: Proposed Kenolio Apartments Multi-family Project
TMK: (2) 3-9-001:157 and 158

Thank you for the opportunity to review this project. We have the following comments to offer:

1. Please provide wastewater disposal method for this project. If you have any questions, please contact Roland Tejano, Environmental Engineer, at 808 984-8232.

2. National Pollutant Discharge Elimination System (NPDES) permit coverage may be required for this project. The Clean Water Branch should be contacted at 808 586-4309.

3. The noise created during the construction phase of the project may exceed the maximum allowable levels as set forth in Hawaii Administrative Rules (HAR), Chapter 11-46, "Community Noise Control." A noise permit may be required and should be obtained before the commencement of work. The Indoor & Radiological Health Branch should be contacted at 808 586-4700.

It is strongly recommended that the Standard Comments found at the Department's website: http://health.hawaii.gov/epo/home/landuse-planning-review-program/ be reviewed and any comments specifically applicable to this project should be adhered to.

RECEIVED
APR 21 2014
CHRIS HART & PARTNERS, INC.
Landscape Architecture and Planning
CC: Brett
12/1/14

Should you have any questions, please call me at 808 984-8230 or E-mail me at patricia.kitkowski@doh.hawaii.gov.

Sincerely,

Patti Kitkowski

Patti Kitkowski
District Environmental Health Program Chief

c EPO

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 9, 2014

Ms. Patti Kitkowski
Acting District Environmental Health Program Chief
Dept. of Health
Maui District Health Office
54. High St.
Wailuku, HI 96793-2102

Dear Ms. Kitkowski,

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your letter of April 17, 2014. The forthcoming Draft EA will provide a detailed analysis on wastewater. The Applicant will coordinate with the Department of Health, Clean Water Branch to determine if a NPDES permit is required for the proposed project. The construction phase of the project will comply with allowable noise levels as set forth in Hawaii Administrative Rules (HAR), Chapter 11-46, "Community Noise Control." The Applicant has reviewed the Standard Comments and will comply, as applicable with the proposed project.

Thank you participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or email Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
Department of Health Comment Letter

CC: Mr. Don Slattery, Project Manager
Project File 12-114

115 N. Market Street, Wailuku, Maui, Hawaii 96793-1717 • Ph 808-242-1955 • Fax 808-242-1956
www.chpmaui.com

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LINDA ROSEN, M.D., M.P.H.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
EMD/CWB

04013PJF.14

April 11, 2014

RECEIVED
APR 16 2014
CHRIS HART & PARTNERS, INC.
Landscape Architecture and Planning

CC: Brett 12/114

Mr. Jordan E. Hart
President
Chris Hart & Partners, Inc.
115 N. Market Street,
Wailuku, Island of Maui, Hawaii 96793-1717

Dear Mr. Hart:

SUBJECT: Comments on Draft Environmental Assessment (DEA) for the Proposed Kenolio Apartments Multi-family Project Kihei, Island of Maui, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated March 24, 2014 (received on March 27, 2014), requesting comments on the subject document. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. Your applicant may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://health.hawaii.gov/epo/files/2013/10/CWB_Oct22.pdf.

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. National Pollutant Discharge Elimination System (NPDES) permit coverage is required for pollutant discharges into State surface waters and for certain situations involving storm water (HAR, Chapter 11-55).

a. Discharges into Class 2 or Class A State waters can be covered under an NPDES general permit only if all of the NPDES general permit requirements are met. Please see the DOH-CWB website (http://health.hawaii.gov/cwb/) for the NPDES general permits and instructions to request coverage.

b. All other discharges into State surface waters and discharges into Class 1 or Class AA State waters require an NPDES individual permit. To request NPDES individual permit coverage, please see the DOH-CWB forms website located at: http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/forms/.

c. NPDES permit coverage for storm water associated with construction activities is required if your project will result in the disturbance of one (1) acre or more of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. NPDES permit coverage is required before the start of the construction activities.

   Land disturbance includes, but is not limited to clearing, grading, grubbing, uprooting of vegetation, demolition (even if leaving foundation slab), staging, stockpiling, excavation into pavement areas which go down to the base course, and storage areas (including areas on the roadway to park equipment if these areas are blocked off from public usage, grassed areas, or bare ground).

3. If the project involves work in, over, or under waters of the United States, it is highly recommend that your applicant contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and HAR, Chapter 11-54.

4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

If you have any questions, please visit our website at: http://health.hawaii.gov/cwb, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

ALEC WONG, P.E., CHIEF
Clean Water Branch

JF:tg

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 9, 2014

Mr. Alec Wong, P.E., Chief
State of Hawaii, Dept. of Health
Clean Water Branch
P.O. Box 3378
Honolulu, HI 96801-3378

Dear Mr. Wong:

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your letter of April 11, 2014. We have provided the following responses to your numerated comments.

Comment 1. *Any project and its potential impacts to State waters must meet the following criteria: a. Antidegradation policy (HAR, Section 11-54-1 .I), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected. b. Designated uses (HAR, Section 11 -54-3), as determined by the classification of the receiving State waters. c. Water quality criteria (HAR, Sections 1 1-54-4 through 1 1-54-8).*

Response 1. The proposed project will comply with the applicable provisions of Chapter 11-54, Hawaii Administrative Rules (HAR) entitled Water Quality Standards and Chapter 11-55, HAR titled Water Pollution Control.

The proposed project will also be developed in accordance with the standards set forth by:

a. Section 11-54-1.1, HAR (General Policy of Water Quality Anti-degradation).

b. Section 11-54-3, HAR (Classification of Water Uses).

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c. The water quality criteria set forth in Sections 11-54-4 through 11-54-8, HAR.

Comment 2. *National Pollutant Discharge Elimination System (NPDES) permit coverage is required for pollutant discharges into State surface waters and for certain situations involving storm water (HAR, Chapter 11-55).*

a. Discharges into Class 2 or Class A State waters can be covered under an NPDES general permit only if all of the NPDES general permit requirements are met. Please see the DOH-CWB website (http://health.hawaii.gov/cwb/) for the NPDES general permits and instructions to request coverage.

b. All other discharges into State surface waters and discharges into Class 1 or Class AA State waters require an NPDES individual permit. To request NPDES individual permit coverage, please see the DOH-CWB forms website located at: http://health.hawaii.gov/cwb/site-maplclean-water-branch-home-page/forms/.

c. NPDES permit coverage for storm water associated with construction activities is required if your project will result in the disturbance of one (1) acre or more of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. NPDES permit coverage is required before the start of the construction activities.

Land disturbance includes, but is not limited to clearing, grading, grubbing, uprooting of vegetation, demolition (even if leaving foundation slab), staging, stockpiling, excavation into pavement areas which go down to the base course, and storage areas (including areas on the roadway to park equipment if these areas are blocked off from public usage, grassed areas, or bare ground).

Response 2. The Applicant acknowledges that a National Pollutant Discharge Elimination System (NPDES) general permit is required for discharges into Class A or Class 2 State waters. Prior to the commencement of construction, an application for an NPDES permit for storm water associated with construction activities will be submitted to the Clean Water Branch (CWB) for review and approval.

Comment 3. *If your project involves work in, over, or under waters of the United States, it is highly recommend that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements. Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401 (a)(l), a Section 401 Water Quality Certification (WQC) is required for "[alny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters ..." (emphasis added). The term "discharge" is defined in CWA, Subsections 5O2(16), 502(l2), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and Hawaii Administrative Rules (HAR), Chapter 11-54.*

Response 3. The U.S. Army Corps of Engineers was provided with a copy of the early consultation letter requesting comments as part of the consultation process for the preparation of the Draft EIS.

Comment 4. *Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.*

Response 4. Notwithstanding other permit requirements, the Applicant understands that all project-related discharges must comply with the State's Water Quality Standards as set forth in Chapter 11-54, HAR.

Thank you participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or email Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
Department of Health Comment Letter

CC: Mr. Don Slattery, Project Manager
Project File 12-114

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LINDA ROSEN, M.D., M.P.H.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:
[EPO 14-054]
[Kenolio Apartments]

April 8, 2014

Jordan E. Hart, President
Chris Hart & Partners, Inc
115 N. Market Street
Wailuku, Maui, HI 96793-1717

Dear Mr. Hart

SUBJECT: Early Consultation for Kenolio Apartment, Multi-family, Kenolio Street, Kihei

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your letter dated March 24, 2014. Thank you for allowing us to review and comment on the subject document. The document was routed to the relevant Environmental Health divisions and offices. They will provide specific comments to you if necessary. EPO recommends that you review the standard comments at: http://health.hawaii.gov/epo/home/landuse-planning-review-program/. You are required to adhere to all applicable standard comments.

You may also wish to review the recently revised Water Quality Standards Maps that have been updated for all islands. The new Water Quality Standards Maps (2013) can be found at: http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/water-quality-standards/

EPO suggests that you examine the many sources available on strategies to support the sustainable and healthy design of communities and buildings, including the:
State of Hawaii, Office of Planning: www.planning.hawaii.gov and the 2013 ORMP;
U.H., School of Ocean and Earth Science and Technology: www.soest.hawaii.edu;
U.S. Health and Human Services: www.hhs.gov/about/sustainability;
U.S. Environmental Protection Agency's sustainability programs: www.epa.gov/sustainability;
U.S. Green Building Council's LEED program: www.usgbc.org/leed; and
Smart Growth America: www.smartgrowthamerica.org
International Well Building Standard: http://delosliving.com

The DOH encourages everyone to apply these sustainability strategies and principles early in the planning and review of projects. We also request that for future projects you consider conducting a Health Impact Assessment (HIA). More information is available at:
www.cdc.gov/healthyplaces/hia.htm
www.epa.gov/research/healthscience/health-impact-assessment.htm
We request you share all of this information with others to increase community awareness on sustainable, innovative, inspirational, and healthy community design.

Mahalo,

Laura Leialoha Phillips McIntyre, AICP
Program Manager, Environmental Planning Office

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 9, 2014

Ms. Laura Leialoha Phillips McIntyre, AICP
Environmental Planning Office Manager
State of Hawaii, Dept. of Health
Environmental Planning Office
P.O. Box 3378
Honolulu, HI 96801-3378

Dear Ms. Leialoha Phillips McIntyre:

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your letter dated April 8, 2014. The Applicant has reviewed the comments provided and will adhere to all applicable standard comments. Additionally the Applicant's consultants will examine the provided sources on strategies to support the sustainable and healthy design of communities and buildings.

The Applicant will review the Health Impact Assessment information provided for future projects.

Thank you again for participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or e-mail Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
Department of Health Comment Letter

CC: Mr. Don Slattery, Project Manager
Project File 12-114

115 N. Market Street, Wailuku, Maui, Hawaii 96793-1717 • Ph 808-242-1955 • Fax 808-242-1956
www.chpmaui.com

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 24, 2014

Chris Hart & Partners, Inc.
Attention: Mr. Jordan E. Hart, President
115 N. Market Street
Wailuku, Hawaii 96793

Dear Mr. Hart:

SUBJECT: Early Consultation Letter for the Proposed Kenolio Apartments Multi-family Project

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comments.

At this time, enclosed are comments from the (a) Engineering Division and (b) Commission on Water Resource Management on the subject matter. Should you have any questions, please feel free to call Lydia Morikawa at 587-0410. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)
cc: Central Files

RECEIVED
APR 28 2014
CHRIS HART & PARTNERS, INC.
Landscape Architecture and Planning

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RECEIVED
LAND DIVISION

2014 APR -1 PM 2:46

DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

'14 MAR 28 AM 09:54 ENGINEERING

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 27, 2014

MEMORANDUM

~~TO:~~ FR:

DLNR Agencies:
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
X Commission on Water Resource Management
__Office of Conservation & Coastal Lands
X Land Division – Maui District
X Historic Preservation

TO:
~~FROM:~~ Russell Y. Tsuji, Land Administrator
SUBJECT: Early Consultation Letter for the Proposed Kenolio Apartments Multi-family Project
LOCATION: Kihei, Island of Maui; TMK: (2) 3-9-001:157 and 158
APPLICANT: Chris Hart & Partners, Inc.

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by April 23, 2014.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Lydia Morikawa at 587-0410. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed:
Print Name: Carty S. Chang, Chief Engineer
Date: 4/1/14

cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/ Russell Y. Tsuji
Ref.: Early Consultation Letter for the Proposed Kenolio Apartments Multi-family Project, Kihei Maui.009

COMMENTS

( ) We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone ___.

(X) **Please take note that parts of the project site, according to the Flood Insurance Rate Map (FIRM), are located in Flood Zones A, AE, XS and X. The National Flood Insurance Program regulates developments within Flood Zones A, AE, XS as indicated in bold letters below, but not Flood Zone X.**

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

(X) **Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.**

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

( ) Mr. Mario Siu Li at (808) 768-8098 or Ms. Ardis Shaw-Kim at (808) 768-8296 of the City and County of Honolulu, Department of Planning and Permitting.

( ) Mr. Frank DeMarco at (808) 961-8042 of the County of Hawaii, Department of Public Works.

(X) **Mr. Carolyn Cortez at (808) 270-7813 of the County of Maui, Department of Planning.**

( ) Mr. Stanford Iwamoto at (808) 241-4884 of the County of Kauai, Department of Public Works.

( ) The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: _____

( ) Other: _____

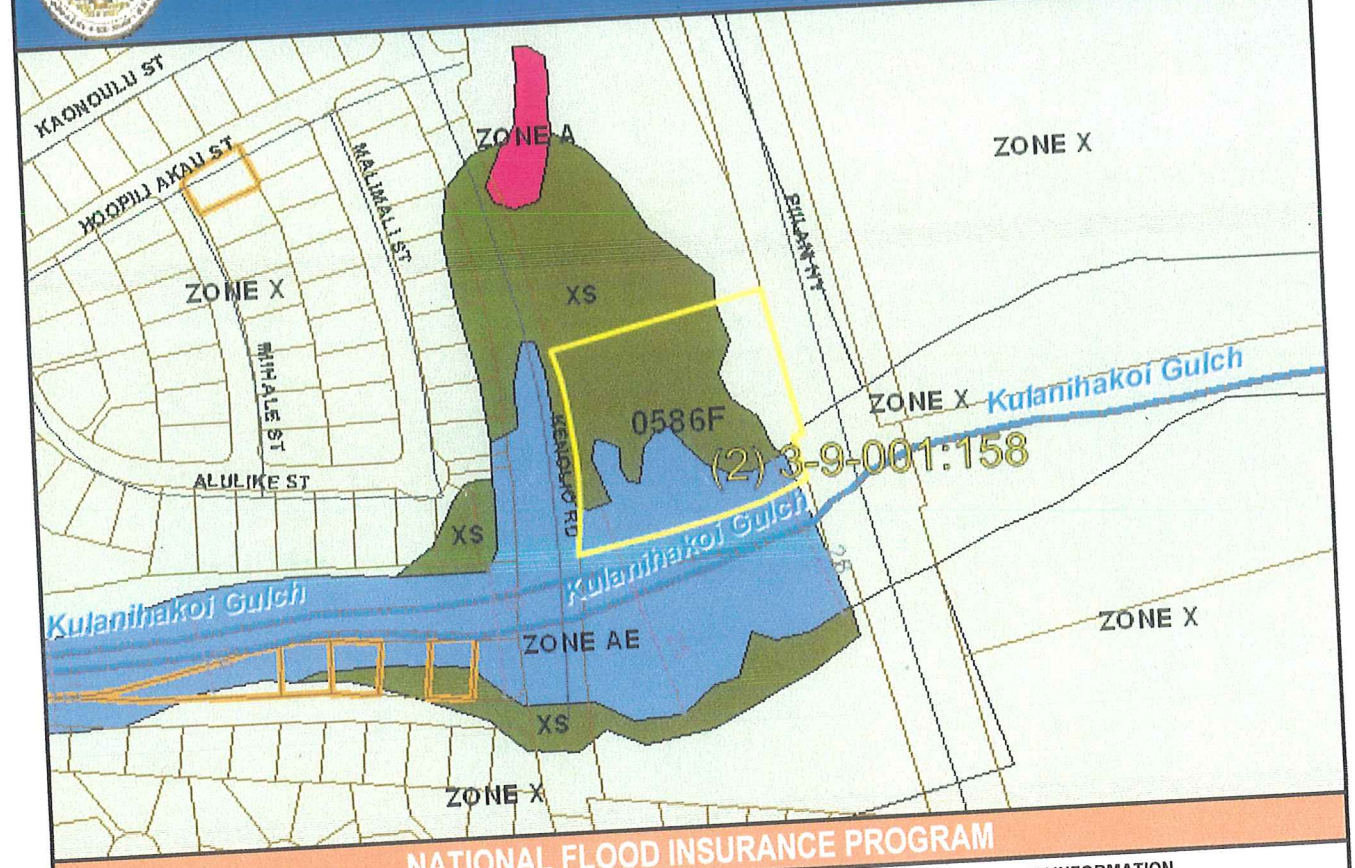
Should you have any questions, please call Mr. Dennis Imada of the Planning Branch at 587-0257.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: 4/1/14

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD – The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- **Zone A:** No BFE determined.
- **Zone AE:** BFE determined.
- **Zone AH:** Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- **Zone AO:** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- **Zone V:** Coastal flood zone with velocity hazard (wave action); no BFE determined.
- **Zone VE:** Coastal flood zone with velocity hazard (wave action); BFE determined.
- **Zone AEF:** Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA – An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- **Zone XS (X shaded):** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- **Zone X:** Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- **Zone D:** Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

PROPERTY INFORMATION

COUNTY:	MAUI
TMK NO:	(2) 3-9-001-158
PARCEL ADDRESS:	KENOLIO RD KIHEI, HI 96753
FIRM INDEX DATE:	SEPTEMBER 19, 2012
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1500030586F
PANEL EFFECTIVE DATE:	SEPTEMBER 19, 2012

PARCEL DATA FROM:	JULY 2013
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

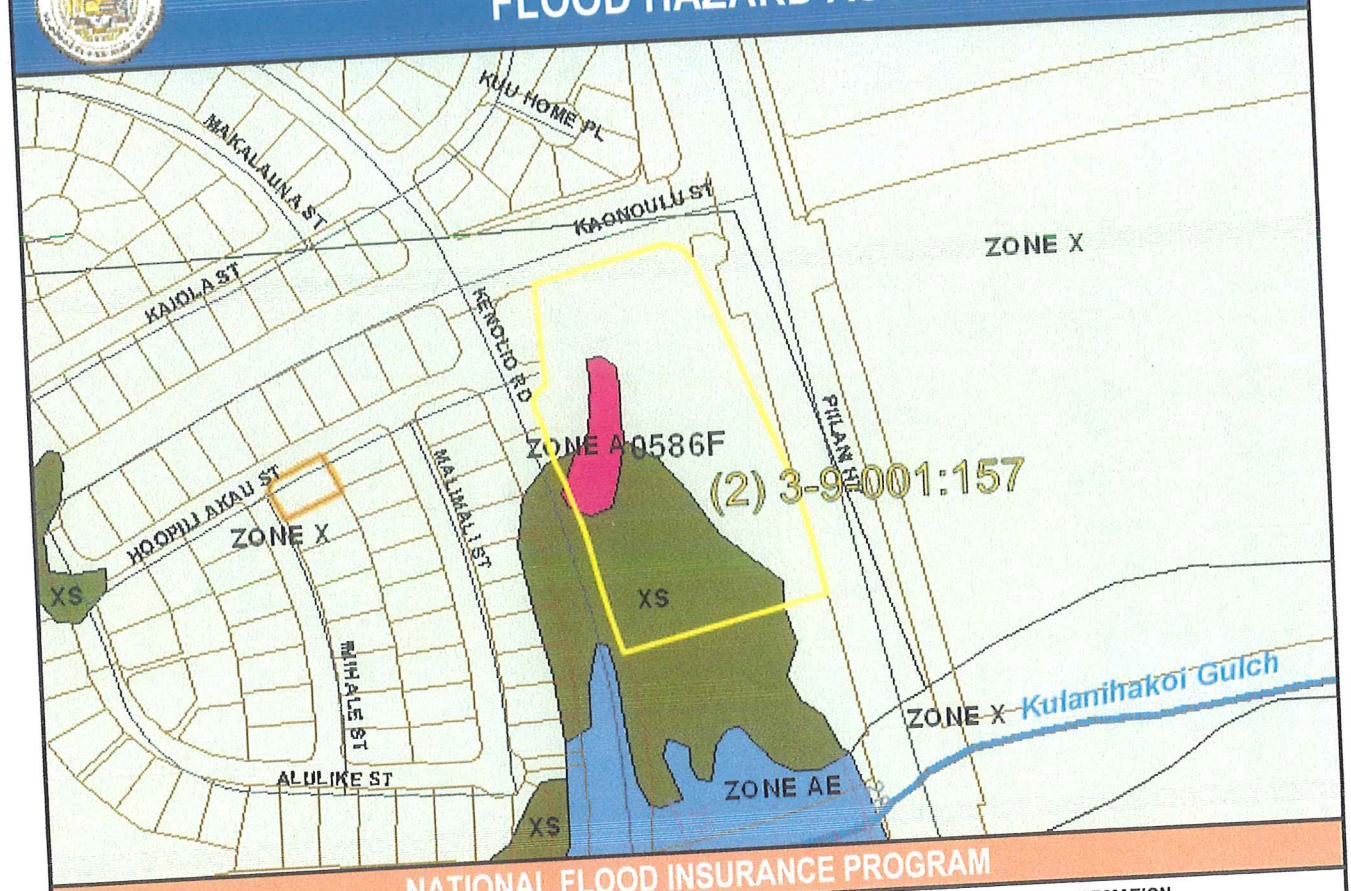
County NFIP Coordinator	
County of Maui	
Carolyn Cortez	(808) 270-7253
State NFIP Coordinator	
Carol Tyau-Beam, P.E., CFM	(808) 587-0267

Disclaimer: The Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use of the information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR from any liability, which may arise from its use.

If this map has been identified as 'PRELIMINARY' or 'UNOFFICIAL', please note that it is being provided for informational purposes and is not to be used for official/legal decisions, regulatory compliance, or flood insurance rating. Contact your county NFIP coordinator for flood zone determinations to be used for compliance with local floodplain management regulations.

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD – The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- **Zone A:** No BFE determined.
- **Zone AE:** BFE determined.
- **Zone AH:** Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- **Zone AO:** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- **Zone V:** Coastal flood zone with velocity hazard (wave action); no BFE determined.
- **Zone VE:** Coastal flood zone with velocity hazard (wave action); BFE determined.
- **Zone AEF:** Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA – An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- **Zone XS (X shaded):** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- **Zone X:** Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- **Zone D:** Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

PROPERTY INFORMATION

COUNTY:	MAUI
TMK NO:	(2) 3-9-001-157
PARCEL ADDRESS:	635 KENOLIO RD KIHEI, HI 96753
FIRM INDEX DATE:	SEPTEMBER 19, 2012
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1500030586F
PANEL EFFECTIVE DATE:	SEPTEMBER 19, 2012

PARCEL DATA FROM:	JULY 2013
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

County NFIP Coordinator	
County of Maui	
Carolyn Cortez	(808) 270-7253
State NFIP Coordinator	
Carol Tyau-Beam, P.E., CFM	(808) 587-0267

Disclaimer: The Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use of the information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR from any liability, which may arise from its use.

If this map has been identified as 'PRELIMINARY' or 'UNOFFICIAL', please note that it is being provided for informational purposes and is not to be used for official/legal decisions, regulatory compliance, or flood insurance rating. Contact your county NFIP coordinator for flood zone determinations to be used for compliance with local floodplain management regulations.

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 15, 2014

Mr. Carty S. Chang, Chief Engineer
State of Hawaii
Department of Land and Natural Resources
Engineering Division
PO Box 621
Honolulu, HI 96809

Dear Mr. Chang:

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your letter of April 1, 2014. Chris Hart and Partners, Inc. (CH&P) has prepared the following responses to your comments:

The Applicant acknowledges that the project must comply with rules and regulations of the national Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken.

The Applicant's Civil Engineer, Otomo Engineering, Inc. has consulted with the State and County NFIP Coordinators' and will coordinate any necessary permits for the proposed project. Any structures which are located within a flood zone other than Zone XS or Zone X will be required to meet County, State and Federal requirements for development within a flood zone.

115 N. Market Street, Wailuku, Maui, Hawaii 96793-1717 • Ph 808-242-1955 • Fax 808-242-1956
www.chpmaui.com

Thank you for participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or e-mail Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
DLNR_ Engineering Division Comment Letter

CC: Mr. Don Slattery, Project Manager
Mr. Paul Fasi, Planning Department Current Division
Project File 12-114

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RECEIVED
LAND DIVISION
14 APR 21 PM 2:33

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 27, 2014

MEMORANDUM

2014 MAR 26 AM 11:37

TO: **DLNR Agencies:**
___Div. of Aquatic Resources
___Div. of Boating & Ocean Recreation
X Engineering Division
___Div. of Forestry & Wildlife
___Div. of State Parks
X Commission on Water Resource Management
___Office of Conservation & Coastal Lands
X Land Division – Maui District
X Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Early Consultation Letter for the Proposed Kenolio Apartments Multi-family Project
LOCATION: Kihei, Island of Maui; TMK: (2) 3-9-001:157 and 158
APPLICANT: Chris Hart & Partners, Inc.

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by April 23, 2014.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Lydia Morikawa at 587-0410. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed:
Print Name: William M. Tam, Deputy Director
Date: April 21, 2014

cc: Central Files

FILE ID: RFD.3949.6
DOC ID: 11536

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON

WILLIAM D. BALFOUR, JR.
KAMANA BEAMER
MILTON D. PAVAO
LINDA ROSEN, M.D., M.P.H.
JONATHAN STARR
TED YAMAMURA

WILLIAM M. TAM
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

April 21, 2014

REF: 3949.6

TO: Russell Tsuji, Administrator
Land Division

FROM: William M. Tam, Deputy Director
Commission on Water Resource Management

SUBJECT: Early Consultation for the Proposed Kenolio Apartments Multi-Family Project, Kihei

FILE NO.:
TMK NO.: (2) 3-9-001:157 and 158

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://www.hawaii.gov/dlnr/cwrm.

Our comments related to water resources are checked off below.

☐ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

☐ 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

☐ 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

☐ 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EPA as having high water efficiency can be found at http://www.epa.gov/watersense/.

☐ 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://hawaii.gov/dbedt/czm/initiative/lid.php.

☐ 6. We recommend the use of alternative water sources, wherever practicable.

☐ 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program

☐ 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf

☐ 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

Permits required by CWRM:
Additional information and forms are available at http://hawaii.gov/dlnr/cwrm/info_permits.htm.

☐ 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

☐ 11. A Well Construction Permit(s) is (are) required before any well construction work begins.

☐ 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 14. Ground water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☐ 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration(s) can be made to the bed and/or banks of a stream channel.

☐ 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is (are) constructed or altered.

☐ 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☒ OTHER:

Planning Response: For project landscaped areas we recommend following the Landscape Industry Council of Hawaii's irrigation water conservation best practices (see page 6-2 of Hawaii Water Conservation Plan located at http://files.hawaii.gov/dlnr/cwrm/planning/hwcp2013.pdf)

Please consider using high efficiency fixtures. A listing of EPA-certified high-efficiency fixtures can be found at http://www.epa.gov/watersense/products/index.html

Ground Water Response: Iao Aquifer and Na Wai Eha are water management areas and its not clear how future water needs will be met for this future use, especially as existing uses have not been finalized.

If there are any questions, please contact Lenore Ohye at 587-0216.

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 15, 2014

Mr. William M. Tam, Deputy Director
State of Hawaii
Department of Land and Natural Resources
Commission on Water Resource Management
PO Box 621
Honolulu, HI 96809

Dear Mr. Tam:

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your letter of April 21, 2014. Chris Hart and Partners, Inc. (CH&P) has prepared the following responses to your comments:

The Applicant has review the Hawaii Water Conservation Plan and will incorporate irrigation water conservation best practices such as drip irrigation, smart water meters, and xeriscaping to conserve water. In addition the applicant is proposing to drill a brackish well on site to provide irrigation water.

The Applicant is committed to using energy efficient fixtures within the rental units where possible as part of water conservation measures.

The Applicant is preparing a 201H Application as part of the this 100% affordable rental project, therefore the Applicant is anticipating that water will be made available for the proposed affordable housing project.

Thank you for participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or e-mail Brett at bdavis@chpmaui.com should you have any questions.

115 N. Market Street, Wailuku, Maui, Hawaii 96793-1717 • Ph 808-242-1955 • Fax 808-242-1956
www.chpmaui.com

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
DLNR_CWRM Comment Letter

CC: Mr. Don Slattery, Project Manager
Mr. Paul Fasi, Planning Department Current Division
Project File 12-114

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
FORD N. FUCHIGAMI
RANDY GRUNE
AUDREY HIDANO
JADINE URASAKI

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
STP 8.1532

April 22, 2014

Mr. Jordan E. Hart
President
Chris Hart and Partners, Inc.
115 North Market Street
Wailuku, Hawaii 96793-1717

Dear Mr. Hart:

Subject: Kenolio Apartments Multi-family Project
Early Consultation for Draft Environmental Assessment
TMK: (3) 3-9-001:157 and 158

Our Department of Transportation's (DOT) comments on the subject project are as follows:

1. The project will impact traffic on our State highways by its contribution of vehicle activity onto the local streets and the collective traffic's access/use of Piilani Highway.

2. The project's access to Piilani Highway should be identified and described.

3. The developer/landowner is required to obtain a permit from DOT Highways Division, Maui District Office, for the transport of oversized and/or overweight materials and equipment on State highway facilities.

4. A traffic impact report (TIR) should be prepared by the developer/landowner and submitted as part of the project's environmental assessment. The TIR should cover both project and regional impacts and the mitigation measures the project will provide, including any developer/landowner projects or financial contributions toward these mitigation measures.

CC: Brett 12/114

RECEIVED
APR 29 2014
CHRIS HART & PARTNERS, INC.
Landscape Architecture and Planning

If there are any questions, please contact Mr. Norren Kato of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 15, 2014

Mr. Glenn M. Okimoto, Ph.D., Director
State of Hawaii Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Okimoto,

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your letter of April 22, 2014.

Comment 1. The project will impact traffic on our State highways by contribution of vehicle activity onto the local streets and the collective traffic's access/use of Piilani Highway.

Response 1: The Applicants acknowledges that the proposed project will impact State Highways. The forthcoming Draft Environmental Assessment will include a Traffic Impact Assessment Report to quantify the project impacts as a result of the proposed project.

Comment 2. The project's access to Piilani Highway should be indentified and described.

Response 2: The Draft EA will describe the project's access to Piilani highway.

Comment 3. the developer/landowner is required to obtain a permit from the DOT Highways Division, Maui District Office, for the transport of oversized and or overweight materials and equipment on State Highway facilities.

Response 3: The Draft EA will describe the project's access to Piilani highway.

Comment 4. A traffic impact report (TIR) should be prepared by the developer/landowner and submitted as part of the project's environmental assessment. The TIR should cover both project

115 N. Market Street, Wailuku, Maui, Hawaii 96793-1717 • Ph 808-242-1955 • Fax 808-242-1956
www.chpmaui.com

and regional impacts and the mitigation measures the project will provide, including any developer/landowner projects or financial contributions toward these mitigation measures.

Response 4: The forthcoming Draft Environmental Assessment will include a Traffic Impact Assessment Report to quantify the project impacts as a result of the proposed project. The report will cover both project and regional impacts and the mitigation measures the project will provide, including any developer/landowner projects or financial contributions toward these mitigation measures.

Thank you participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or email Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
Department of Transportation Comment Letter

CC: Mr. Don Slattery, Project Manager
Mr. Paul Fasi, Planning Department Current Division
Project File 12-114

ALAN M. ARAKAWA
Mayor

WILLIAM R. SPENCE
Director

MICHELE CHOUTEAU McLEAN
Deputy Director

COUNTY OF MAUI
DEPARTMENT OF PLANNING

April 15, 2014

RECEIVED
APR 17 2014
CHRIS HART & PARTNERS, INC.
Landscape Architecture and Planning
CC: Brett 12/114

Mr. Jordan E. Hart, President
Chris Hart & Partners, Inc.
115 North Market Street
Wailuku, Hawaii 96793-1717

Dear Mr. Hart:

SUBJECT: REQUEST FOR COMMENTS (RFC) ON THE DRAFT ENVIRONMENTAL ASSESSMENT (EA) FOR THE PROPOSED KENOLIO APARTMENTS MULTI-FAMILY PROJECT, KIHEI, ISLAND OF MAUI, HAWAII, (RFC 2014/0030)

The Department of Planning (Department) is in receipt of the above-referenced RFC. At this time, the Department has one (1) comment to offer: The parcel is located in the Special Management Area (SMA) and will be required to acquire a SMA Permit as noted in your letter.

The Department looks forward to the Early Consultation Process for this project on April 25, 2014. Please contact Staff Planner Paul Fasi on the place and time of this meeting at paul.fasi@mauicounty.gov or at (808) 270-7814.

Sincerely,

CLAYTON I. YOSHIDA, AICP
Planning Program Administrator

for WILLIAM SPENCE
Planning Director

xc: Paul F. Fasi, Staff Planner (PDF)
Project File
General File
WRS:CIY:PFF:
K:\WP_DOCS\PLANNING\RFC\2014\0030_KenolioApts\LTR1.doc

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 9, 2014

Mr. William Spence, Director
County of Maui, Department of Planning
One Main Plaza Building
2200 Main Street, Suite 315
Wailuku, HI 96793

Dear Mr. Spence,

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your comment letter of April 15, 2014. The Applicant will submit a Special Management Area Permit application for the proposed project.

Thank you for participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or e-mail Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
Department of Planning Comment Letter

CC: Mr. Don Slattery, Project Manager
Mr. Paul Fasi, Planning Department Current Division
Project File 12-114

115 N. Market Street, Wailuku, Maui, Hawaii 96793-1717 • Ph 808-242-1955 • Fax 808-242-1956
www.chpmaui.com

ALAN M. ARAKAWA
Mayor

GLENN T. CORREA
Director

BRIANNE L. SAVAGE
Deputy Director

(808) 270-7230
Fax (808) 270-7934

DEPARTMENT OF PARKS & RECREATION

700 Hali'a Nakoa Street Unit 2, Wailuku, Hawaii 96793

RECEIVED
APR 14 2014
CHRIS HART & PARTNERS, INC.
Landscape Architecture and Planning

CC: Brett 12/114

April 10, 2014

Mr. Jordan E. Hart, President
Chris Hart & Partners, Inc.
115 N. Market Street
Wailuku, Hawaii 96793

Dear Mr. Hart:

SUBJECT: PROPOSED KENOLIO APARTMENTS MULTI-FAMILY PROJECT TMK: (2) 3-9-001:157 AND 158

Thank you for the opportunity to review and comment on the subject project. As the project will be 100% affordable, the exemption from Section 18.16.320, Maui County Code, will be provided once the Maui County Council has approved the 201H Application.

Please feel free to contact Karla Peters, CIP Coordinator, at 270-7981 should you have any questions.

Sincerely,

Brianne Savage

FOR GLENN T. CORREA
Director of Parks & Recreation

c: Brianne L. Savage, Deputy Director
Robert Halvorson, Chief of Planning and Development
Brett Davis, Chris Hart & Partners, Inc.

GTC:RH:kp

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 9, 2014

Mr. Glenn T. Correa, Director
County of Maui, Department of Parks & Recreation
700 Hali'a Nakoa Street, Unit 2
Wailuku, HI 96793

Dear Mr. Correa,

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your comment letter of April 10, 2014. We acknowledge that the exemption from Section 18.16.320, Maui County Code, may be provided by the Maui County Council's approval of the forthcoming 201H application.

Thank you for participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or e-mail Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
Department of Parks and Recreation Comment Letter

CC: Mr. Don Slattery, Project Manager
Project File 12-114

115 N. Market Street, Wailuku, Maui, Hawaii 96793-1717 • Ph 808-242-1955 • Fax 808-242-1956
www.chpmaui.com

ALAN M. ARAKAWA
Mayor

DAVID C. GOODE
Director

ROWENA M. DAGDAG-ANDAYA
Deputy Director

Telephone: (808) 270-7845
Fax: (808) 270-7955

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS

200 SOUTH HIGH STREET, ROOM NO. 434
WAILUKU, MAUI, HAWAII 96793

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

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

April 10, 2014

RECEIVED
APR 16 2014
CHRIS HART & PARTNERS, INC.
Landscape Architecture and Planning
CC: Brett 4/14

Mr. Brett Davis
CHRIS HART & PARTNERS, INC.
115 North Market Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Davis:

SUBJECT: EARLY CONSULTATION FOR KENOLIO APARTMENTS MULTI-FAMILY PROJECT; TMK (2) 3-9-001:157 AND 158

We reviewed your early consultation request and have the following comments:

Comments from the Highways Division:

1. Our primary concern is with drainage as it affects the County roads we maintain. A major drainage system crosses through the property - how will this system be managed/designed? The drainage should be kept out of the road right of way proposed to be dedicated to the County. If not, the developer shall procure an easement to perpetually maintain the drainage way within the County right of way and take any emergency corrective action as may occur as a result of the drainage way failure.

2. The above drainage merges into the Kaonoulu Gulch channel. This drainage frequently overflows its banks near the intersection of Kaonoulu Street and South Kihei Road causing flooding and mud/debris on the road. If the planned project proposes to discharge water into the Kaonoulu Gulch drainage, what mitigative measures will be implemented to reduce the flooding impacts on the makai roads?

3. All landscape plantings along County roadways shall be provided with root barriers to mitigate uplifting of pavements, sidewalks, etc.

4. Further comments may be possible after development of a more concrete proposal.

Please call Rowena M. Dagdag-Andaya at 270-7845 if you have any questions regarding this letter.

Sincerely,

DAVID C. GOODE
Director of Public Works

DCG:RMDA:da
xc: Highways Division
Engineering Division
S:\DSA\Engr\CZM\Draft Comments\39001157_158_Kenolio_apts_multi_fam_proj_ec.wpd

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 15, 2014

Mr. David Goode, Director
County of Maui, Department of Public Works
200 South High Street Room No 434
Wailuku, HI 96793

Dear Mr. Goode,

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your letter of April 10, 2014. The responses to your numerated comments are as follows.

Comment 1. *Our primary concern is with drainage as it affects the County roads we maintain. A major drainage system crosses through the property - how will this system be managed/designed? The drainage should be kept out of the road right of way proposed to be dedicated to the County. If not, the developer shall procure an easement to perpetually maintain the drainage way within the County right of way and take any emergency corrective action as may occur as a result of the drainage way failure.*

Response 1. The forthcoming Draft EA includes a Preliminary Engineering Report with a drainage plan to mitigate stormwater impacts from the proposed development. Specifically, a concrete box culvert will be installed from the outlet of the double 102-inch culverts at Piilani Highway, through the project site and connect to the existing 16'-0" x 6'-6" concrete box culvert on the site. The proposed concrete box culvert will meander through the site to avoid conflicts with any structures or improvements.

As part of the Kaonoulu Estates- Phase IV Subdivision, Lot 6 and portions of Lots 4 and 5 of Kaonoulu Estates Phase 3 was used for the construction of a detention basin. According to the "Drainage and Soil Erosion Control Report for Kaonoulu

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Estates -Phase IV." Prepared by Otomo Engineering, Inc., with a revision date of August 2001, the detention basin was designed to accommodate the increase in runoff from Phase IV project site, the then-proposed 140-unit multi-family site and commercial development is now the site of the current proposed project. The report also states that the detention basin was sized to accommodate 198,700 cubic feet of storage, of which 60,000 cubic feet of storage was provided for this project. (**See:** Appendix C "Preliminary Engineering and Drainage Report")

The post development runoff from the project site is estimated to be 23.16 cfs, with an increase of 15.57 cfs over existing conditions. The resulting storage volume for developed conditions is 22,925 cubic feet. Accordingly the project is required to provide mitigation for 15.57 cfs with a corresponding storage volume of 14,273 cubic feet. As mentioned, 60,000 cubic feet of existing storage capacity is allotted for this project.

Onsite runoff will be collected by catch basins located at appropriate intervals along the interior roadways and landscaped area. Drain lines from the catch basins will convey the runoff to an outlet in Kulanihakoi Gulch. As noted herein, there is storage volume within the existing detention basin, which was created for this project.

Comment 2. *The above drainage merges into the Kaonoulu Gulch channel. This drainage frequently overflows its banks near the intersection of Kaonoulu Street and South Kihei Road causing flooding and mud/debris on the road. If the planned project proposes to discharge water into the Kaonoulu Gulch drainage, what mitigative measures will be implemented to reduce the flooding impacts on the makai roads?*

Response 2. As part of the Kaonoulu Estates- Phase IV Subdivision, Lot 6 and portions of Lots 4 and 5 of Kaonoulu Estates Phase 3 was used for the construction of a detention basin. According to the "Drainage and Soil Erosion Control Report for Kaonoulu Estates -Phase IV." Prepared by Otomo Engineering, Inc., with a revision date of August 2001, the detention basin was designed to accommodate the increase in runoff from Phase IV project site, the then-proposed 140-unit multi-family site and commercial development is now the site of the current proposed project. The detention basin is sized to prevent downstream flooding as a result of the proposed development.

Comment 3. *All landscape plantings along County roadways shall be provided with root barriers to mitigate uplifting of pavements, sidewalks, etc.*

> **Response 3.** The Applicant will provide root barriers in all landscape plantings along County roadways.

Comment 4. *Further comments may be possible after development of a more concrete proposal.*

> **Response 4.** The Applicant acknowledges that the Department may provide further comment on the proposed project.

Thank you for participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or email Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
Department of Public Works Comment Letter

CC: Mr. Don Slattery, Project Manager
Mr. Paul Fasi, Planning Department, Current Division
Project File 13-029

ALAN M. ARAKAWA
Mayor

DAVID TAYLOR, P.E.
Director

PAUL J. MEYER
Deputy Director

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793-2155
www.mauiwater.org

April 24, 2014

Jordan Hart, Land Planner
Chris Hart and Partners, INC.
115 N. Market Street
Wailuku, Hawai`i 96793-1717

Project Name: Kenolio_Apartments_Multi_Family_Project
TMK: (2) 3-9-001: 157 and 158
Pre-Draft Environmental Assessment (EA) and Special Management Area Permit (SMA)

Dear Mr. Hart:

Thank you for the opportunity for the County of Maui Department of Water Supply (DWS) to provide comments on this Pre-EA and Pre-SMA. The project proposes to develop a 186-unit, 100% affordable housing project in Kihei, including: onsite parking; a pool; a playground and a community building. This letter is intended to supplement our previous letter dated September 27, 2010 (see attachment comment letter), and we note the project scope has increased by 62 units since our last communication: from 124 to 186 multi-family units. In 2010 the DWS was provided a consolidated 201H Affordable Housing and SMA Use Permit Application to review, but other than one Location Map, we received no other documentation for this review.

Source Availability and Consumption
The EA should identify potable and non-potable demand. The project is subject to the county's availability policy codified in Chapter 14.12 of the Maui County Code. According to DWS Guidelines, anticipated consumption for the project is projected to be 104,160 gpd when calculated per unit ([560 gallons/unit] x [186 units]), or 41,370 gpd when calculated by project acreage ([5000gpd/acre] x [8.274 acres]). However, empirical data for the Kihei area indicates approximately 500% higher consumption than the island-wide standard of 560 gallons/unit; therefore, the actual consumption may be closer to 500,000 gpd.

System Infrastructure
DWS infrastructure in the vicinity of the proposed project includes a 36-inch waterline that crosses both project parcels and an 18-inch waterline running adjacent to both parcels along Kenolio Road. The project parcels are not presently serviced by any DWS meters.

Domestic, irrigation and fire flow calculations shall be submitted to our Engineering Division in the building permit process to determine required system improvements.

Should you have any questions, please contact Alex Buttaro at 463-3103, or email him at alex.buttaro@co.maui.hi.us.

Sincerely,

David Taylor, Director

cc: Engineering Division

Attachment: September 27, 2010 DWS Letter

CHARMAINE TAVARES
Mayor

JEFFREY K. ENG
Director

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793-2155
www.mauiwater.org

September 27, 2010

Mr. Allen T. Yap
Clearly Maui Inc.
635 Kenolio Road
Kihei, HI 96753

Dear Mr. Yap:

SUBJECT: KENOLIO 6 AFFORDABLE HOUSING PROJECT
TMK 3-9-001:157 & 158, KIHEI, MAUI, HAWAII

Thank you for meeting with my staff on September 22, 2010. The Department of Water Supply (DWS) appreciates your efforts to develop a 100% affordable housing project. DWS is interested in working with you to provide potable water to the subject project, provided that you comply with the following conditions:

1. Any off-site water system improvements shall be designed and constructed in accordance with DWS standards and requirements. Furthermore, all such improvements shall be dedicated to the DWS upon inspection and approval by DWS.

2. Total potable allocation from the DWS system will be limited to 31,000 gpd, or 250 gpd per multi-family unit. Exceeding the allocation could result in penalty, including discontinuing potable service from the DWS system.

3. All non potable demand, including the proposed county park for the project will be served from an on-site privately owned irrigation well to be developed at applicant's expense.

4. Installation of backflow preventer, approved, installed and tested by a technician certified by the State Department of Health will be required to mitigate potential effects of cross connection of the dual water system.

5. The project shall be subject to strict water conservation requirements for both its domestic and irrigation demands. A comprehensive water conservation plan demonstrating strict water conservation shall be required to be submitted to the DWS for

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its approval prior to the issuance of any water meter. The conservation plan should include the following measures:

1. Start a Water Conservation Program
a. Install signs encouraging water conservation in public areas.
b. Seek resident's suggestions on water conservation; put suggestion boxes in prominent areas.
c. Provide information and resources for residents to check for leaks and identify ways they can conserve and provide an easy method for residents to report any leaks/waste found on the property.

2. Indoor Conservation Measures
a. Use EPA WaterSense labeled plumbing fixtures.
b. Install flow reducers and faucet aerators in all plumbing fixtures where-ever possible.
c. Install dual flush toilets with high efficiency models that use 1.28 gallons per flush or less.
d. Install showerheads with a flow rate of 1.5 gpm at 60 psi or less in all units.
e. Install bathroom sink faucets with fixtures that do not exceed 1 gpm at 60 psi. Laundry facilities and/or individual unit machines must use Energy Star labeled washers.
f. Limit the distance from the hot water source to the tap early in the design stage.

3. Exterior Areas
a. Install infrastructure necessary to utilize a future connection to reclaimed water line
b. Plan landscapes that require less water by using native, zone-appropriate plants.
c. Use Smart Approved WaterMark irrigation products. Examples include ET irrigation controllers, drip irrigation, and water saving spray heads.
d. Avoid plant fertilizing and pruning that would stimulate excessive growth.
e. Remove weeds and unhealthy plants so remaining plants can benefit from the water saved. Time watering to occur in the early morning or evening to limit evaporation. Limit turf to as small an area as possible.

Sincerely,

JEFFREY K. ENG
Director
emb

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 15, 2014

Mr. David Taylor, Director
County of Maui, Department of Water Supply
200 South High Street
Wailuku, HI 96793-2155

Dear Mr. Taylor,

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your letter of April 24, 2014. The previous land owner submitted an affordable housing application in 2010 however the application was withdrawn. On behalf of the new owner and Applicant, we have provided the following responses to your comments.

Source Availability and Consumption
In response to comments from the County of Maui Department of Water Supply (DWS) the forthcoming Draft EA will include potable and non-potable demand calculations as part of a Preliminary engineering report.

System Infrastructure
The Applicant will provide domestic, irrigation and fire flow calculations to the Engineering Division during the building permit process to determine required system improvements.

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www.chpmaui.com

Thank you for participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or e-mail Brett at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
Department of Water Supply Comment Letter

CC: Mr. Don Slattery, Project Manager
Mr. Paul Fasi, Planning Department Current Division
Project File 12-114

KCA

Kihei Community Association

"Working together to shape our Community's future"

April 13, 2014

Jordan E. Hart, President
Chris Hart & Partners, Inc.
115 N. Market Street
Wailuku, Maui, Hawai'i 96793

Aloha Jordan,

Thank you for your letter requesting our comments on the proposed Kenolio Apartments Multi-family Project. Particular areas of concern for us include the following:

1. The property is bordered on the south side by Kulanihakoi Gulch. This gulch is notorious for carrying eroded soil into the ocean. Please prevent this property from contributing to that by establishing a riparian zone, a vegetative buffer, along the gulch.

2. There is a smaller gulch which runs diagonally SW across the property from Pi'ilani Highway to Kulanihakoi gulch. This gulch should be maintained in it's original pathway, with a riparian zone on each side as well.

3. There is a large area just north of Kulanihakoi Gulch that is wet even during dry weather. Please address how this wetland area will be handled.

4. The property is adjacent to path of the North-South Collector Road. When this road is developed it should be done according to Complete Streets principles, with separate bike paths and pedestrian walkways.

5. Please address how the additional traffic generated from the 186 new units will be handled at the intersections of Kaonoulo & Pi'ilani Highway and of Kaonoulu & South Kihei Road.

6. The property is currently messy. KCA had asked Betsell Brothers to clean it up, as the property is located at a gateway to south Maui. Please convey our concern over the current state of the property to the new owners and ask them to be good neighbors and clean it up.

We appreciate the opportunity to contribute to the project and look forward to reviewing the draft EA.

Aloha,

Mike Moran
President

RECEIVED
APR 15 2014
CHRIS HART & PARTNERS, INC.
Landscape Architecture and Planning

CC: Brett
12/11/14

P.O. Box 662, Kihei, HI 96753 www.gokihei.org 508 499 9996

CHRIS HART
& PARTNERS, INC.
Landscape Architecture
City & Regional Planning

May 15, 2014

Mr. Mike Moran, President
Kihei Community Association
PO Box 662
Kihei, HI 96753

Dear Mr. Moran,

RE: Early Consultation for the proposed Kenolio Apartments, a 100% affordable rental development, located in Kihei, Maui, Hawaii at TMK's: (2) 3-9-001:157 and 158.

Thank you for your letter of April 13, 2014. Below are the responses to your numerated comments.

Comment 1. *The property is bordered on the south side by Kulanihakoi Gulch. This gulch is notorious for carrying eroded soil into the ocean. Please prevent this property from contributing to that by establishing a riparian zone, a vegetative buffer, along gulch.*

Response 1. The forthcoming Draft EA includes a proposed site plan. The plan will include landscape planting along the owner/applicant's southern property line to create a vegetative buffer that will support the KCA's goal of establishing a riparian zone. **Note:** the Kulanihakoi Gulch is not on land owned by the Applicant.

Comment 2. *There is a smaller gulch which runs diagonally SW across the property from Piilani Highway to Kulanihakoi gulch. This gulch should be maintained in its original pathway, with a riparian zone on each side as well.*

Response 2. The Draft EA will include a Preliminary Engineering Report outlining the proposed drainage plan for the project which includes anticipated impacts and mitigation measures.

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www.chpmaui.com

Comment 3. *There is a large area just north of Kulanihakoi Gulch that is wet even during dry weather, Please address how this wetland area will be handled.*

Response 3. In review of the United States Fish and Wildlife Service, National Wetlands Inventory, we were unable to identify wetlands located just north of Kulanihakoi Gulch. Additionally we were unable to identify wetlands located on the subject project parcels. http://www.fws.gov/wetlands/Data/Mapper.html

Comment 4. *The property is adjacent to path of the North-South Collector Road. When this road is developed it should be done according to Complete Streets principles, with separate bike paths and pedestrians walkways.*

Response 4. The adjoining half of the North-South Collector Road fronting the project site will be improved to County standards for roadways within the urban district. The improvements will be coordinated with the Department of Public Work's.

Comment 5. *Please address how the additional traffic generated from the 186 new units will be handled at the intersections of Kaonoulu & Piilani Highway and of Kaonoulu & South Kihei Road.*

Response 5. The Draft EA includes a Traffic Impact Assessment Report that will provide and estimate of additional traffic and impacts to surrounding intersections of Kaonoulu & Piilani Highway and of Kaonoulu & South Kihei Road.

Comment 6. *The property is currently messy. KCA has asked Betsill Brothers to clean it up, as the property is located a gateway to south Maui. Please convey our concern over the current state of the property to the new owners and ask them to be good neighbors and clean it up.*

Response 6. The owner acknowledges your concern and will work with a local contractor to clean up the property in the near future.

Thank you again, for participating in the environmental review process. Please feel free to call me or Mr. Brett Davis at (808) 242-1955 or email at bdavis@chpmaui.com should you have any questions.

Sincerely yours,

Jordan E. Hart, President

ENCLOSURES: (1)
KCA Comment Letter

CC: Mr. Don Slattery, Project Manager
Mr. Paul Fasi, Planning Department, Current Division
Project File 12-114

APPENDIX B
Botanical Flora and Fauna Report

BOTANICAL AND FAUNA SURVEY

for

THE KA'ONOULU HOUSING PROJECT

KA'ONOULU, KIHEI, MAUI

by

ROBERT W. HOBDY
Environmental Consultant
Kokomo, Maui
January 2014

Prepared for: Pacific West Communities, Inc.

BOTANICAL AND FAUNA SURVEY
KA'ONOULU HOUSING PROJECT
KA'ONOULU, KIHEI, MAUI

INTRODUCTION

The Ka'onoulu Housing project lies on 8.274 acres in north Kihei, Maui (TMK's (2) 3-9-01:157 and 158) (see Figure 1). The project area is adjacent to Pi'ilani Highway to the east, Ka'onoulu Street to the north, residential housing to the west and Kūlanihāko'i Stream channel to the south. This study was initiated by the owners in fulfillment of environmental requirements of the planning process.

SITE DESCRIPTION

The project area is situated on undeveloped land below Pi'ilani Highway at elevations ranging from 25 to 35 feet above sea level. The terrain is gently sloping and the soil is characterized as Waiakoa extremely stony silty clay loam, 3 – 25% slopes (WID2) which has experienced significant surface erosion (Foote et al, 1972). Vegetation consists of open grassland and herbaceous species with a few scattered trees and shrubs. A manmade drainage channel passes through the property and connects to an underground culvert system off-site to the west. Annual rainfall averages less than 10 inches with the bulk occurring during winter storms (Armstrong, 1983).

BIOLOGICAL HISTORY

The project area was once a dry native savannah with a scattering of trees and shrubs such as wiliwili (*Erythrina sandwicensis*), 'ohe makai (*Reynoldsia sandwicensis*) and 'a'ali'i (*Dodonaea viscosa*) and a variety of other native grasses and vines. Nearly two centuries of cattle (*Bos taurus*) grazing and more recently browsing by axis deer (*Axis axis*) have greatly reduced the diversity and numbers of native plants and widfires have repeatedly swept through these dry grasslands all but eliminating them. The native plants have been replaced by hardy non-native species that can survive both grazing and fires.

SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna survey of the proposed Kaonoulu Housing Project which was conducted in January 2014.

The objectives of the survey were to:

1. Document what plant and animal species occur on the property or may likely occur in the existing habitat.

2. Document the status and abundance of each species.

3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.

4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora and fauna in this part of the island.

BOTANICAL SURVEY REPORT

SURVEY METHODS

A walk-through botanical survey method was used following a route to ensure complete coverage of the area. Areas most likely to harbor native or rare plants such as gullies or rocky outcroppings were more intensively examined. Notes were made on plant species, distribution and abundance as well as on terrain and substrate.

DESCRIPTION OF THE VEGETATION

The vegetation of the project area consists primarily of grasses and herbaceous plants with a few scattered trees and shrubs. The vegetation was green and growing vigorously in response to recent rains. The most abundant species found was buffelgrass (*Cenchrus ciliaris*) which was everywhere on the property. Also common were Carolina lovegrass (*Eragrostis pectinacea*), spiny amaranth (*Amaranthus spinosus*), hairy merremia (*Merremia aegyptia*) and ‘uhaloa (*Waltheria indica*).

A total of 80 plant species were recorded during the course of the survey. Of these five species were indigenous native plants: ‘akulikuli (*Sesuvium portulacastrum*), kipukai (*Heliotropium curassavicum*), pohuehue (*Ipomoea pes-caprae* subsp. *brasiliensis*), ‘ilima (*Sida fallax*) and ‘uhaloa. The remaining 75 species were non-native, including 9 ornamentals and 66 common weedy species.

DISCUSSION AND RECOMMENDATIONS

Most of the project area has been heavily impacted by grazing animals, fires and human disturbances and is currently dominated by hardy non-native plants. The five native plant species are all common throughout Hawaii as well as on numerous other Pacific islands and are of no special conservation concern. No special native plant habitats occur on or near this property.

The proposed project is not expected to have a significant negative impact on the botanical resources in this part of Maui.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within two groups: Monocots and Dicots. Taxonomy and nomenclature of the flowering plants (Monocots and Dicots) are in accordance with Wagner et al. (1999).

For each species, the following information is provided:

1. Scientific name with author citation

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.

   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).

   non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

   abundant = forming a major part of the vegetation within the project area.

   common = widely scattered throughout the area or locally abundant within a portion of it.

   uncommon = scattered sparsely throughout the area or occurring in a few small patches.

   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
MONOCOTS			
ARECACEAE (Palm Family)			
Dypsis lutescens (Wendl.) Beentje & Dransfield	golden-fruited palm	non-native	rare
Thrinax radiata J.A. & J.H. Schultes	thatch palm	non-native	rare
Washingtonia robusta H. Wendland	Mexican Washingtonia	non-native	rare
CANNACEAE (Canna Family)			
Canna indica L.	canna	non-native	rare
CYPERACEAE (Sedge Family)			
Cyperus rotundus L.	nut sedge	non-native	uncommon
POACEAE (Grass Family)			
Cenchrus ciliaris L.	buffelgrass	non-native	abundant
Cenchrus barbata (L.) Sw.	swollen fingergrass	non-native	rare
Chloris radiata (L.) Sw.	plush grass	non-native	rare
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	rare
Eleusine indica (L.) Gaertn.	wiregrass	non-native	rare
Eragrostis pectinacea (Michx) Nees	Carolina lovegrass	non-native	common
Eremochloa ophiuroides (Munro) Hackel	centipede grass	non-native	rare
Megathyrsus maximus (Jacq.) Simon & Jacobs	Guinea grass	non-native	rare
Panicum repens L.	torpedo grass	non-native	rare
Setaria verticillata (L.) P. Beauv.	bristly foxtail	non-native	uncommon
Tragus berteronianus Schult.	bur grass	non-native	uncommon
DICOTS			
AIZOACEAE (Fig-marigold Family)			
Sesuvium portulacastrum (L.) L.	'ākulikuli	indigenous	rare
AMARANTHACEAE (Amaranth Family)			
Atriplex suberecta Verd.	saltbush	non-native	rare
Amaranthus spinosus L.	spiny amaranth	non-native	common
Amaranthus viridis L.	slender amaranth	non-native	rare
Chenopodium carinatum R. Br.	keeled goosefoot	non-native	rare
Chenopodium murale L.	'āheahea	non-native	uncommon
ASTERACEAE (Sunflower Family)			
Bidens pilosa L.	Spanish needle	non-native	rare
Calyptocarpus vialis Less.	straggler daisy	non-native	rare
Emilia fosbergii Nicolson	red pualele	non-native	rare
Flaveria trinervia (Spreng.) C. Mohr	clustered yellowtops	non-native	uncommon
Pluchea carolinensis (Jacq.) G. Don	sourbush	non-native	rare
Pluchea indica (L.) Less.	Indian fleabane	non-native	rare
Senecio madagascariensis Poir.	fireweed	non-native	rare
Sonchus oleraceus L.	pualele	non-native	uncommon
Tridax procumbens L.	coat buttons	non-native	rare
Verbesina encelioides (Cav.) Benth & Hook.	golden crown-beard	non-native	uncommon

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Xanthium strumarium L.	kikania	non-native	rare
BATACEAE (Saltwort Family)			
Batis maritima L.	pickleweed	non-native	rare
BIGNONIACEAE (Bignonia Family)			
Tabebuia aurea (Silva Manso) S. Moore	silver trumpet tree	non-native	rare
BORAGINACEAE (Borage Family)			
Heliotropium curassavicum L.	kipūkai	indigenous	rare
CLEOMACEAE (Spider Plant Family)			
Cleome gynandra L.	wild spider flower	non-native	rare
CLUSIACEAE (Mangosteen Family)			
Clusia rosea Jacq.	autograph plant	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea pes-caprae subsp. *brasiliensis* (L.) R.Br.	pōhuehue	indigenous	rare
Ipomoea triloba L.	little bell	non-native	rare
Merremia aegyptia (L.) Urb.	hairy merremia	non-native	common
CUCURBITACEAE (Gourd Family)			
Cucumis dipsaceus Ehrenb. ex Spach	hedgehog gourd	non-native	rare
EUPHORBIACEAE (Spurge Family)			
Euphorbia heterophylla L.	kaliko	non-native	uncommon
Euphorbia hirta L.	hairy spurge	non-native	uncommon
Euphorbia hypericifolia L.	graceful spurge	non-native	rare
Euphorbia prostrata Aiton	prostrate spurge	non-native	rare
Euphorbia thymifolia L.	thyme-leaved spurge	non-native	rare
Ricinus communis L.	Castor bean	non-native	uncommon
FABACEAE (Pea Family)			
Acacia farnesiana (L.) Willd.	klu	non-native	rare
Cassia x nealiae Irwin & Barneby	rainbow shower	non-native	rare
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	rare
Crotalaria incana L.	fuzzy rattlepod	non-native	rare
Crotalaria pallida Aiton	smooth rattlepod	non-native	rare
Desmanthus pernambucanus (L.) Thellung	slender mimosa	non-native	rare
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	non-native	uncommon
Indigofera hendecaphylla Jacq.	creeping indigo	non-native	rare
Leucaena leucocephala (Lam.) de Wit	koa haole	non-native	uncommon
Macroptilium atropurpureum (DC.) Urb.	siratro	non-native	uncommon
Medicago polymorpha L.	bur clover	non-native	uncommon
Neonotonia wightii (Wight & Arnott) Lackey	glycine	non-native	uncommon
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	non-native	uncommon
Samanea saman (Jacq.) Merr.	monkeypod	non-native	rare
LAMIACEAE (Mint Family)			
Leonotis nepetifolia (L.) R. Br.	lion's ear	non-native	uncommon
MALVACEAE (Mallow Family)			

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Corchorus olitorius L.	jute	non-native	rare
Hibiscus rosa-sinensis L.	Chinese red hibiscus	non-native	rare
Malva parviflora L.	cheese-weed	non-native	uncommon
Malvastrum cormandelianum (L.) Garckey	False mallow	non-native	rare
Sida ciliaris L.	red 'ilima	non-native	rare
Sida fallax Walp.	'ilima	indigenous	uncommon
Waltheria indica L.	'uhaloa	indigenous	common
MORACEAE (Fig Family)			
Ficus microcarpa L. fil.	Chinese banyan	non-native	rare
NYCTAGINACEAE (Four-o'clock Family)			
Boerhavia coccinea Mill.	scarlet spiderling	non-native	rare
OLEACEAE (Olive Family)			
Olea europaea L.	olive	non-native	rare
PORTULACACEAE (Purslane Family)			
Portulaca oleracea L.	pigweed	non-native	rare
SOLANACEAE (Nighshade Family)			
Datura stramonium L.	jimson weed	non-native	uncommon
Nicandra physalodes (L.) Gaertn.	apple-of-Peru	non-native	uncommon
Nicotiana glauca R.C. Graham	tree tobacco	non-native	rare
Solanum lycopersicum L.	cherry tomato	non-native	rare
ZYGOPHYLLACEAE (Creosote Bush Family)			
Tribulus terrestris L.	puncture vine	non-native	rare

FAUNA SURVEY REPORT

SURVEY METHODS

A walk-through survey method was conducted in conjunction with the botanical survey. All parts of the project area were covered. Field observations were made with the aid of binoculars and by listening to vocalizations. Notes were made on species, abundance, activities and location as well as observations of trails, tracks, scat and signs of feeding. In addition an evening visit was made to record crepuscular activities and vocalizations and to see if there was any evidence of occurrence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) in the area.

RESULTS

MAMMALS

Four non-native mammal species were recorded within the project area during two site visits. Taxonomy and nomenclature follow Tomich (1986). Most common were axis deer (*Axis axis*) whose tracks and scat were found throughout the property. Also present were domestic cats (*Felis catus*), mice (*Mus domesticus*) and domestic dogs (*Canis familiaris*). Other mammals likely to utilize this property, but which were not observed include rats (*Rattus* spp.) and mongoose (*Herpestes auropunctatus*).

A special effort was made to look for the native Hawaiian hoary bat which is listed as an Endangered species. These bats have been observed in the past around the Waiakoa Stream estuary about 2 miles north of the property. When present in an area these bats can be easily identified as they forage for insects, their distinctive flight patterns clearly visible in the glow of twilight. No evidence of such activity was observed though visibility was excellent. In addition a bat detection device (Batbox IIID) was employed, set to the frequencies of 27,000 to 28,000 hertz which this species is known to use. No bats were detected using this device.

BIRDS

Birdlife was modest both in species present and in total numbers. Taxonomy and nomenclature follow American Ornithologists' Union (2013). Most common were zebra dove (*Geopelia striata*) and common myna (*Acridotheres tristis*). Less common were gray francolin (*Francolinus pondicerianus*), Java sparrow (*Padda oryzivora*) and African silverbill (*Lonchura cantans*). Spotted dove (*Streptopelia chinensis*) and black francolin (*Francolinus francolinus*) were rare. Other non-native birds that likely utilize this area, but which were not seen, include: house finch (*Carpodacus mexicanus*), house sparrow (*Passer domesticus*), red-crested cardinal (*Paroaria coronata*), northern cardinal (*Cardinalis cardinalis*), Japanese white-eye (*Zosterops japonicus*) and Pacific golden-plover (*Pluvialis fulva*). This habitat is not suitable for Hawaii's native forest birds that are restricted to higher elevation native forests that are beyond the range of mosquitoes and the deadly avian diseases they carry and transmit. This dry property also has no habitat for Hawaii's Endangered water birds or the Endangered nēnē, and none were seen.

INSECTS

The lush quality of the vegetation produced a spike in insect activity, and a total of 21 species were recorded. Taxonomy and nomenclature follow Nishida (1992). Two insect species were abundant throughout the project area: beet Webworm moth (*Spladea recurvalis*) and short-horned grasshopper (*Oedaleus abruptus*). Also common were: longtail blue butterfly (*Lampides boeticus*), painted lady butterfly (*Vanessa cardui*) and dungfly (*Musca sorbens*).

Just one native insect species, Blackburn's sphinx moth (*Manduca blackburni*) was observed. Blackburn's sphinx moth is federally listed as an Endangered species. One mature larva (4 inches long x ¾ inch diameter) was found during the evening survey feeding on a non-native jimson weed plant (*Datura stramonium*), which is one of its known host plants.

DISCUSSION AND RECOMMENDATIONS

The animal species recorded during this survey were almost entirely non-native in character. The only native species found was a larva of the Blackburn's sphinx moth, and this moth is federally listed as an Endangered species. Its specific host species are some members of the nightshade family including the native 'aiea tree *(Nothocestrum* spp.) and non-native representatives such as tree tobacco (*Nicotiana glauca*), jimson weed and tomato (*Solanum lycopersicum*). No 'aiea occur on or near this property but eleven tree tobacco shrubs, one wild tomato plant and a few dozen jimson weed plants were found in the project area. These were each examined during the daytime without result, but during the evening survey one mature larva was found on a jimsom weed plant. This finding triggers a consultation with the U.S. Fish and Wildlife Service which administers and adjudicates actions that affect listed species. They will outline steps that will help you to proceed with this project without harming this Endangered moth.

This project area does not provide ideal habitat for any other native or listed mammal, bird, or insect species and any such use would be infrequent and incidental.

ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within three groups: Mammals, Birds and Insects. For each species the following information is provided:

1. Common name

2. Scientific name

3. Bio-geographical status. The following symbols are used:

   endemic = native only to Hawaii; not naturally occurring anywhere else in the world.

   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).

   non-native = all those animals brought to Hawaii intentionally or accidentally after western contact.

   migratory = spending a portion of the year in Hawaii and a portion elsewhere. In Hawaii the migratory birds are usually in the overwintering/non-breeding phase of their life cycle.

4. Abundance of each species within the project area:

   abundant = many flocks or individuals seen throughout the area at all times of day.

   common = a few flocks or well scattered individuals throughout the area.

   uncommon = only one flock or several individuals seen within the project area.

   rare = only one or two seen within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
MAMMALS			
Axis axis Erxleben	axis deer	non-native	uncommon
Felis catus L.	domestic cat	non-native	rare
Mus domesticus L.	house mouse	non-native	rare
Canis familiaris L.	domestic dog	non-native	rare
BIRDS			
Acridotheres tristis L.	common myna	non-native	common
Geopelia striata L.	zebra dove	non-native	common
Francolinus pondicerianus Gmelin	gray francolin	non-native	uncommon
Padda oryzivora L.	Java sparrow	non-native	uncommon
Lonchura cantans Gmelin	African silverbill	non-native	uncommon
Streptopelia chinensis Scopoli	spotted dove	non-native	rare
Francolinus francolinus L.	black francolin	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Order ARANAE - true spiders			
ARANEIDAE (Orb Weaver Spider Family)			
Araneus diadematus clerck	European garden spider	non-native	rare
Order COLEOPTERA - beetles			
CHRYSOMELIDAE (Chrysomelid Beetle Family)			
Lema trilineata daturaphila Kogan & Goeden	three-lined potato beetle	non-native	uncommon
Order DIPTERA - flies			
MUSCIDAE (House Fly Family)			
Musca domestica L.	house fly	non-native	rare
Musca sorbens Wiedemann	dung fly	non-native	common
SYRPHIDAE (Hoverfly Family)			
Simosyrphus grandicornis Macquart	Australian hoverfly	non-native	rare
Order HETEROPTERA - true bugs			
RHYPAROCHROMIDAE (Seed Beetle Family)			
Pseudopachybrachius vinctus Say	dirt-colored seed bug	non-native	rare
Order HYMENOPTERA - bees, wasps, ants			
APIDAE (Honey Bee Family)			
Apis mellifera L.	honey bee	non-native	uncommon
Xylocopa sonorina Smith	Sonoran carpenter bee	non-native	rare
MEGACHILIDAE (Leaf Cutter Bee Family)			
Megachile gentilis Cressor	leaf cutter bee	non-native	rare
FORMICIDAE (Ant Family)			
Paretrichina longicornis Latreille	crazy ant	non-native	rare
Order LEPIDOPTERA - butterflies, moths			
CRAMBIDAE (Grass Moth Family)			
Spoladea recurvalis Fabricius	beet webworm moth	non-native	abundant
LYCAENIDAE (Gossamer-winged Butterfly Family)			
Lampides boeticus L.	long tail blue butterfly	non-native	common
NOCTUIDEA (Owlet Moth Family)			
Achaea janata L.	Castor looper moth	non-native	uncommon
NYMPHALIDAE (Brush-footed Butterfly Family)			
Vanessa cardui L.	painted lady butterfly	non-native	common
PAPILIONIDAE (Swallowtail Butterfly Family)			
Papilio xuthus L.	Asian swallowtail	non-native	rare
PIERIDAE (Small white and Sulphur Butterfly Family)			
Phoebis agarithe Boisduval	large orange sulphur butterfly	non-native	rare
Pieris rapae L.	cabbage butterfly	non-native	uncommon

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
SPHYNGIDAE (Sphinx Moth Family)			
Manduca blackburni Butler	Blackburn's sphinx moth	endemic	rare
Order MANTODEA - mantis			
MANTIDAE (Mantis Family)			
Tenodera angustipennis Saussure	narrow-winged mantis	non-native	rare
Order ORTHOPTERA - grasshoppers, crickets			
ACRIDIDAE (Grasshopper Family)			
Oedaleus abruptus Thunberg	short-horned grasshopper	non-native	abundant
Schistocerca nitens Thunberg	graybird grasshopper	non-native	rare

Figure 1. Project area in northern Kihei, Maui.

Figure 2. View of the project area in the northeast corner toward Piilani Highway.

Figure 3. View south toward the central portion of the project area. Note the dead trees and sparse grass resulting from a previous brush fire.

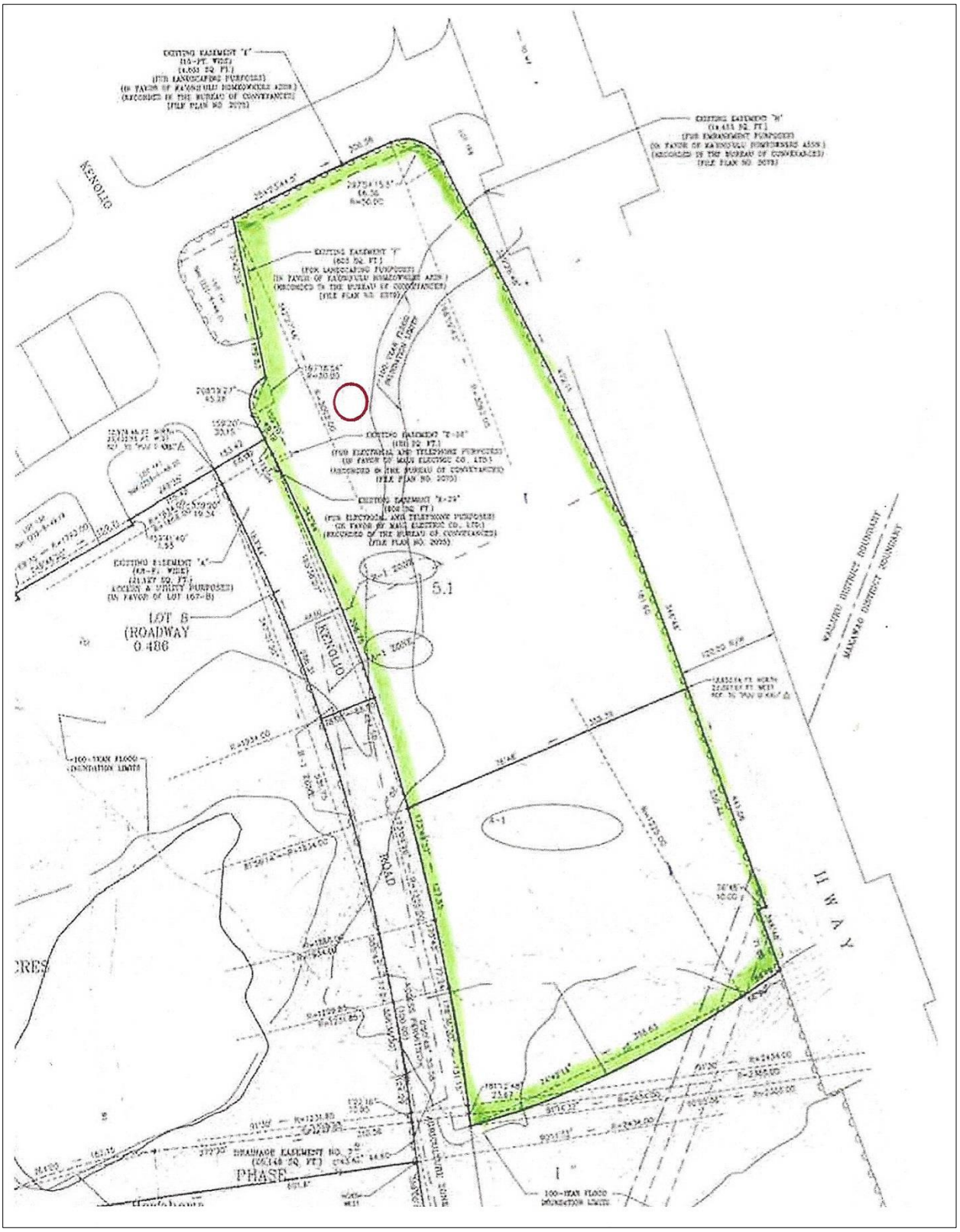

Figure 4. Location of the Blackburn's hawk moth larva on the jimson weed plant.

Figure 5. A mature larva of Endangered Blackburn's sphinx moth (*Manduca blackburni*) feeding on a jimson weed plant in the northwestern part of the project area.

Figure 6. Closeup of Blackburn's sphinx moth larva.

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APPENDIX C
Preliminary Engineering Report

PRELIMINARY ENGINEERING REPORT

FOR

KENOLIO APARTMENTS

Kihei, Maui, Hawaii

T.M.K.: (2) 3-9-001: 157 & 158

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April 2014

TABLE OF CONTENTS

1.0 INTRODUCTION

2.0 EXISTING INFRASTRUCTURE

2.1 ROADWAYS

2.2 DRAINAGE

2.3 SEWER

2.4 WATER

2.5 ELECTRIC, TELEPHONE AND CABLE TV

3.0 ANTICIPATED INFRASTRUCTURE IMPROVEMENTS

3.1 ROADWAYS

3.2 DRAINAGE

3.3 SEWER

3.4 WATER

3.5 ELECTRIC, TELEPHONE AND CABLE TV

APPENDICES

A HYDROLOGIC CALCULATIONS

B WATER DEMAND CALCULATIONS

C WASTEWATER CALCULATIONS

EXHIBITS

1 LOCATION MAP

2 VICINITY MAP

3 SOIL SURVEY MAP

4 FLOOD INSURANCE RATE MAP

PRELIMINARY ENGINEERING REPORT
FOR
KENOLIO APARTMENTS
T.M.K.: (2) 3-9-001: 157 & 158

1.0 INTRODUCTION

The purpose of this report is to provide information on the existing infrastructure which will be servicing the proposed project. It will also evaluate the adequacy of the existing infrastructure and anticipated improvements which may be required for the proposed project.

The subject properties are identified as T.M.K.: (2) 3-9-001: 157 and158. It is also Lots 1 and 2 of Kaonoulu Estates - Phase III. Parcel 157 contains an area of 5.171 acres and parcel 158 contains 3.103 acres. Both parcels will be consolidated and the total project area will contain 8.274 acres. The project site is bordered by Kaonoulu Street and a residential lot to the north, Piilani Highway to the east, Kulanihakoi Gulch to the south and the proposed North-South Collector Road to the west.

The development plan is to construct a 100 percent affordable multi-family residential project. The development mix includes 63 one-bedroom units, 100 two-bedroom units and 23 three-bedroom units for a total of 186 units. Associated improvements include a community building, utility connections, paved parking areas, offsite roadway improvements, and landscaping.

The project site is partially developed with offices being used by Betsill Brothers Construction and for material stockpiling. The majority of the site is undeveloped and covered with grass and weeds.

2.0 EXISTING INFRASTRUCTURE

2.1 ROADWAYS

North Kihei Road is the arterial that provides access to the Kihei region from West Maui and the Wailuku area. Mokulele Highway provides access

from the Kahului and Upcountry areas. Mokulele Highway is a four-lane roadway which connects Piilani Highway with Kuihelani Highway and Dairy Road. North Kihei Road is a two-lane roadway which connects Piilani Highway with Honoapiilani Highway. Both of these roadways are under the control of the State Department of Transportation.

Piilani Highway is the primary arterial for South Maui and runs along the eastern boundary of the project. It is a four-lane, undivided highway with a north-south orientation connecting with Mokulele Highway to the north and the Wailea Resort to the south.

South Kihei Road is a two-lane roadway which parallels Piilani Highway along the coastline and serves most of the commercial and residential communities in the Kihei area.

Uwapo Road, Ohukai Road, Kaonoulu Street and Kulanihakoi Street are the nearby roadways running in the east-west direction in the vicinity of the project site. Uwapo Road and Ohukai Road are signalized at its intersection with Piilani Highway. These roadways are owned by the County.

The North-South Collector Road is located between Piilani Highway and South Kihei Road. Portions of this roadway are improved and the County of Maui is in the planning stages of improving additional sections of the North-South Collector Road.

Kenolio Road is a segment of the proposed North-South Collector Road. It is a two-lane roadway which is owned by the County and located between Uwapo Road and Kaonoulu Street. It is improved from Uwapo Road to the northwest edge of the project site.

2.2 DRAINAGE

The elevation on the site ranges from 47 feet above mean sea level at the northeastern corner of the site to 16 feet at the southwestern corner, with a slope averaging approximately 2.8%. According to Panel No. 1500030586E of the Flood Insurance Rate Maps, with a revised date of September 19, 2012, the project site is situated in Flood Zones A, AE, X and XS (See Exhibit 4).

Flood Zone A is designated as a special flood hazard area subject to inundation by the 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. No base flood elevations have been determined. Flood Zone AE is designated as a special flood hazard area subject to inundation by the 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The base flood elevations have been determined to be between 23 feet and 28 feet. Flood Zone XS is designated as areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. Flood Zone X is designated as areas outside the 0.2% annual chance flood plain.

According to the "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii (August, 1972)," prepared by the United States Department of Agriculture Soil Conservation Service, the soils within the project site are classified as Alae sandy loam (AaB) and Waiakoa extremely stony silty clay loam (WID2) - (See Exhibit 3). Alae sandy loam is characterized as having slow runoff and a slight erosion hazard. Waiakoa extremely stony silty clay loam is characterized as having medium runoff and a severe erosion hazard.

There are two gulches which traverse through the project site. The first is an unnamed gulch which conveys runoff across Piilani Highway from double 102-inch culverts. This gulch starts near the intersection of Kaonoulu Street and Piilani Highway and traverses diagonally across the project site. As part of the Kaonoulu Estates - Phase IV Subdivision, a 16'-0" x 6'-6" concrete box culvert was installed to convey runoff from the unnamed gulch, across the North-South Collector Road and discharging into Kulanihakoi Gulch.

The second gulch is Kulanihakoi Gulch, which is a major drainageway. It traverses near the southern boundary of the site from an existing bridge at Piilani Highway to the four existing 6'-0" x 4'-0" concrete box culverts at its

crossing on South Kihei Road. As part of the Kaonoulu Estates - Phase IV Subdivision, a portion of Kulanihakoi Gulch was improved with a boulder lining and geotextile invert. A detention basin was also created mauka of South Kihei Road. The County of Maui is currently in the process of improving the culvert system at South Kihei Road.

According to the "Drainage and Soil Erosion Control Report for Ka'ono'ulu Estates-Phase I," revised July, 1990 by Warren S. Unemori Engineering, Inc. (WSUE), the 100-year storm runoff in the unnamed gulch is 1,109 cfs and 10,860 cfs in Kulanihakoi Gulch.

Presently, runoff from the project site sheet flows in an east to west direction and into the unnamed gulch or onto the North-South Collector Road. The onsite runoff eventually flows into Kulanihakoi Gulch and ultimately flows into the ocean. It is estimated that the present 50-year, 1-hour runoff from the project site is 7.59 cfs. The resulting storage volume is 8,652 cubic feet.

2.3 SEWER

There is an existing 8-inch sewerline on Ho'opili Akau Street which terminates with an 8-inch stubout at the northwest corner of the property. The 8-inch stubout connects to an 8-inch sewer main on Ho'opili Akau Street, then to a 10-inch sewerline on Alulike Street, to a 10-inch sewerline on Kaonoulu Street, and to a 27-inch sewer main on South Kihei Road.

As part of the Kaonoulu Estates - Phase IV Subdivision, a 10-inch sewer stubout was provided within a utility easement on Lot 51 for the subject project. The existing 10-inch sewerline connects to an existing 10-inch sewerline along Alulike Street which connects to the 10-inch sewerline mentioned above.

Sewer from the project site will flow to a series of collection systems and pump stations along South Kihei Road, which transports the wastewater to the main sewer pump station located in Kalama Park. Wastewater collected from the Kihei area is transported to the Kihei Wastewater Reclamation Facility located above Piilani Highway and south of the Elleair Golf Course.

2.4 WATER

Domestic water and fire flow will be provided by the County's water system. There is an existing 18-inch waterline which runs diagonally across the northwest corner of the project site and along the North-South Collector Road. The 36-inch Central Maui Waterline runs diagonally across the southeast corner of the project site, then along the North-South Collector Road.

A 2.0 million gallon reservoir, located approximately a mile above Piilani Highway provides storage for the area. The source for this water system is from the Central Maui area.

2.5 ELECTRIC, TELEPHONE AND CABLE TV

There are existing overhead and telephone lines which are located along the North-South Collector Road. The surrounding Kaonoulu Estates and Piilani Village Subdivisions have existing underground electrical distribution systems which can be extended to serve the project.

3.0 ANTICIPATED INFRASTRUCTURE IMPROVEMENTS

3.1 ROADWAYS

Access to the project will be from the terminus of Ho'opili Akau Street and the North-South Collector Road. The adjoining half of the North-South Collector Road will be improved to County standards for roadways within the urban district. It has an existing right-of-way width of 68 feet. The improvements will be coordinated with the County's preliminary design for their North-South Collector Road project.

The interior project roadways will have a minimum pavement width of 24 feet. The onsite parking stalls will meet the number and size requirements set forth by the Maui County Code. The geometrics and alignment will be coordinated with the Fire Department.

The following summary and recommendations were proposed by Phillip Rowell and Associates in the *Traffic Impact Analysis for Kenolio Apartments, an Affordable Housing project*, dated April 2, 2014:

"1. The proposed project is summarized as follows:

a. The project is located in the South Kihei area of Maui, between Piilani Highway and Kenolio Street and south of Kaonoulu Road.

b. The proposed action is the construction of 186 affordable apartments.

c. Access and egress will be provided by two new driveways along the east side of Kenolio Street.

d. The project will be completed before or during 2017. Therefore, the design horizon year is 2017.

2. A level-of-service analysis of 2017 background conditions without project generated concluded that the intersection of Piilani Highway at Ohukai Road should be improved. The following improvements are recommended to accommodate background growth and traffic generated by the related projects:

a. The eastbound approach should be modified to provide an additional separate left turn lane.

b. The westbound approach should be modified to provide an additional separate left turn lane.

c. The southbound approach should be modified to provide an additional separate left turn or thru lane.

3. The trip generation analysis estimated that the project will generate a total of 103 trips during the morning peak hour and 127 trips during the afternoon peak hour.

4. The level-of-service analysis of the signalized intersections along Piilani Highway concluded that the project generated traffic has a negligible impact

on intersection. There is no change in the level-of-service of the overall intersections or any lane groups as a result of project generated traffic. Several of the side street approach and/or left turn from Piilani Highway will operate at Level-of-Service E or F, but these movements will have low volume-to-capacity ratios. Adding green time to these movements did not change the levels-of-service, indicating that the low levels-of-service are the result of the traffic signal cycle length.

5. *The level-of-service analysis of the intersection of South Kihei Road at Kaonoulu Street concluded that the project generated traffic has a negligible impact on this intersection. There is no change in the level-of-service of the overall intersection or any lane groups as a result of project generated traffic. All lane groups will operate at Level-of-Service C, or better, without and with project traffic.*

6. *The level-of-service analysis of the unsignalized intersections of Kaonoulu Street at Kenolio Road and Kaonoulu Street at Alulike Street concluded that all lane groups will operate at Level-of-Service C, or better, without and with project traffic.*

7. *A level-of-service analysis of the project's driveways along Kenolio Road concluded that all lane groups will operate at Level-of-Service A as unsignalized intersections. No separate left turn lanes will be required at the driveways. It was also assumed that all the driveways will be one lane wide.*

8. *The traffic study for the Piilani Promenade, which will be located along the east side of Piilani Highway and across from the study project, will not be completed for several months, and then there will be the delay while the report is being reviewed by the State of Hawaii Department of Transportation. Piilani Promenade will not be completed before 2018, one*

year after the design year for Kenolio Apartments. Primary access to and egress from Piilani Promenade will be via the intersection of Piilani Highway at Kaonoulu Street. Attachment Y is a schematic drawing of this intersection as currently planned to accommodate traffic generated by Piilani Promenade."

3.2 DRAINAGE

A concrete box culvert will be installed from the outlet of the double 102-inch culverts at Piilani Highway, through the project site and connect to the existing 16'-0" x 6'-6" concrete box culvert on the site. The proposed concrete box culvert will meander through the site to avoid conflicts with any structures or improvements.

As part of the Kaonoulu Estates - Phase IV Subdivision, Lot 6 and portions of Lots 4 and 5 of the Kaonoulu Estates - Phase III was used for the construction of a detention basin. According to the "Drainage and Soil Erosion Control Report for Ka'ono'ulu Estates - Phase IV," prepared by Otomo Engineering, Inc., with a revision date of August 2001, the detention basin was designed to accommodate the increase in runoff from the Phase IV project site, which was at the time, a 140-unit multifamily and commercial development. The previous 140-unit multi-family site and commercial development is now the site of the proposed project. The report also stated that the detention basin was sized to accommodate 198,700 cubic feet of storage, of which 60,000 cubic feet of storage was provided for this project.

The post development runoff from the project site is estimated to be 23.16 cfs, with an increase of 15.57 cfs over existing conditions. The resulting storage volume for the developed conditions is 22,925 cubic feet. In accordance with the County drainage standards, the project is required to mitigate the increase in runoff generated by the development. Accordingly, the project is required to provide mitigation for 15.57 cfs with a corresponding

storage volume of 14,273 cubic feet. As mentioned herein, 60,000 cubic feet of existing storage capacity is allotted for this project.

Onsite runoff will be collected by catch basins located at appropriate intervals along the interior roadways and landscaped areas. Drainlines from the catch basins will convey the runoff to an outlet in Kulanihakoi Gulch. As noted herein, there is storage volume within the existing detention basin which was created for this project. Additional onsite detention basins will be constructed within the landscaped areas, which will provide additional storm water detention for the project.

Any proposed structures which are located within a flood zone other than Zone XS or Zone X will be required to meet County, State and Federal requirements for development within a flood zone. A Best Management Practices plan will be submitted as part of the grading permit. In addition, an NPDES permit for construction activities will be required since the area of grading is greater than one acre. The NPDES permit will be secured before the issuance of the grading permit.

The proposed drainage system will be designed in accordance with Chapter 4, "Rules for the Design of Storm Drainage Facilities in the County of Maui" and Chapter 15-11 Rules for the Design of Storm Water Treatment Best Management Practices."

3.3 SEWER

The proposed 186-unit multi-family development will generate approximately 47,430 gallons per day of wastewater (See Appendix C). The onsite sewerage collection system will be designed to accommodate this flow. The existing collection and transmission systems, pumping facilities and treatment plant have the capacity to handle the anticipated wastewater generated by the development.

According to the Wastewater Reclamation Division, County of Maui, as of August 27, 2013, the KWRF has a capacity of 8.0 million gallons per day

(mgd). The average flow into the KWRF is 3.5 mgd and the allocated capacity is 6.805 mgd. The remaining wastewater capacity at the KWRF is approximately 1.2 mgd.

The onsite sewer system will consist of a gravity system which will connect to the existing 8-inch sewerline on Ho'opili Akau Street and the existing 10-inch sewerline at the east end of Alulike Street. The gravity system will eventually connect to the existing sewer system on South Kihei Road.

According to the Wastewater Assessment areas and fees set by the County of Maui, the subject project is located within the Kihei Assessment Area 3. At the present time, the County is assessing sewer fees of $1,743.00 per unit for the collection system upgrade and $1,185.75 per unit for the treatment plant facility expansion for multi-family development.

3.4 WATER

In accordance with the Department of Water Supply's Domestic Consumption Guidelines for multi-family residential development, the average daily demand for the 186-unit project is approximately 104,160 gallons per day (See Appendix B). The project will utilize low-flow fixtures as part of the water conservation measure. Fire flow demand for multi-family residential development is 2,000 gallons per minute for a 2-hour duration. Fire hydrants will be installed with a maximum spacing of 250 feet.

The project will connect to the existing 18-inch waterline along the North-South Collector Road, which is capable of providing water service and fire flow for the project. The project is subject to the County's water availability policy outlined in Chapter 14.12 of the Maui County Code.

The required water meter size will be determined at the time the building permit is applied for. The Department of Water Supply (DWS) cannot guarantee water for the project. A water meter can be applied for and

secured after the required improvements are installed, inspected and accepted by the DWS.

The Developer will drill an onsite non-potable well which will be used for the project's landscape irrigation. This source will also be used for dust control during the construction period.

Domestic, irrigation and fire flow calculations will be submitted to the Department of Water Supply during the building permit review process to determine the required system improvements.

3.5 ELECTRIC, TELEPHONE AND CABLE TV

The proposed electrical, telephone and cable TV distribution systems for the subject project will be installed underground from the existing facilities along the North-South Collector Road or from the adjacent developments. Street lights will be within the project site at intervals to be determined by the electrical engineer. All lighting will be shielded and faced downward.

APPENDIX A

HYDROLOGIC CALCULATIONS

Hydrologic Calculations

Purpose: Determine the increase in onsite surface runoff from the development of the proposed project based on a 50-year storm.

A. Determine the Runoff Coefficient (C):

EXISTING CONDITIONS:

Infiltration (Medium)	=	0.07
Relief (Flat)	=	0.00
Vegetal Cover (Good)	=	0.03
Development Type (Open)	=	0.15
	C=	0.25

DEVELOPED CONDITIONS:

ROOF AREAS:

Infiltration (Negligible)	=	0.20
Relief (Hilly)	=	0.06
Vegetal Cover (None)	=	0.07
Development Type (Roof)	=	0.55
	C=	0.88

PAVED AREAS:

Infiltration (Negligible)	=	0.20
Relief (Flat)	=	0.00
Vegetal Cover (None)	=	0.07
Development Type (Pavement)	=	0.55
	C=	0.82

LANDSCAPE AREAS:

Infiltration (Medium)	=	0.07
Relief (Flat)	=	0.00
Vegetal Cover (Good)	=	0.03
Development Type (Open)	=	0.15
	C=	0.25

DEVELOPED CONDITIONS:

Paved Area = 3.79 Acres

Roof Area = 1.98 Acres

Landscaped Area = 2.50 acres

WEIGHTED C = 0.62

B. Determine the 50-year 1-hour rainfall:

i_{50} = 2.2 inches

Adjust for time of concentration to compute Rainfall Intensity (I):

Existing Condition:

T_c = 19 minutes

I = 3.67 inches/hour

Developed Condition:

T_c = 11 minutes

I = 4.51 inches/hour

C. Drainage Area (A) = 8.274 Acres

D. Compute the 50-year storm runoff volume (Q):

$$\mathbf{Q = CIA}$$

Existing Conditions:

$$Q = (0.25)(3.67)(8.274)$$
$$= 7.59 \text{ cfs}$$

Developed Conditions:

$$Q = (0.62)(4.51)(8.274)$$
$$= 23.16 \text{ cfs}$$

The increase in runoff due to the proposed development is 23.16 - 7.59 = 15.57 cfs.

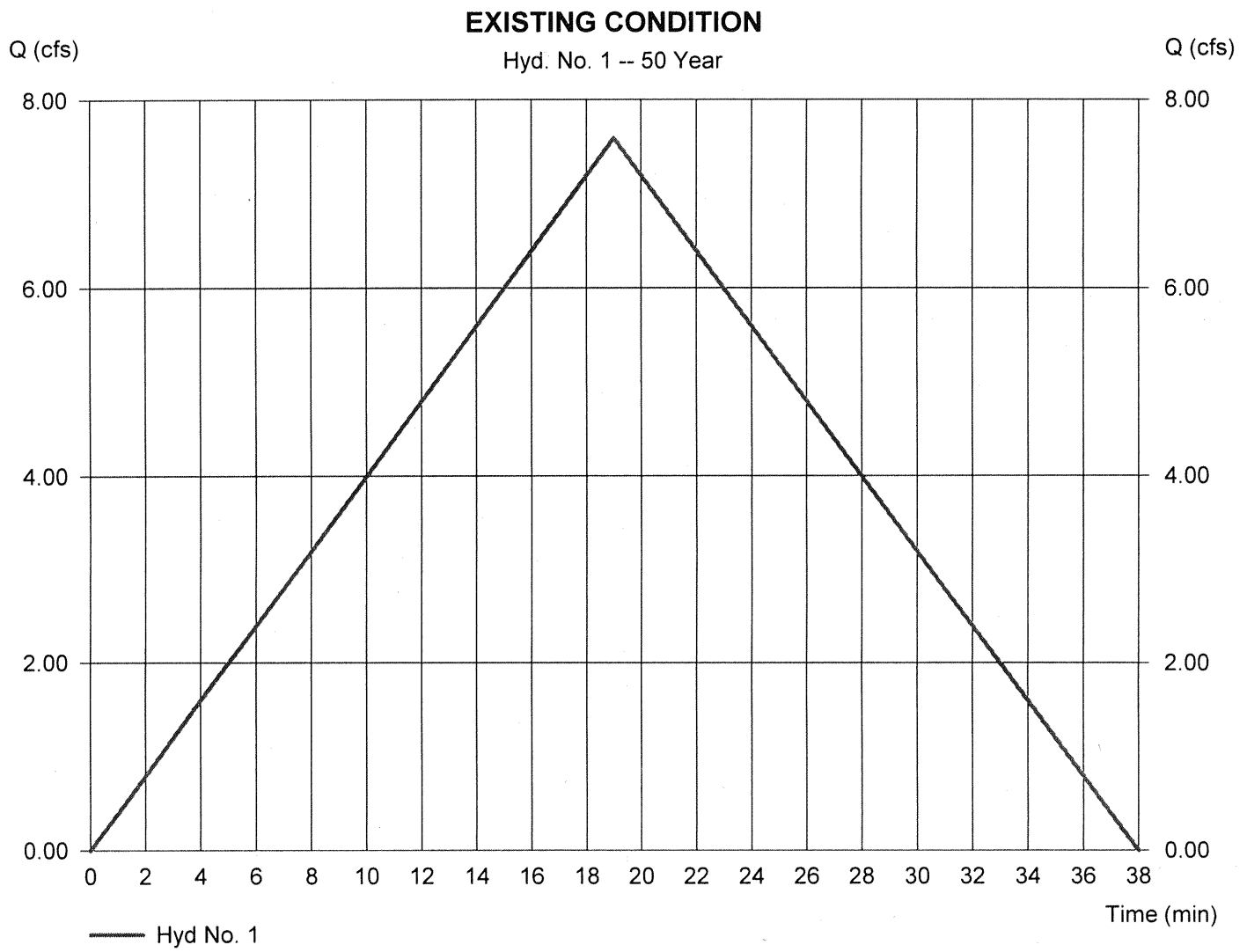
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Monday, 04 / 21 / 2014

Hyd. No. 1

EXISTING CONDITION

Hydrograph type	= Rational	Peak discharge	= 7.590 cfs
Storm frequency	= 50 yrs	Time to peak	= 19 min
Time interval	= 1 min	Hyd. volume	= 8,652 cuft
Drainage area	= 8.274 ac	Runoff coeff.	= 0.25
Intensity	= 3.669 in/hr	Tc by User	= 19.00 min
IDF Curve	= 2-2.IDF	Asc/Rec limb fact	= 1/1



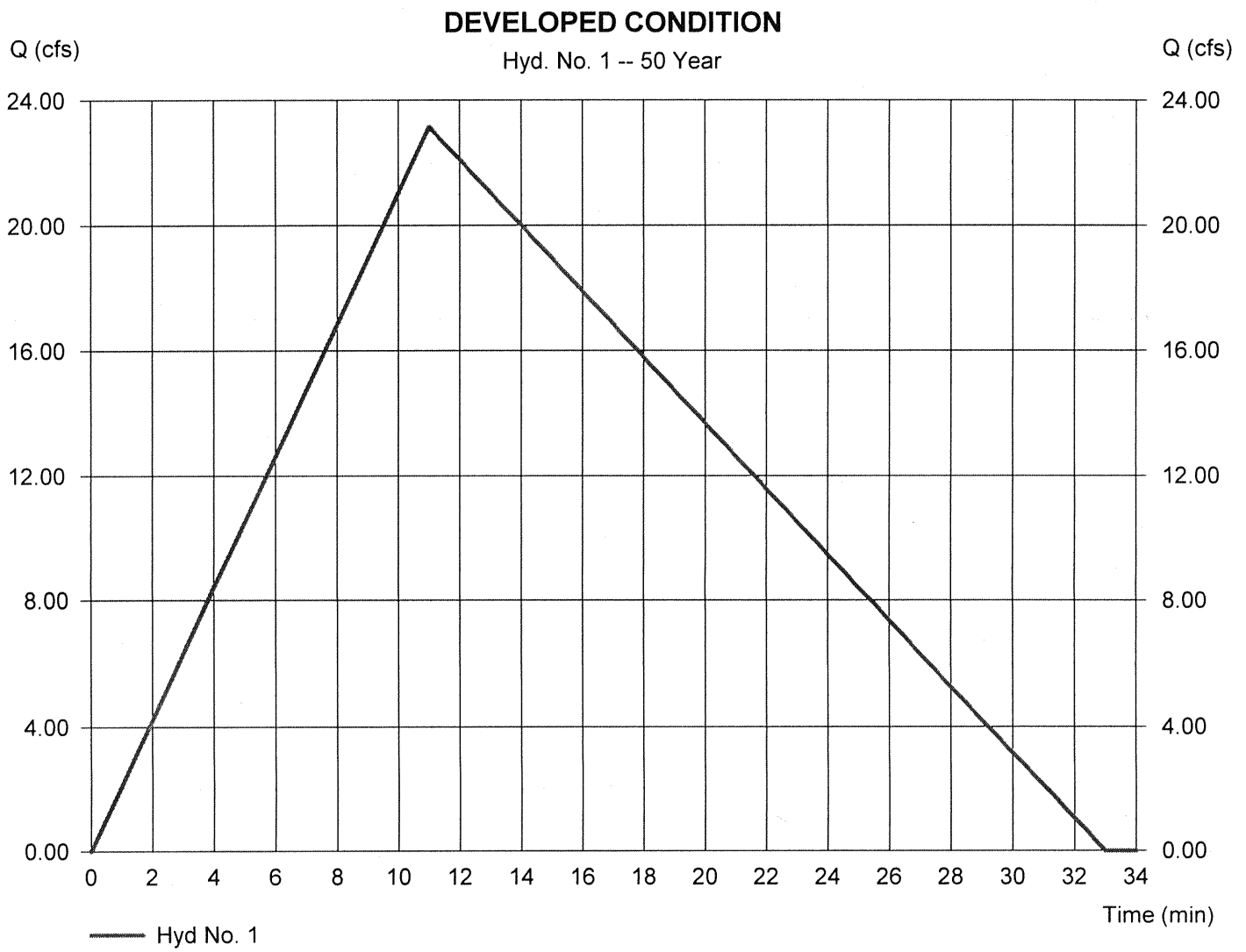
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Monday, 04 / 21 / 2014

Hyd. No. 1

DEVELOPED CONDITION

Hydrograph type	= Rational	Peak discharge	= 23.16 cfs
Storm frequency	= 50 yrs	Time to peak	= 11 min
Time interval	= 1 min	Hyd. volume	= 22,925 cuft
Drainage area	= 8.273 ac	Runoff coeff.	= 0.62
Intensity	= 4.515 in/hr	Tc by User	= 11.00 min
IDF Curve	= 2-2.IDF	Asc/Rec limb fact	= 1/2



APPENDIX B

WATER DEMAND CALCULATIONS

WATER DEMAND CALCULATIONS

Per 2002 Water System Standards:

Average Daily Demand (ADD) = 560 gallons per unit or 5,000 gallons per acre

ADD = (560 gallons/unit) x (186 units) = 104,160 gallons per day

ADD = (5,000 gallons/acre) X (8.274 acres) = 41,370 gallons per day

Average Daily Demand is 104,160 gallons (Greater of the two ADDs)

APPENDIX C

WASTEWATER CALCULATIONS

WASTEWATER CALCULATIONS

Per the 1993 Wastewater Flow Standards:

Wastewater Contribution for a Multi-Family Unit is 255 gallons/day/unit

Contribution = (186 units) x (255 gallons/unit/day) = 47,430 gallons per day

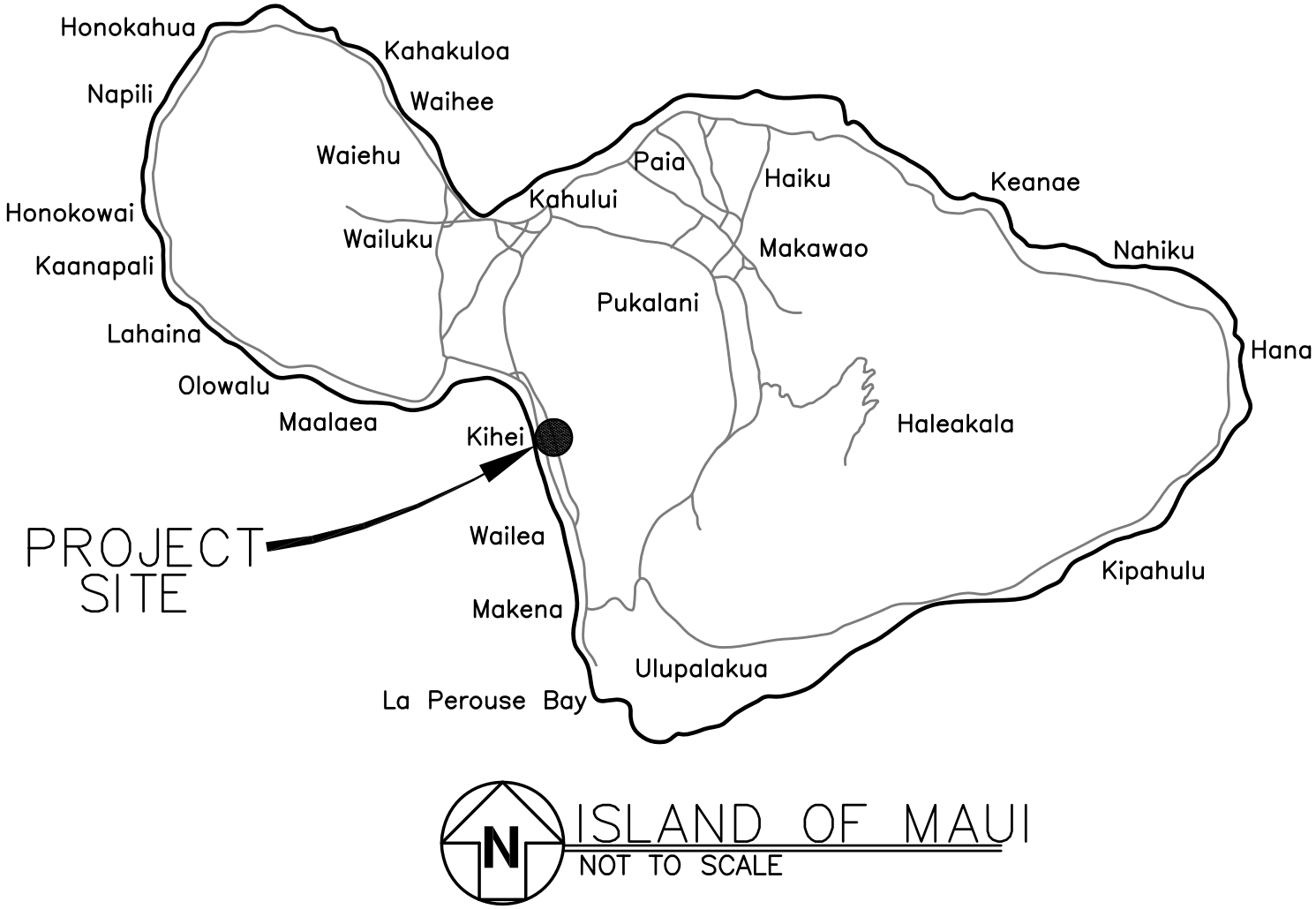
EXHIBITS

1 Location Map

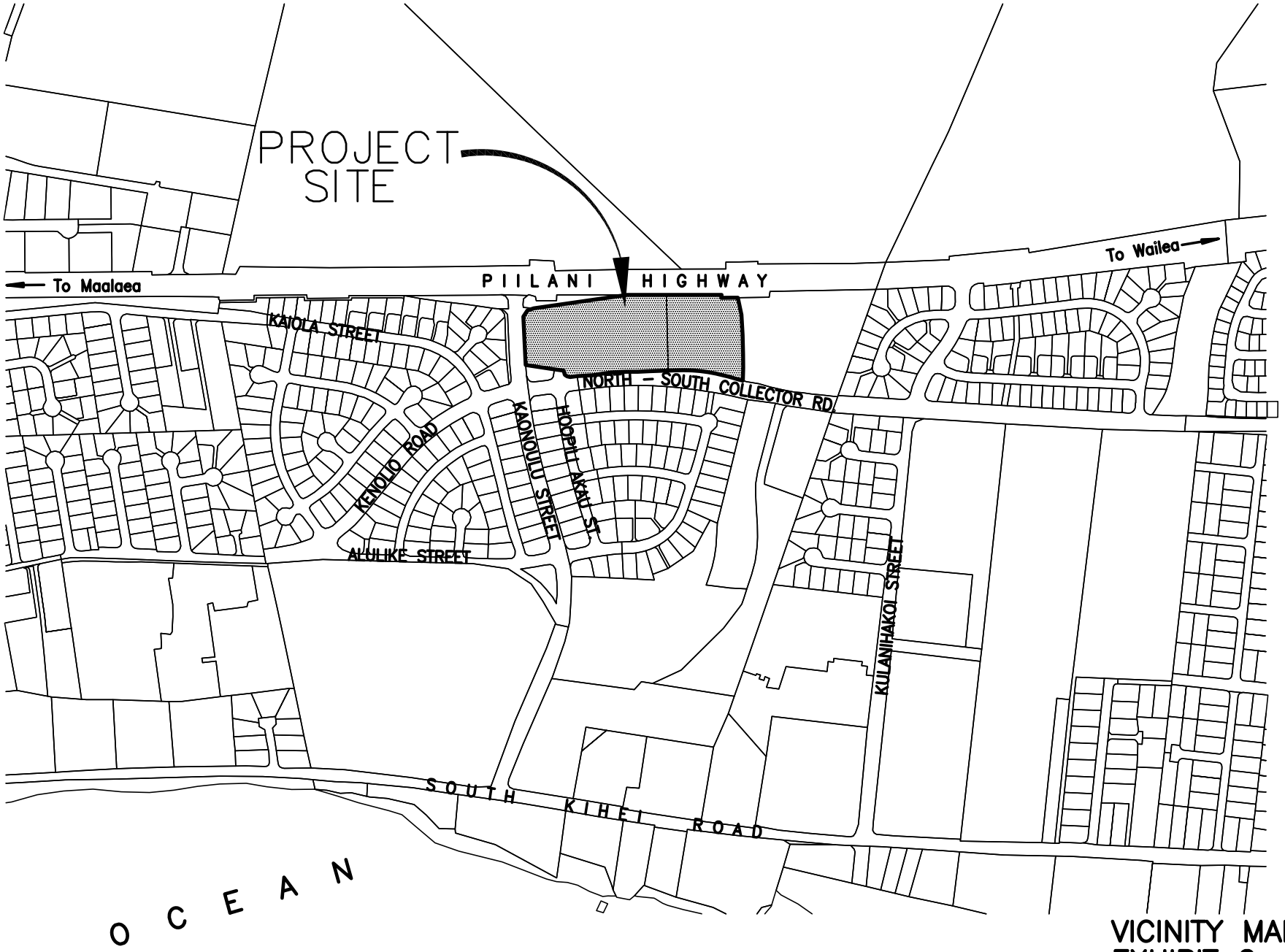
2 Vicinity Map

3 Soil Survey Map

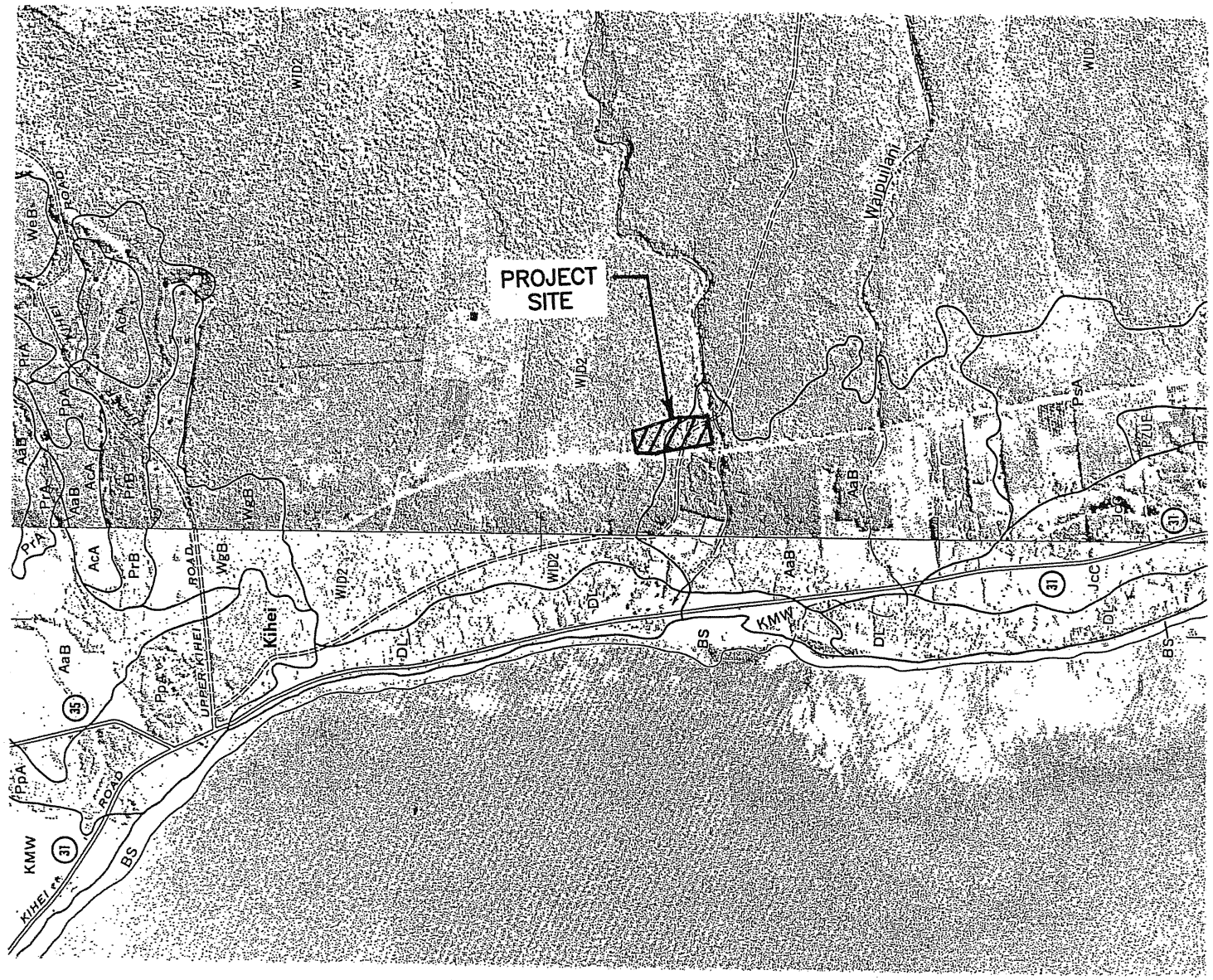
4 Flood Insurance Rate Map



LOCATION MAP
EXHIBIT 1



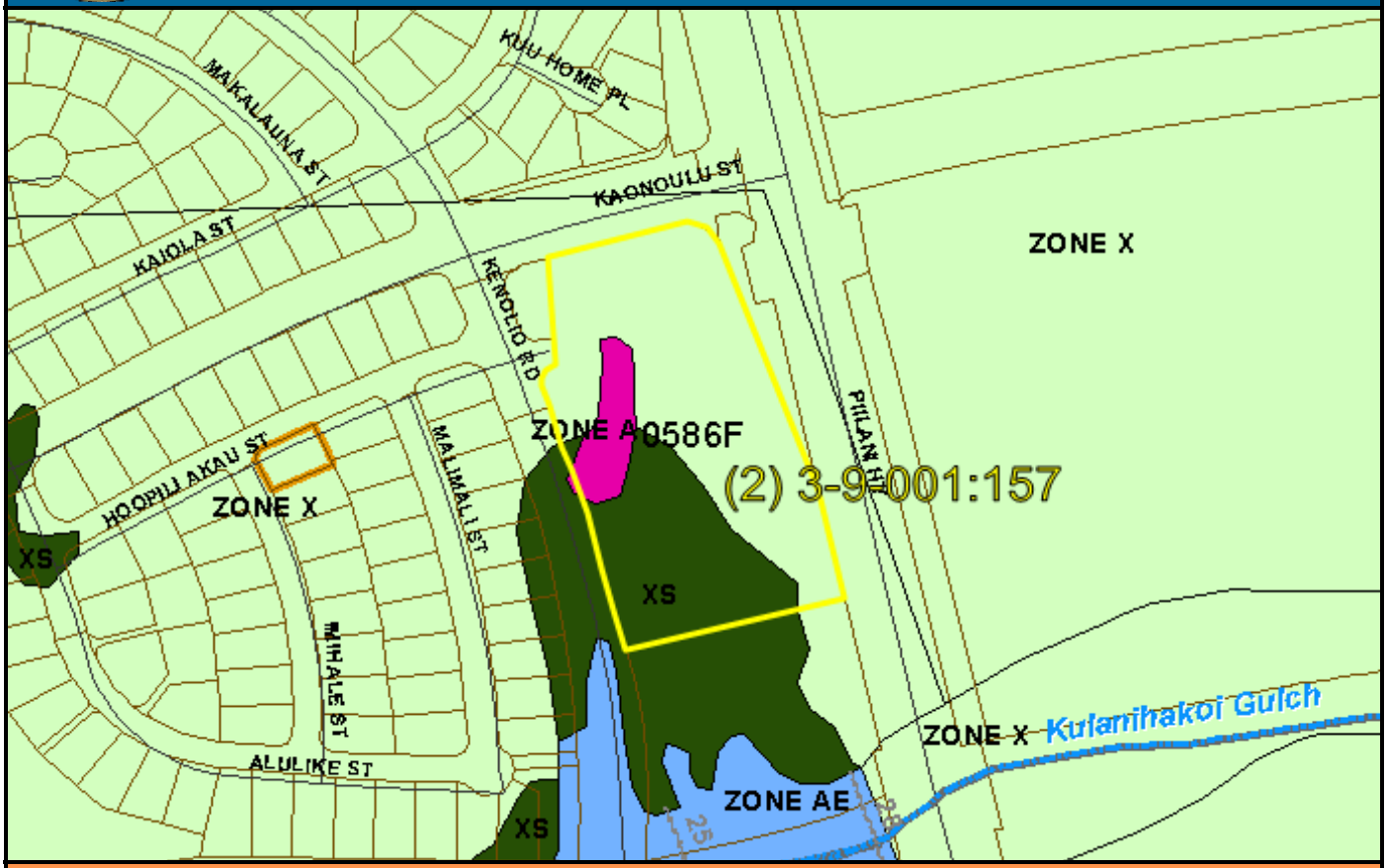
VICINITY MAP
EXHIBIT 2



SOIL SURVEY MAP
EXHIBIT 3

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD – The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- Zone A: No BFE determined.
- Zone AE: BFE determined.
- Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
- Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
- Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA – An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

PROPERTY INFORMATION

COUNTY:	MAUI
TMK NO:	(2) 3-9-001-157
PARCEL ADDRESS:	635 KENOLIO RD KIHEI, HI 96753
FIRM INDEX DATE:	SEPTEMBER 19, 2012
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1500030586F
PANEL EFFECTIVE DATE:	SEPTEMBER 19, 2012

PARCEL DATA FROM:	JULY 2013
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

County NFIP Coordinator	
County of Maui	
Carolyn Cortez	(808) 270-7253
State NFIP Coordinator	
Carol Tyau-Beam, P.E., CFM	(808) 587-0267

Disclaimer: The Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use of the information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR from any liability, which may arise from its use.

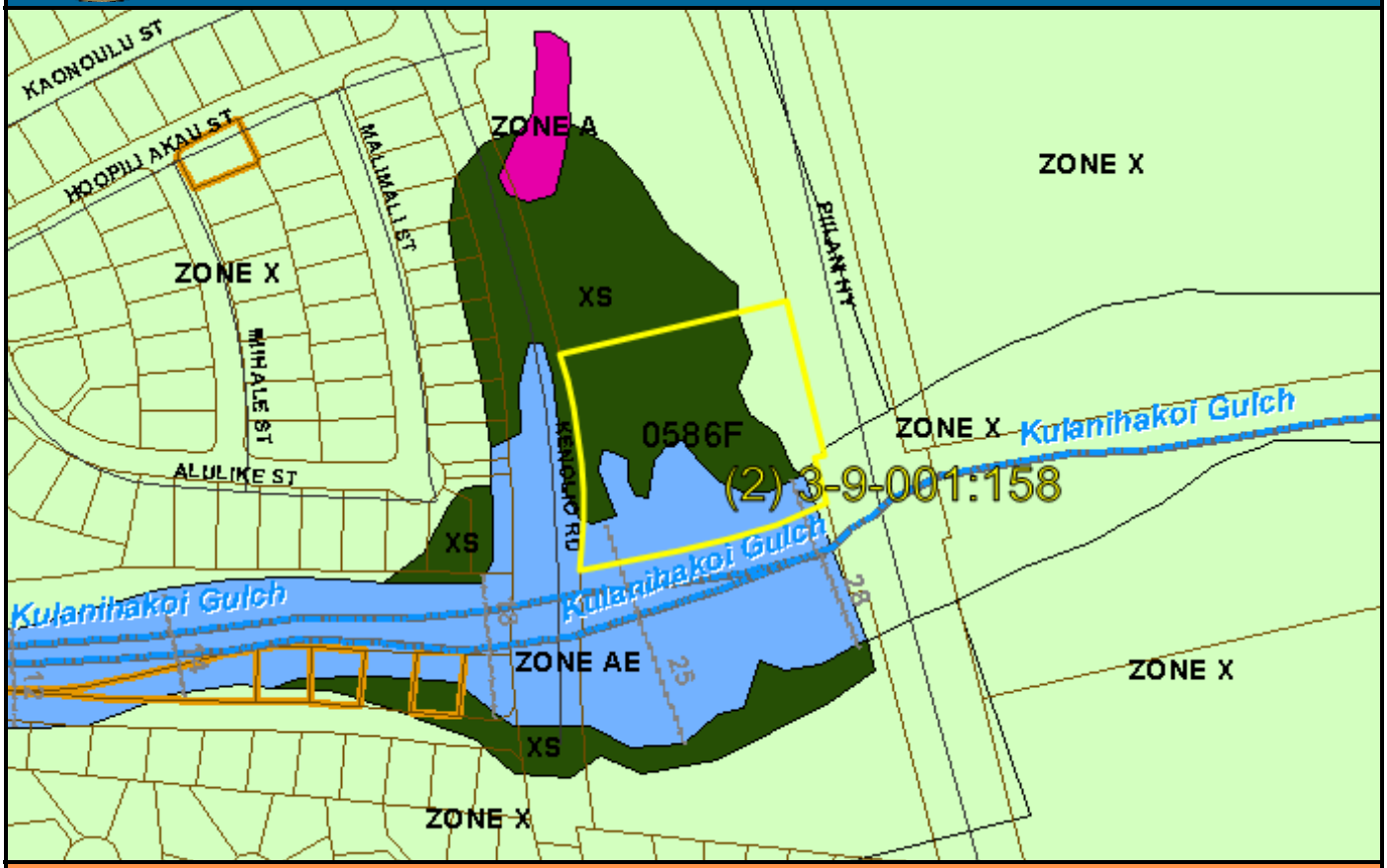
If this map has been identified as 'PRELIMINARY' or 'UNOFFICIAL', please note that it is being provided for informational purposes and is not to be used for official/legal decisions, regulatory compliance, or flood insurance rating. Contact your county NFIP coordinator for flood zone determinations to be used for compliance with local floodplain management regulations.

EXHIBIT 4

FLOOD INSURANCE RATE MAP

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD – The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- Zone A: No BFE determined.
- Zone AE: BFE determined.
- Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
- Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
- Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA – An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

PROPERTY INFORMATION

COUNTY:	MAUI
TMK NO:	(2) 3-9-001-158
PARCEL ADDRESS:	KENOLIO RD KIHEI, HI 96753
FIRM INDEX DATE:	SEPTEMBER 19, 2012
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL(S):	1500030586F
PANEL EFFECTIVE DATE:	SEPTEMBER 19, 2012

PARCEL DATA FROM:	JULY 2013
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

County NFIP Coordinator	
County of Maui	
Carolyn Cortez	(808) 270-7253
State NFIP Coordinator	
Carol Tyau-Beam, P.E., CFM	(808) 587-0267

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EXHIBIT 4

FLOOD INSURANCE RATE MAP

APPENDIX D

Early Consultation with US Fish and Wildlife Service

From: Ian Bordenave [mailto:ian_bordenave@fws.gov]
Sent: Wednesday, May 07, 2014 12:07 PM
To: Brett Davis
Cc: hobdyr001@hawaii.rr.com; Angela.G.Amlin@hawaii.gov
Subject: RE: Kenolio Apartments

Hi Brett,

Sorry for the delayed reply. Absolutely you should proceed with having Bob take another look at the site before hand-clearing it. We've dried out a bit over the last couple of weeks, which ought to reduce the likelihood of finding any more BSM larvae in the area, but it's better to be safe than sorry. ☺

The following is language that we've come up with here at the Service for working in areas that may have BSM occupancy. Some of it you've already done:

- Surveys for BSM and its potential larval host plants should be conducted during the wettest portion of the year (November to April – early surveys can be done if there have been Kona storms), approximately four to eight weeks following a significant rainfall event. In some cases, multiple surveys may be recommended. If larval host plants are detected and will be affected during project construction or operation, the plants will be clearly marked with flagging and a qualified biologist will document 1) general larval plant density; 2) proximity of larval plants to project sites; 3) average height of the larval plants; 4) signs of larval feeding damage on leaves; and 5) presence of BSM larvae on leaves.

- If the larval host plant is entirely herbaceous and there are no BSM larvae or signs indicating the possibility of pupating larvae (such as frass, chewed stems or other browsing characteristics), the entire plant may be removed.

- If the larval host plant is woody, and there are no signs of BSM, the above-ground portion of the plant maybe cut off and removed. Since the plant has developed woody structure it is possible that the signs of BSM foraging have been shed and that root disturbance could dislodge larvae. Therefore, the soil and plant roots should be left intact for a period of one year.

- A 33-foot (10-meter) disturbance-free buffer around the larval host plant shall be established to prevent disturbance to any pupating larvae which may be in the ground in the area near the plant. NOTE, this area can be hand-cleared of vegetation to reduce fire fuel loads. Just don't do use any heavy equipment or do any grubbing activities within the buffer area. Cut stems should be treated with herbicide to prevent regrowth and potential use by BSM. After one year, the plant roots may be removed. The one-year waiting period will ensure any larvae pupating in the soil will have pupated and emerged from the soil prior to disturbance of the plant or soil.

- Monitor the area periodically (particularly during the wet season) in the run-up to breaking ground to ensure that you don't get any re-growth or recruitment of Solanaceous plants in the meantime, as this could potentially re-set the clock on the waiting period for grubbing and ground breaking.

Adult nectar plants, such as beach morning glory (*Ipomoea pes-caprae*), ilima (*Sida fallax*), ilie'e (*Plumbago zeylanica*), and maiapilo (*Capparis sandwichiana*), are not considered limiting factors for BSM. There is no need to avoid these plants, and no need to exclude or monitor for them. Adult moths are capable of flying long distances, so if you clear a patch of morning glory in the course doing of veg. control or grubbing…don't worry about it. The moths will find another patch nearby. If the morning glory grows back (which it will do, very quickly)…don't worry about it. It's a nectar resource for the moths and butterflies in that area, but they aren't going to lay eggs there if there aren't any Solanaceous plants to lay them on.

Ian Bordenave
Biologist
U.S. Fish and Wildlife Service
Maui Nui Field Station
Milepost 6 Mokulele Highway
Kihei, HI. 96793
Phone: (808) 270-1432
E-Mail: ian_bordenave@fws.gov

APPENDIX E

Archaeological Assessment Survey

STATE OF HAWAII
OFFICIAL RECEIPT

No. 0311

STATE HISTORIC PRESERVATION DIVISION
Department or Agency

DATE: 4 SEPT. 20 13

RECEIVED from XAMANEK RESEARCHES LLC

Fifty and 00/100 DOLLARS

Archaeological Assessment survey: 8.274 Acre Portion of Land for Proposed Ka'ono'ulu 201-H Housing Project (Formerly Known as Ka'ono'ulu Phase VI). Ka'ono'ulu, Wailuku & Makawao, Maui. TMK (2)3-9-001:157 and 158

$ 50.00
Check # 2893

C. Lorenzo Kami
Authorized Signature

STATE ACCOUNTING FORM B-24
July 1, 1999 (Revised)

Submitted Plan/Report Fee & Type: (All reports or plans submitted to the SHPD for review shall be accompanied by the appropriate fee in accordance with HAR §13-275-4 and §284-4).

.....		Indicate here (X) if report is a re-submittal (no fee charged)
✓	$50	Archaeological Assessment
.....	$150	Archaeological Inventory Survey Plan
.....	$450	Archaeological, Architectural or Ethnographic Survey Report
.....	$150	Preservation Plan
.....	$25	Monitoring Plan
.....	$150	Archaeological Data Recovery Plan
.....	$250	Burial Treatment Plan
.....	$100	Archaeological Monitoring Report, if resources reported
.....	$450	Archaeological Data Recovery Report
.....	$450	Ethnographic Documentation Report
.....	$25	Burial Disinterment Report
.....	$50	Osteological Analysis Report

Fee Total: $ 50.00

Make check payable to "Hawai'i Historic Preservation Special Fund." A service charge of $15 will be assessed on all dishonored checks pursuant to HRS §40-35.5" A copy of this form will be mailed or faxed back to you and will serve as your receipt.

For Office Use Only:

Date Received: 30 AUG 2013	Receipt No.: 0311
	Payment Method:
	Cash ..... $ 50.00
	Check: ✓ Check No.: 2893
Log. No.: 2013.5197	Receipt Issued by:
	Treasury Deposit Receipt No:

An Archaeological Field Inspection of a 8.274 acre portion of land located in Ka`ono`ulu *Ahupua`a*, Wailuku District, Maui
(TMK 3-9-001: 157 and 158)

Prepared at the direction of:

Ms. Faith Okuma, Project Manager
Kihei, Maui

Prepared by:

Xamanek Researches, LLC
Pukalani, Maui

Erik M. Fredericksen

28 November 2006

Introduction

Xamanek Researches, LLC conducted a field inspection of 8.274 acres of land in Ka`ono`ulu *ahupua`a*, Kihei, Maui in October 2006 (Figures 1, 2, 3 and 4). Given that the project area had been previously impacted, our field inspection was carried out following discussions with Dr. Melissa Kirkendall, State Historic Preservation Division (SHPD) staff archaeologist for Maui. The field inspection with subsurface testing was undertaken in order to assess the level of previous impact to the project area. The study area consists of two adjacent parcels—Lot 1 and Lot 2 (TMK 3-9-001: 157 and 158, respectively).[1] The property owner, Betsill Brothers Construction, Inc., plans to consolidate the two parcels and preliminarily plans to develop 166 - 168 multi-family housing units on the overall project area.[2]

Pi`ilani Highway borders the study area on the east, while Ka`ono`ulu Street bounds the northern portion, Kenolio Road borders the *makai* or western side, and Kulanihakoi Gulch forms the southern boundary. These adjacent parcels have been heavily altered by previously permitted activities. At present, a permitted single family home, an office complex and a portion of a base yard are located on Lot 1 (Photographs). Lot 2 contains the rest of the base yard, along with a permitted stockpile, along with quantities of fill material and boulders. A previously constructed drainage swale crosses both properties and feeds into an installed underground culvert that empties into Kulanihakoi Gulch to the south. An existing County of Maui water line crosses the southeastern portion of Lot 2.

I first conducted an initial field inspection of the project area on 5 October 2006, in order to assess the area. A subsequent pedestrian inspection of the overall study area was undertaken on 27 October 2006. Given the level of previous disturbance, we undertook backhoe testing on 30 October to assess the degree of the previous impacts. The results of our field inspection of the project area are presented below.

Background

The project area is located in Ka`ono`ulu *Ahupua`a*, Wailuku District, Maui (TMK: (2) 3-9-001: 157 & 158). However, a small portion of southeastern corner of Lot 2 is located in Makawao District. The study area is a part of a larger portion of Royal Patent Number 7447, Land Commission Award Number 3237 Part 2 to H. Hewahewa.

[1] Lot 1 presently consists of 5.171 acres, while Lot 2 is comprised of 3.103 acres.
[2] The final housing mix for the project area has not been finalized at the writing of this report.

The approximate elevation of this property is 18-42 ft AMSL. The parcel presently contains large amounts of imported fill (including boulders), a stock pile, a base yard, informally deposited fill/debris, a previously constructed home, and an office complex. The southern portion of the project area was previously altered for a permitted flood control project in 2000 and leads into a water retention area that can not be developed (Figure 3). The c. 8.25 acre study area was apparently first substantially impacted around 1990, at which time archaeological monitoring was undertaken by Archaeological Consultants of Hawaii and a finding of "no effect" was issued by the State Historic Preservation Division (SHPD DOC NO: AG1007a/393). In addition, a follow-up SHPD review letter, which covered actions proposed for a residential development (Phase I) on a portion of the project area, was generated in May of 1998. At this time, no further work was recommended for proposed activities on the parcel (SHPD DOC NO: 9003BD25). Finally, a "no effect" letter was generated for a more recent development (Phase III—File No: 3.2085) in 2004, because of previous impacts to the general area (SHPD DOC NO: 0403CD12).

Xamanek Researches, LLC carried out a field inspection of a c. 9.5 acre parcel known as Ka`Ono`Ulu Estates Phase V to the southwest of the current project area. This previous field inspection of this nearby parcel was carried out in early 2006. The property was found to have been extensively disturbed and no further work was recommended (Fredericksen, 2006). The SHPD subsequently issued a no-effect letter, following review of the field inspection report (SHPD DOC NO: 0607JP19).

The Phase VI study area has been previously impacted by activities associated with grubbing, grading, and the construction of an adjacent flood control project to the south in early 2000, as well as the development of the Ka`Ono`Ulu Phase III project immediately to the west. The earlier flood control measures impacted the adjacent Kulanihakoi Gulch, and included extensive grubbing and mass grading. This flood control project was undertaken with the necessary County of Maui grading (G2000/64) and SMA (SMI 99/10013 and SMI 98/0004) permits. A drainage swale crosses Lot 1 and feeds into an underground concrete culvert that was previously installed on Lot 2. This previously installed drainage system discharges into the nearby Kulanihakoi Gulch that lies to the south of Lot 2. Grading and grubbing, along with the placement of and stockpiling of fill also occurred within the Phase VI project area in association with the development of the Ka`Ono`Ulu Phase III project in the late 1990s and in 2000.

Field Inspection

As previously noted, an initial field inspection was carried out on 5 October 2006. Following consultation with the SHPD Maui office, a pedestrian 100% surface inspection was then conducted on 27 October. The study area is adjacent to and north of the previously noted impacted section of Kulanihakoi Gulch. As noted above, this drainage

feature has been heavily modified for flood control purposes within about the last 6 years.[3]

The study area contains access roads along on its southern half; as well as large amounts of imported fill (including boulders), a stock pile, a base yard, informally deposited fill/debris, a previously constructed single family residence, and an office complex. The southern portion of the project area was previously altered for a permitted flood control project in 2000, which leads into a water retention area that can not be developed. The modified Kulanihakoi Gulch lies adjacent to and south of the Phase VI project area.

Surface visibility on the study area at the time of the field visits was fair to good. Observed vegetation was dominated by non-native grass species (primarily buffelgrass). In addition, a few scattered *kiawe* (Prosopis pallida) trees (young), as well as *koa haole* (Leucaena leucocephela) shrubs and various annual weeds were also noted. Two pioneering native plants species, *`ilima* (Sida fallax) and *`uhaloa* (Waltheria americana), were noted in low quantities in some open portions of this previously disturbed parcel.

The pedestrian inspection of the Ka`Ono`Ulu Phase VI project area did not reveal any evidence of significant material culture remains. There were several areas where bare ground was visible. In addition, it was evident that the study area had been heavily impacted by previous earthmoving activities. Surface evidence of previous disturbance included several piles of boulders, a large base yard, an extensive stock pile, a previously installed drainage swale, a relatively new home, and an existing office complex.

Subsurface Results

Given the apparent level of disturbance within the study area, a total of 8 backhoe trenches were excavated to assess subsurface conditions (see Figures 5-11, and Photographs 13-20). Encountered fill in tested portions of the project area ranged from a minimum of about 60 cm to over 100 cm in depth.[4] In general, two common strata were encountered in the testing process. When present, these layers were found to underlay imported fill. It appeared that an unknown amount of the upper portion of Layer I had been previously impacted, possibly by earlier earthmoving activities that took place on the project area. This compact stratum consisted of reddish brown (5 YR 4/4) silty clay. There were no significant material culture remains noted in this layer, which was up to 50 cm thick. Layer II, when encountered, was up to 40 cm in thickness in tested areas.[5] This reddish brown (5 YR 4/3) clay was sterile and contained weathered pieces of bedrock. A third stratum, Layer III, was located only in BT 1. This compact, brown (7.5 YR 4/4) silt was sterile and contained weathered bedrock.

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[3] The western (*makai*) portion of the flood control area, which is located *makai* (west) of the Phase VI study area, is currently being reestablished as a wetland area with native plants.

[4] Backhoe Trenches 3-5 were terminated because of very difficult subsurface excavation conditions in boulder fill. It remains unclear in these test instances how much deeper the fill extended.

[5] This layer was located in Backhoe Trenches 1, 6 and 7.

Summary

In conclusion, there were no significant material culture remains or intact cultural layers noted during the surface inspection and subsurface testing of this previously disturbed parcel. Fill in tested portions of the study area ranged from 50 to over 100 cm in thickness. Given the level of surface disturbance to the general 8.274 acre Ka`Ono`Ulu Phase VI study area, as well as the subsurface evidence of previous impact, no further archaeological work appears to be warranted for this property at this point in time.

Please feel free to contact me @ 572-8900 should you have any questions or need additional information regarding the field inspection of this c. 8.25 acre portion of land in Kihei, Maui (TMK 3-9-001: 157, 158).

Sincerely,

Erik M. Fredericksen

Erik M. Fredericksen

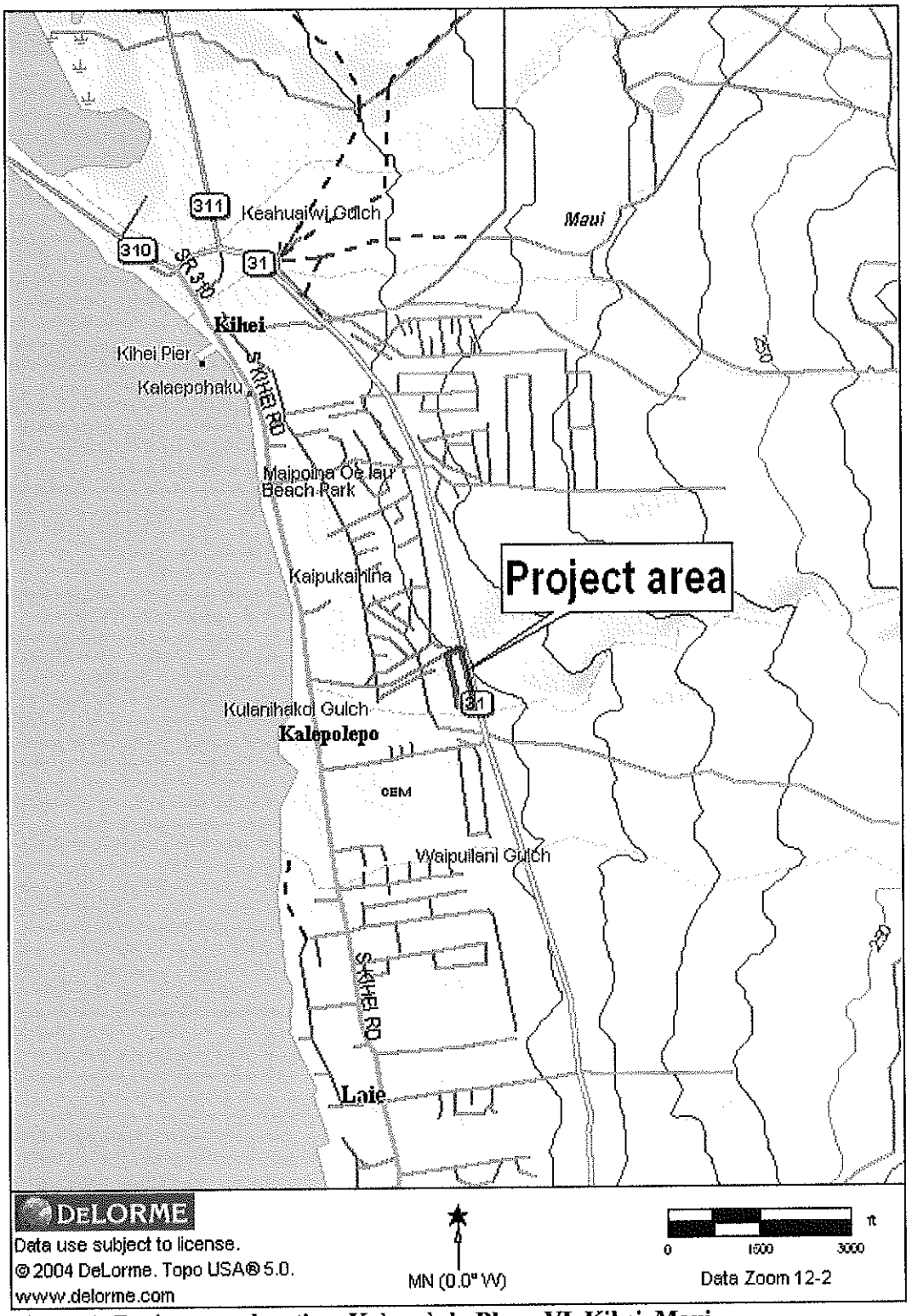


Figure 1: Project area location, Ka`ono`ulu Phase VI, Kihei, Maui.

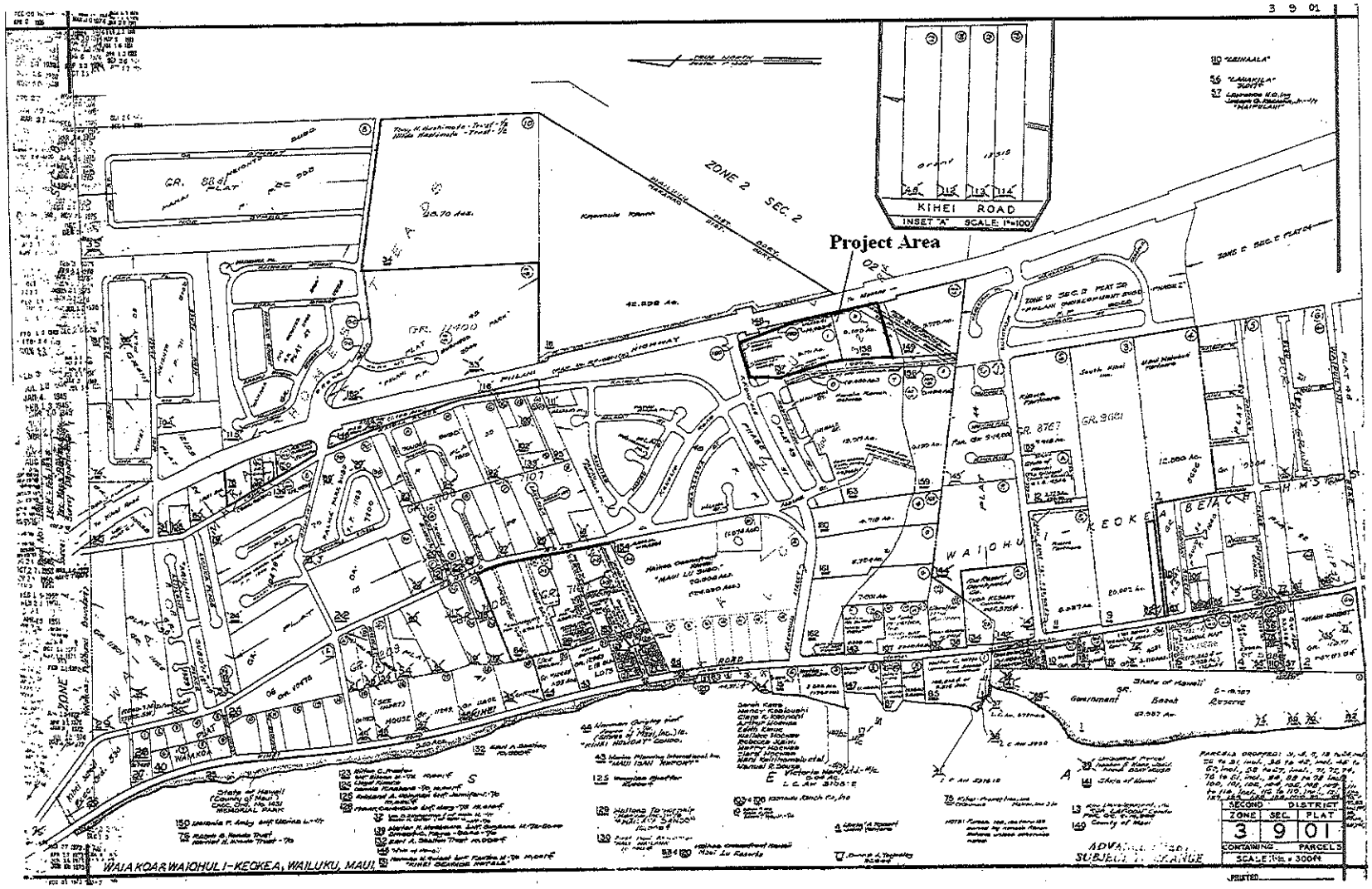


Figure 2: Plan view of Tax Map with location of the Ka`ono`ulu Phase VI project area.

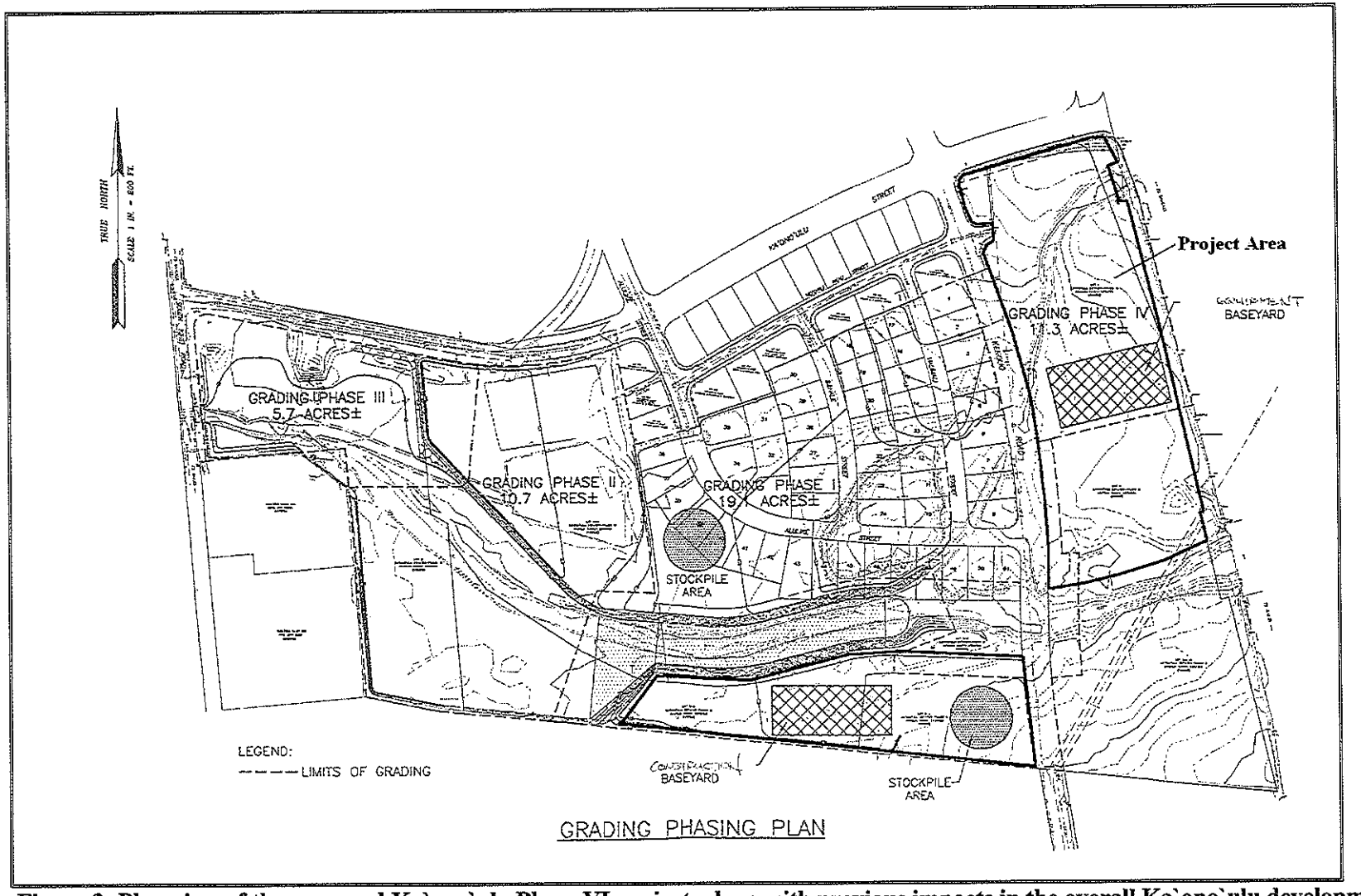


Figure 3: Plan view of the proposed Ka`ono`ulu Phase VI project, along with previous impacts in the overall Ka`ono`ulu development.

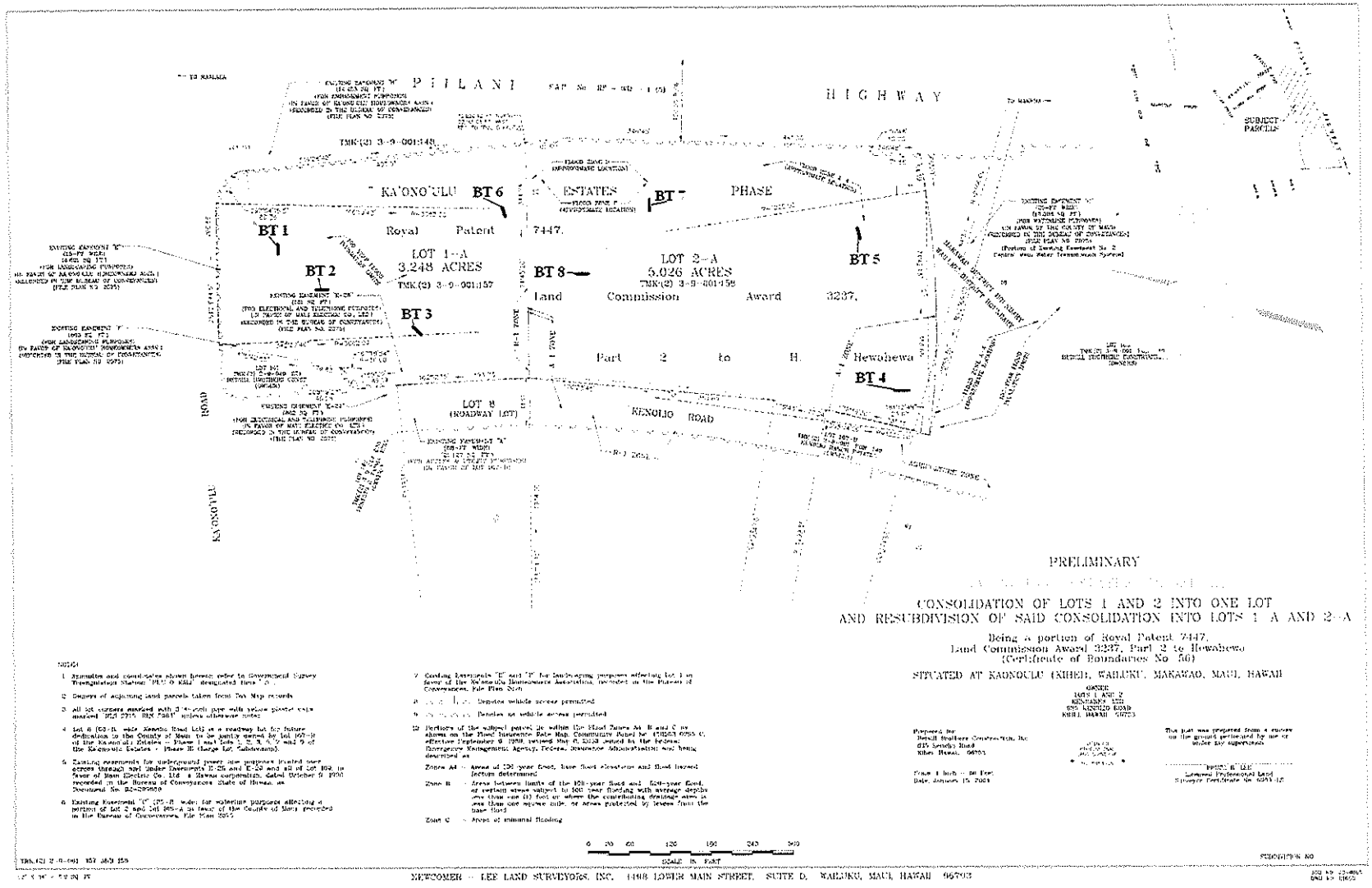
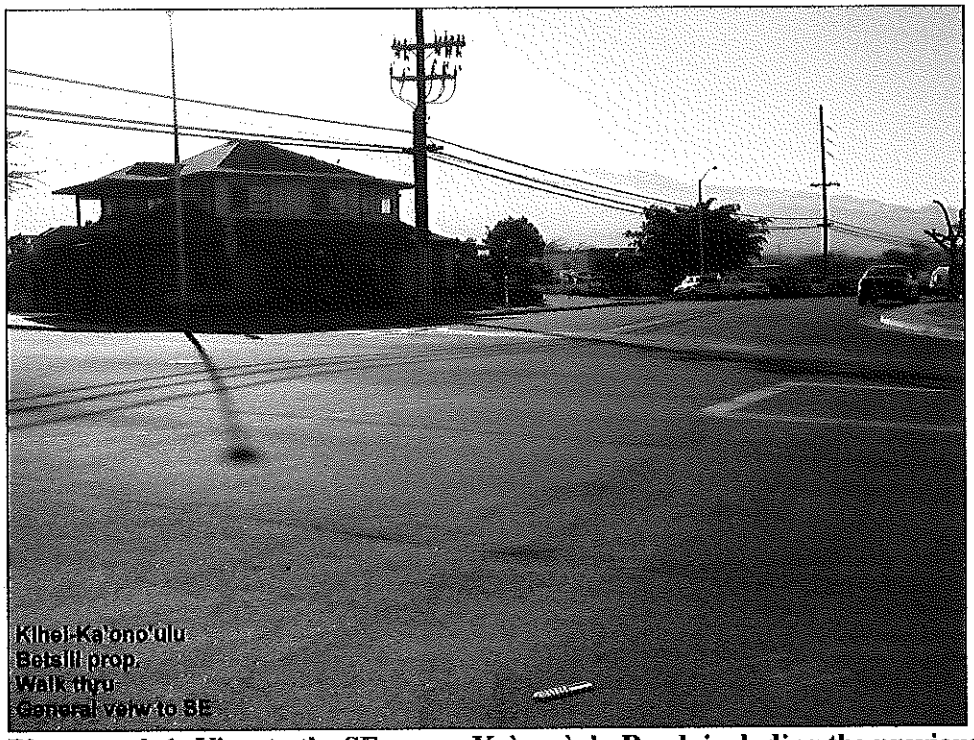
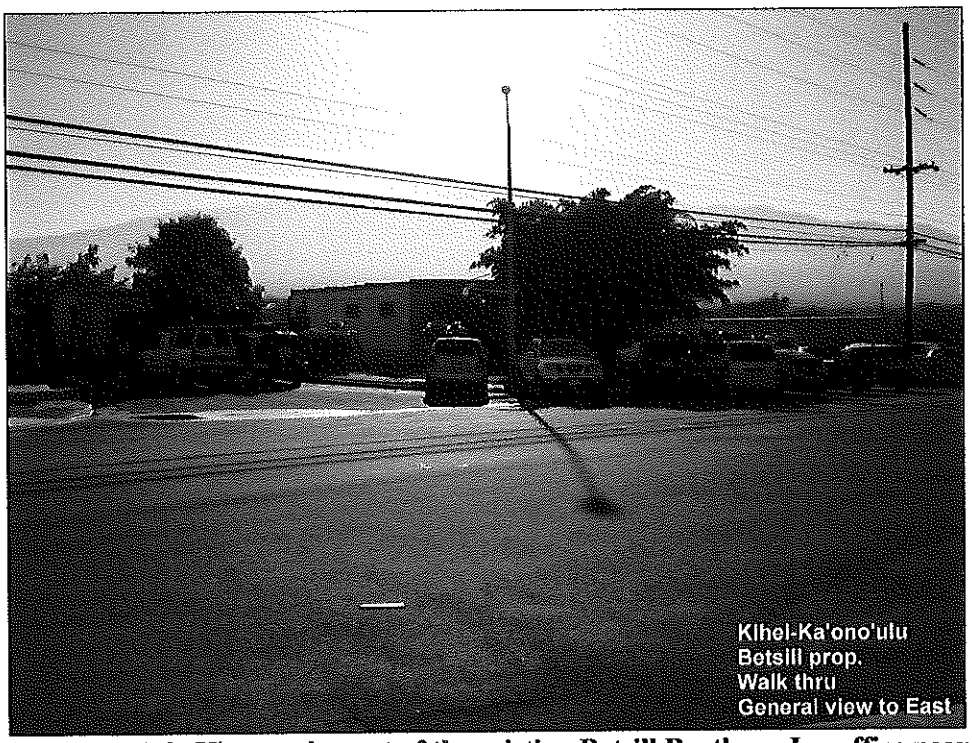


Figure 4: Plan view of the proposed Ka`ono`ulu Phase VI project, including backhoe trench locations.

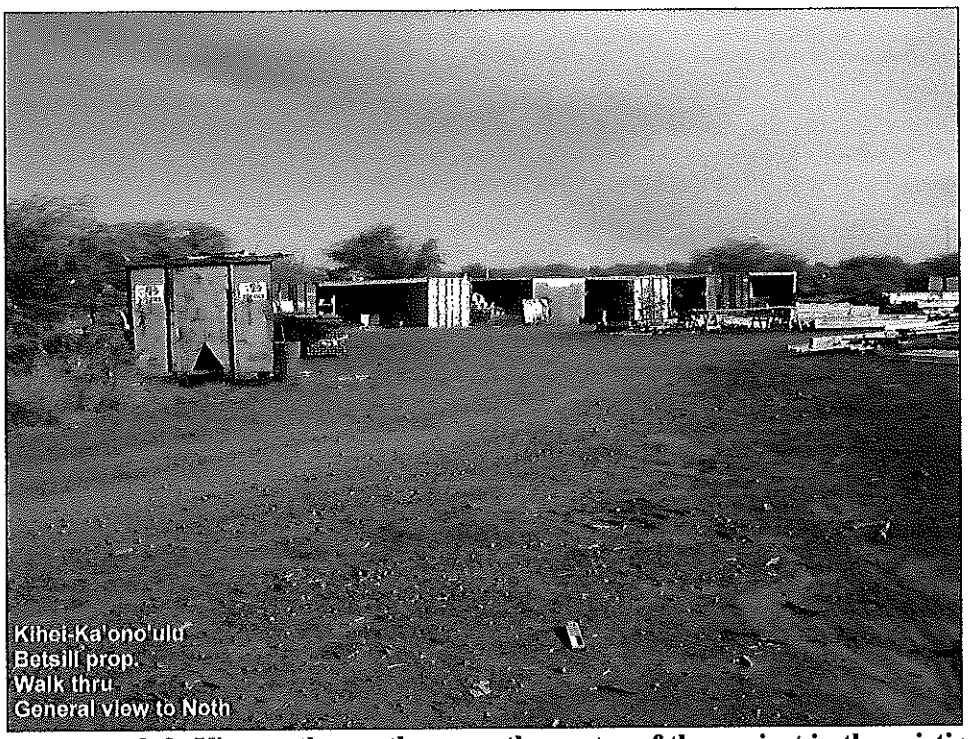
General Project Area - Photographs 1 to 12



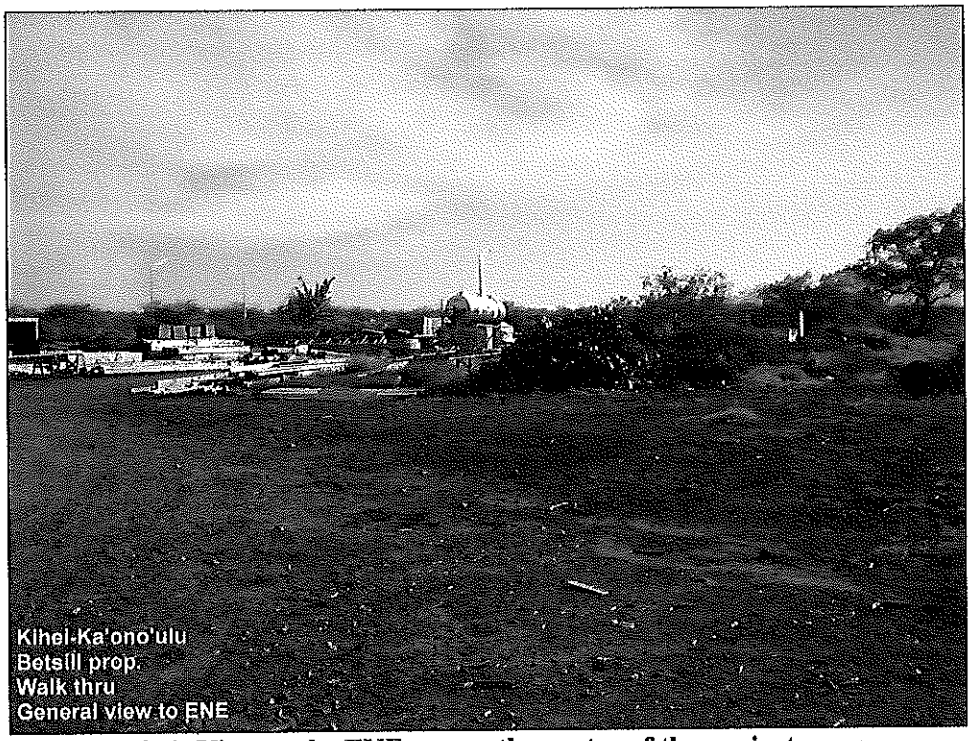
Photograph 1: View to the SE across Ka`ono`ulu Road, including the previously developed house and office buildings.



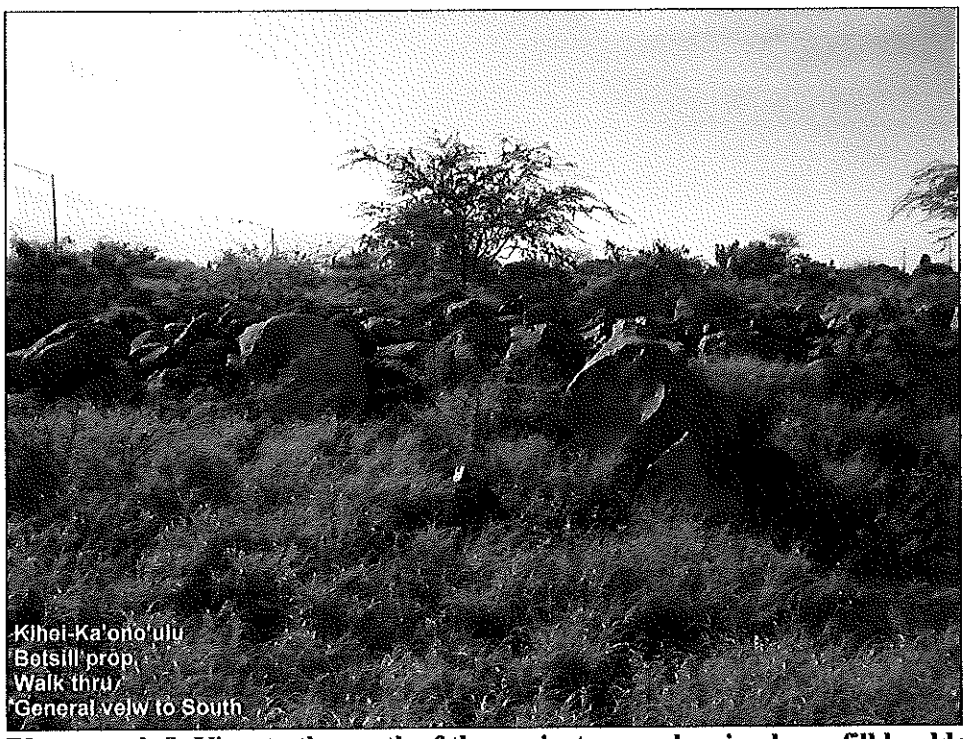
Photograph 2: View to the east of the existing Betsill Brothers, Inc office near the center of the project area.



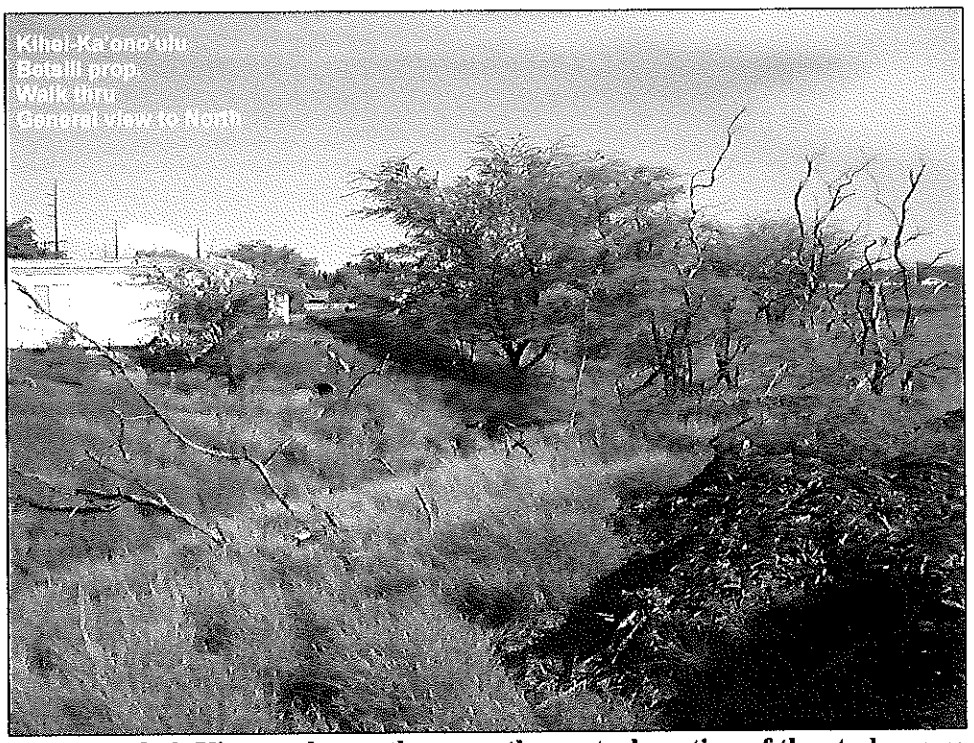
Photograph 3: View to the north across the center of the project in the existing base yard.



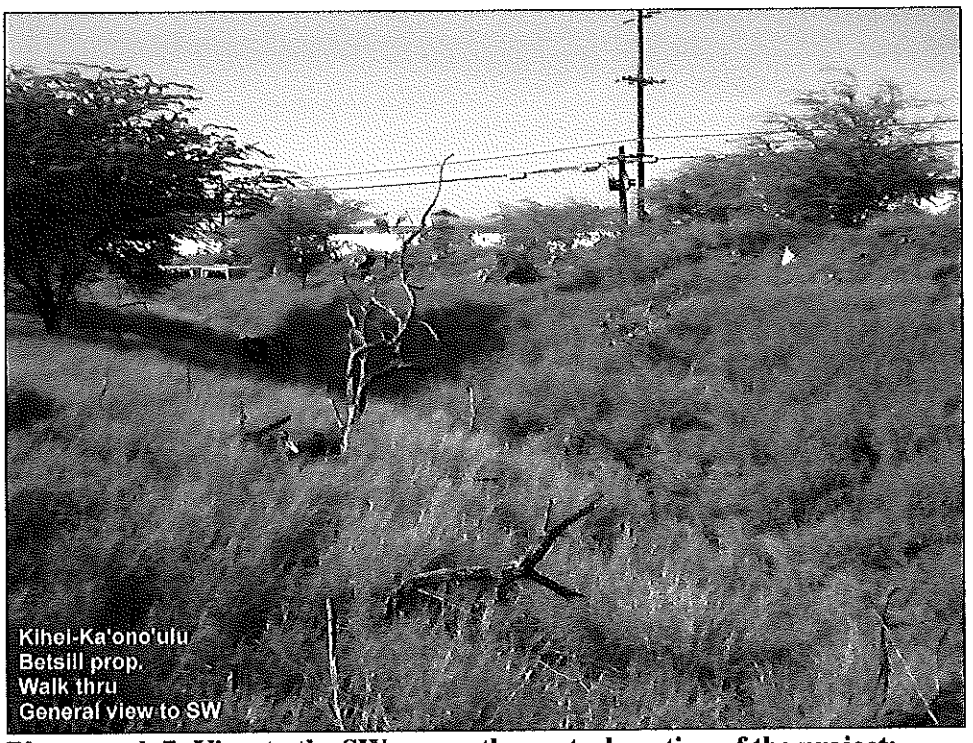
Photograph 4: View to the ENE across the center of the project area; existing base yard is in the center.



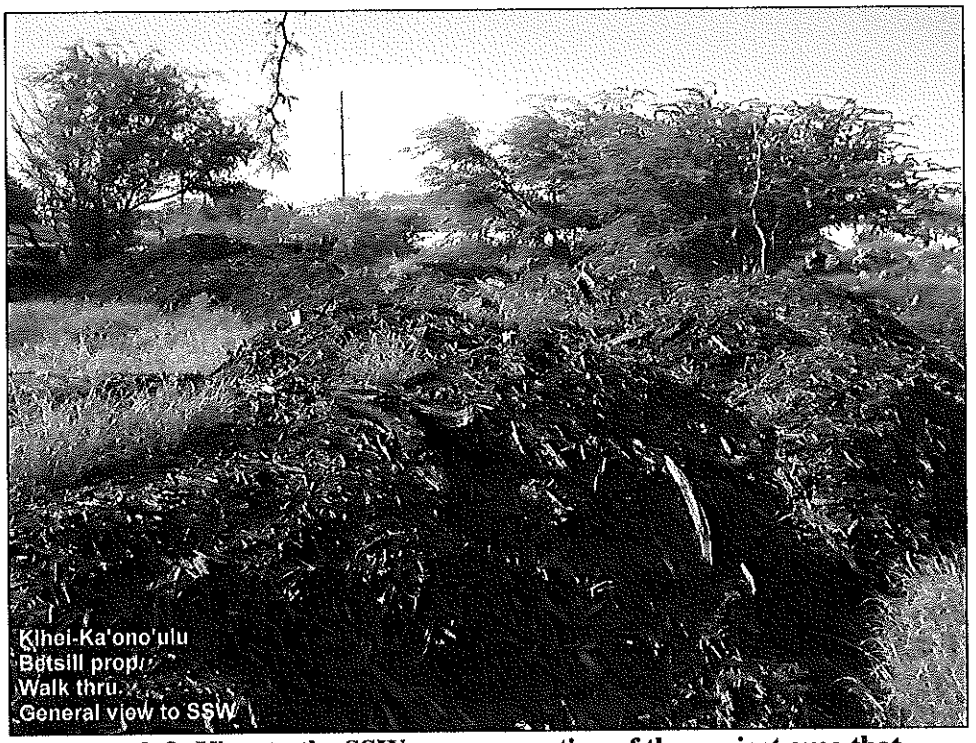
Photograph 5: View to the south of the project area, showing large fill boulders.



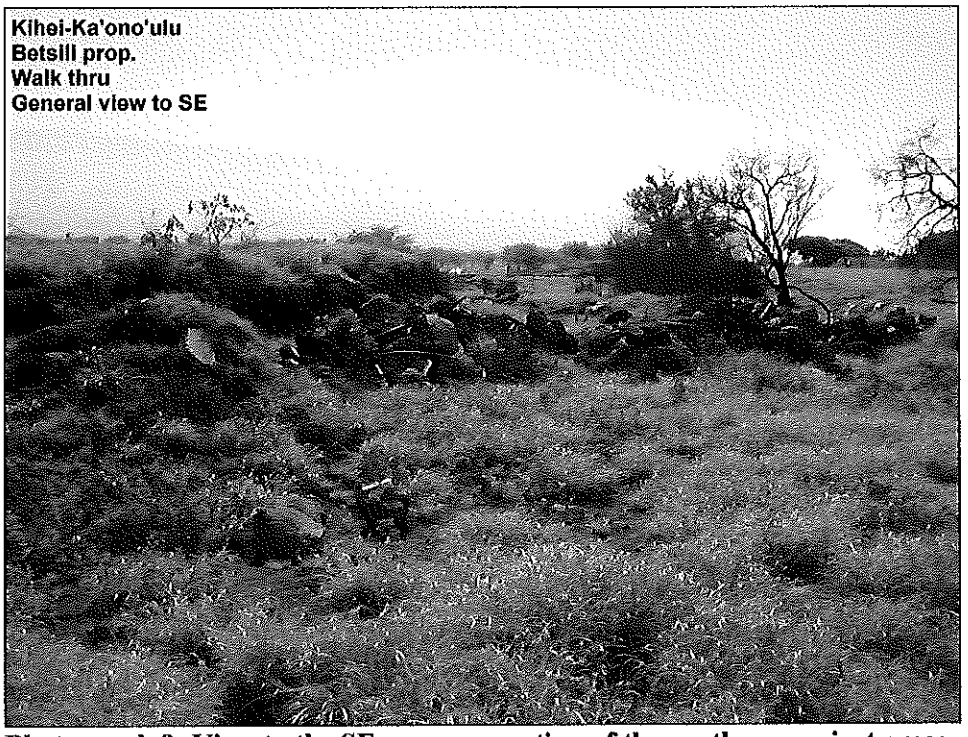
Photograph 6: View to the north across the central portion of the study area; previously installed drainage swale extends from lower left to center right. Office complex is in center left of photograph.



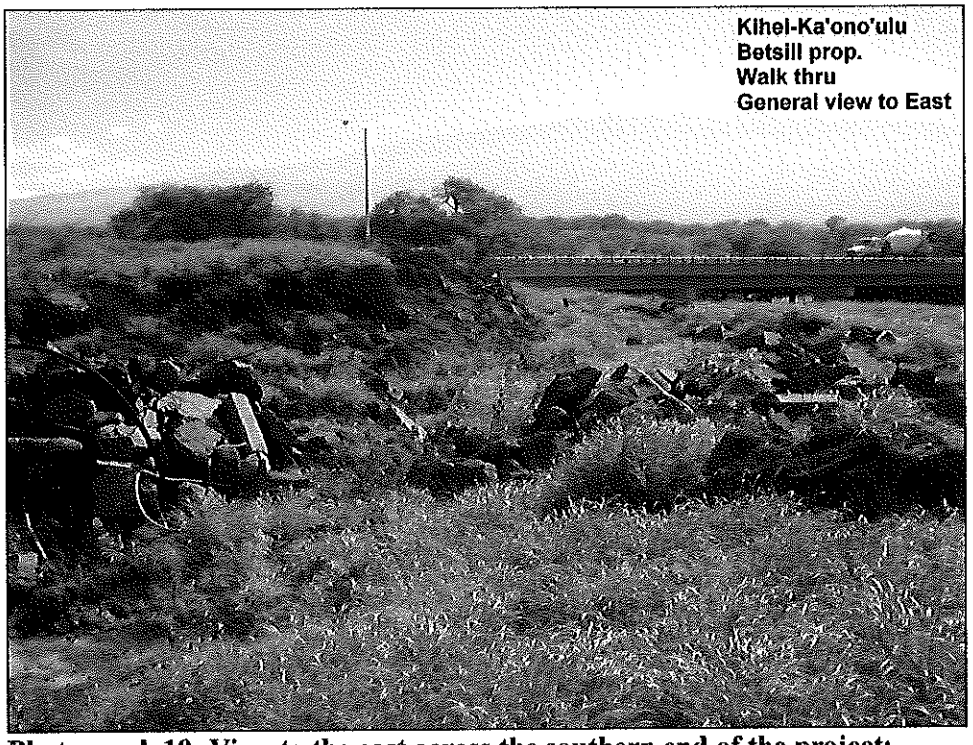
Photograph 7: View to the SW across the central portion of the project; note charred kiawe stumps in center of photograph and drainage swale.



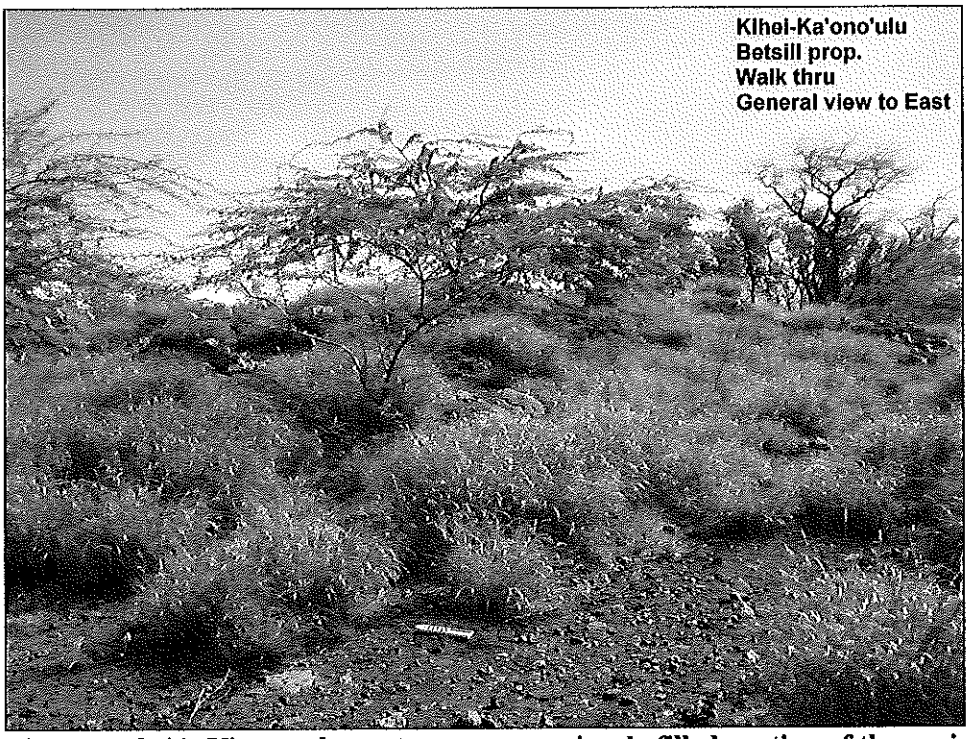
Photograph 8: View to the SSW across a section of the project area that contains organic fill.



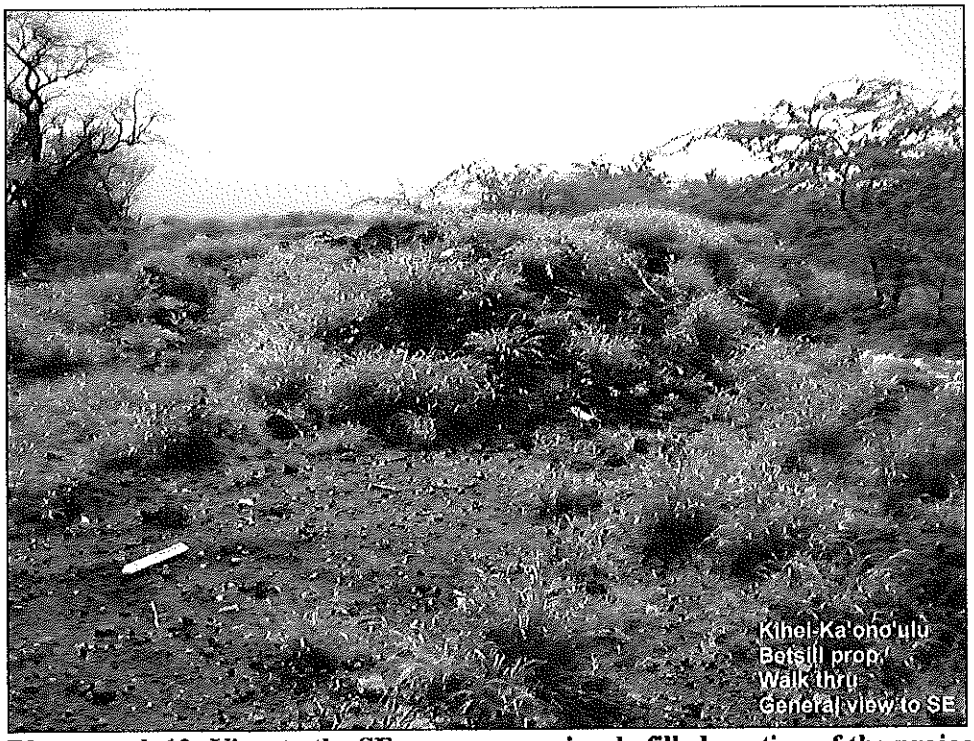
Photograph 9: View to the SE across a portion of the southern project area; note imported boulder and soil fill.



Photograph 10: View to the east across the southern end of the project; note Kulanihakoi Gulch bridge in center right background.



Photograph 11: View to the east across a previously filled portion of the project.



Photograph 12: View to the SE across a previously filled portion of the project.

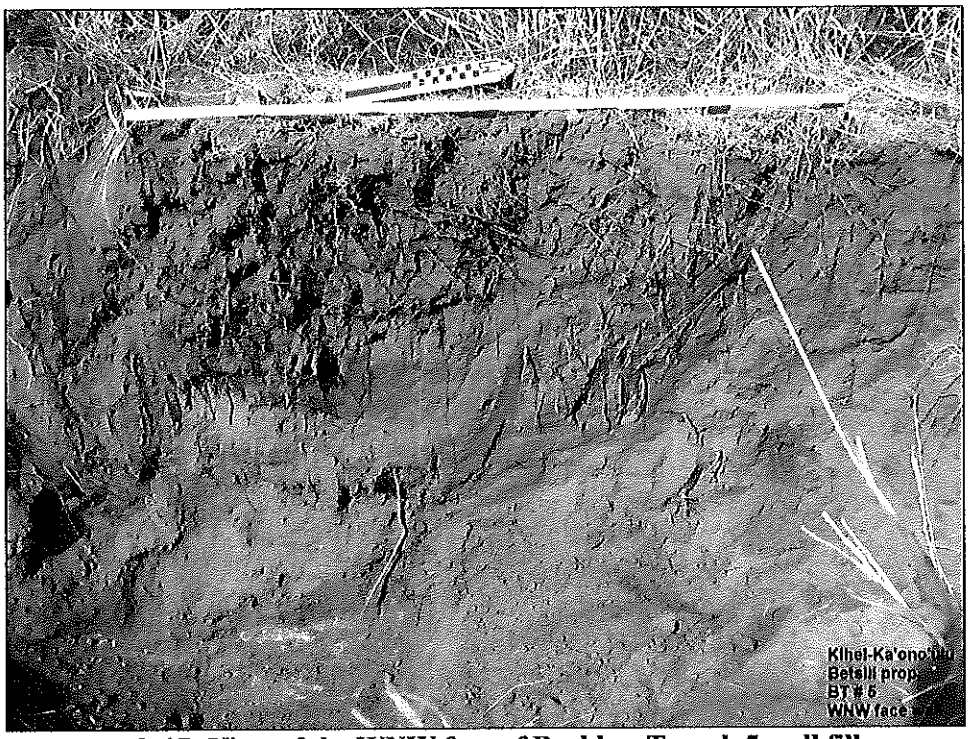
Backhoe Trenches - Photographs 13 to 20

Photograph 13: View of the west face of Backhoe Trench 1.

Photograph 14: View of the SE face of Backhoe Trench 2.

Photograph 15: View of the WNW face of Backhoe Trench 3 – all fill.

Photograph 16: View of the west face of Backhoe Trench 4 – all fill.



Photograph 17: View of the WNW face of Backhoe Trench 5 – all fill.

Photograph 18: View of the E face of Backhoe Trench 6.

Photograph 19: View of the W face of Backhoe Trench 7.

Photograph 20: View of the E face of Backhoe Trench 8.

Backhoe Trench profiles – Figures 5 to 11

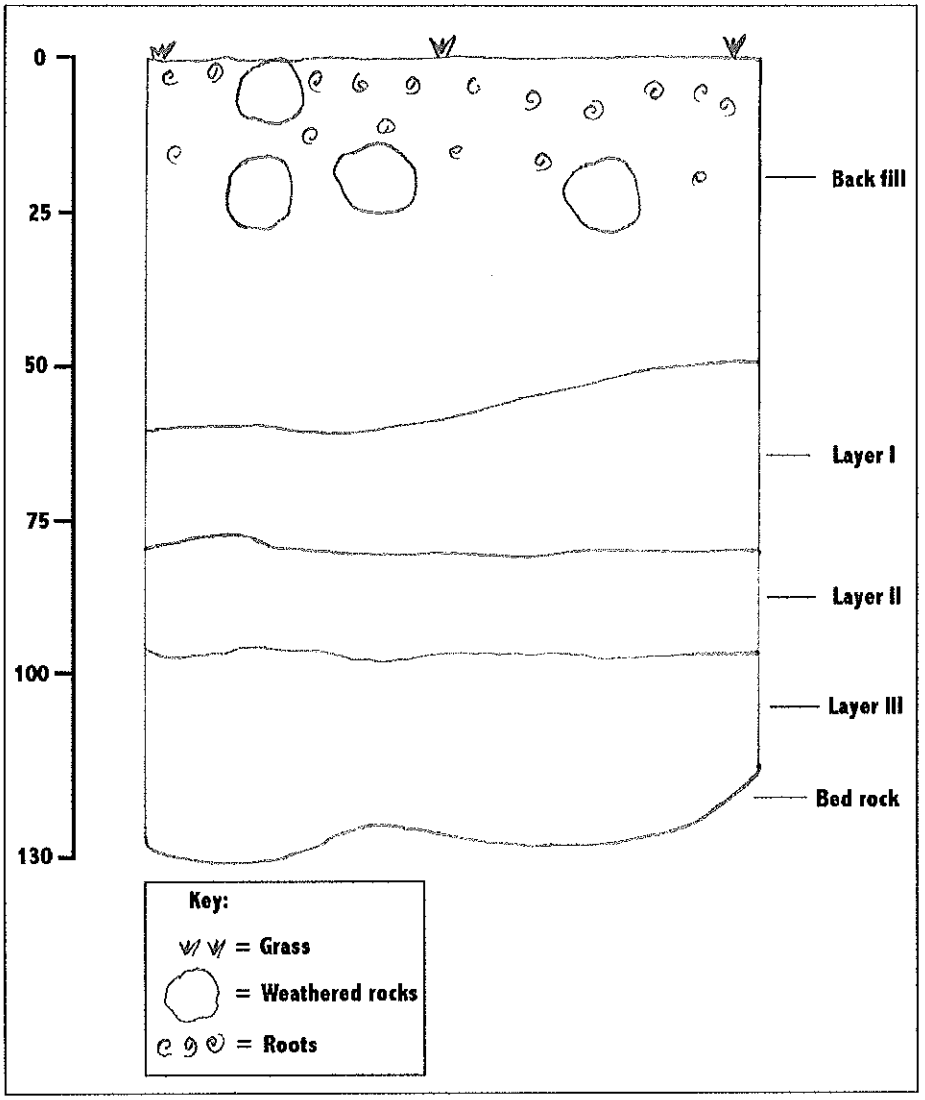


Figure 5: BT 1 – west face wall profile.

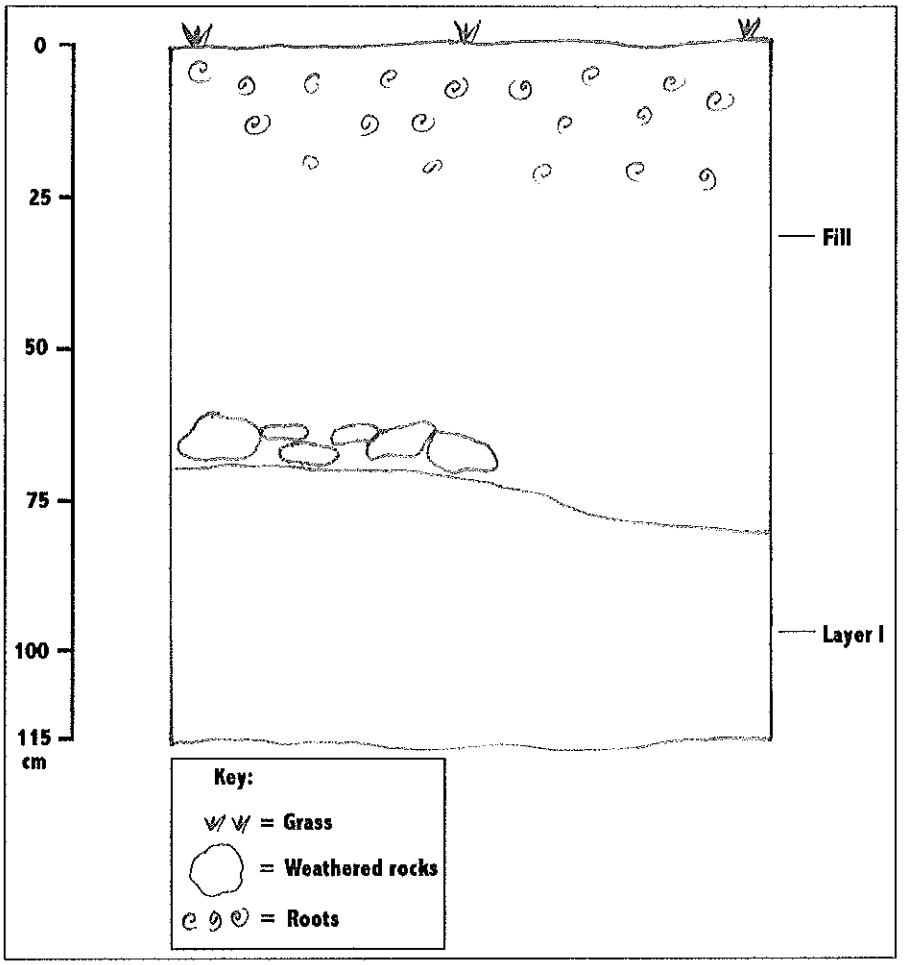


Figure 6: BT 2 - SE face wall profile.

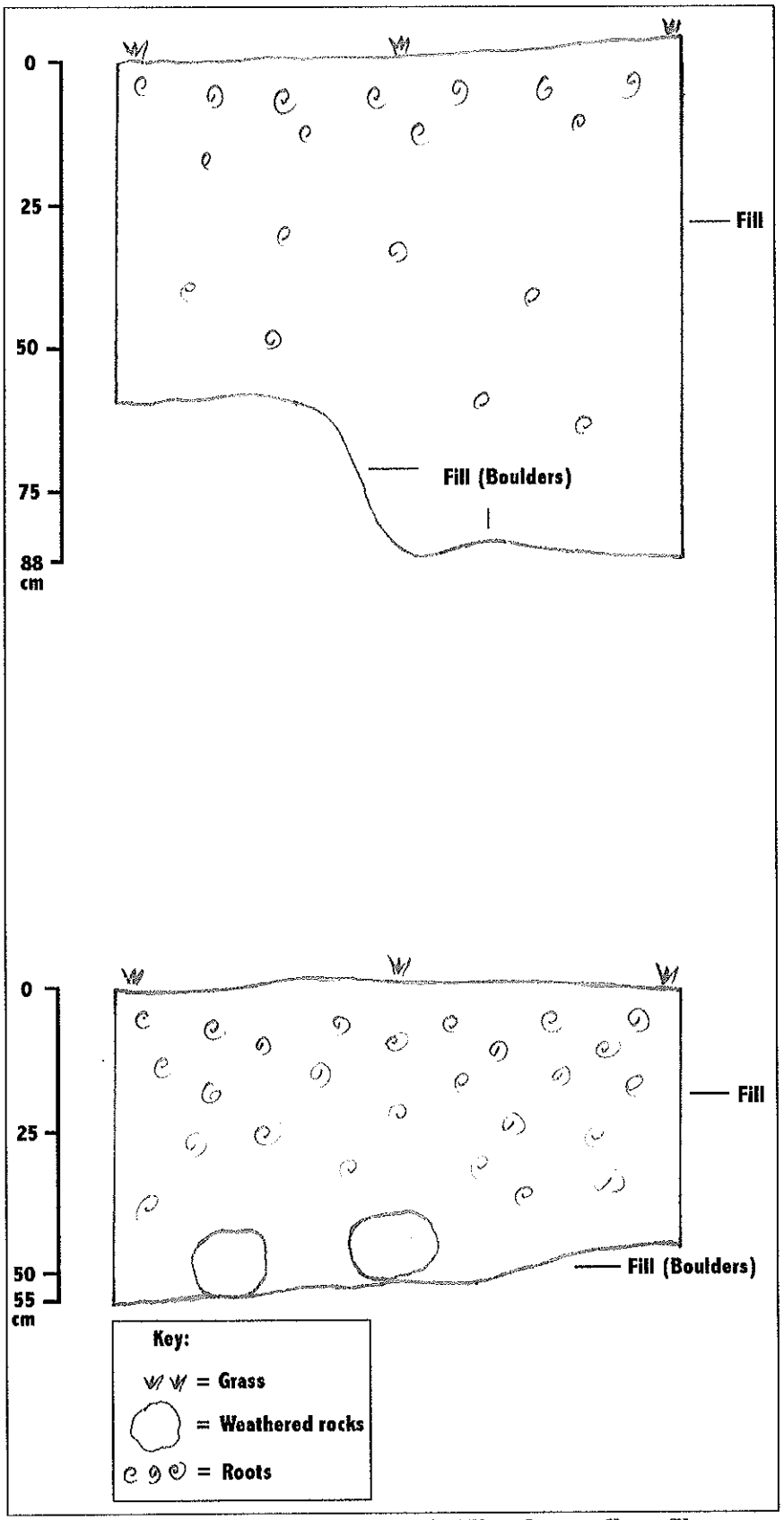


Figure 7: BT 3 - WNW face wall, BT 4 - West face wall profile.

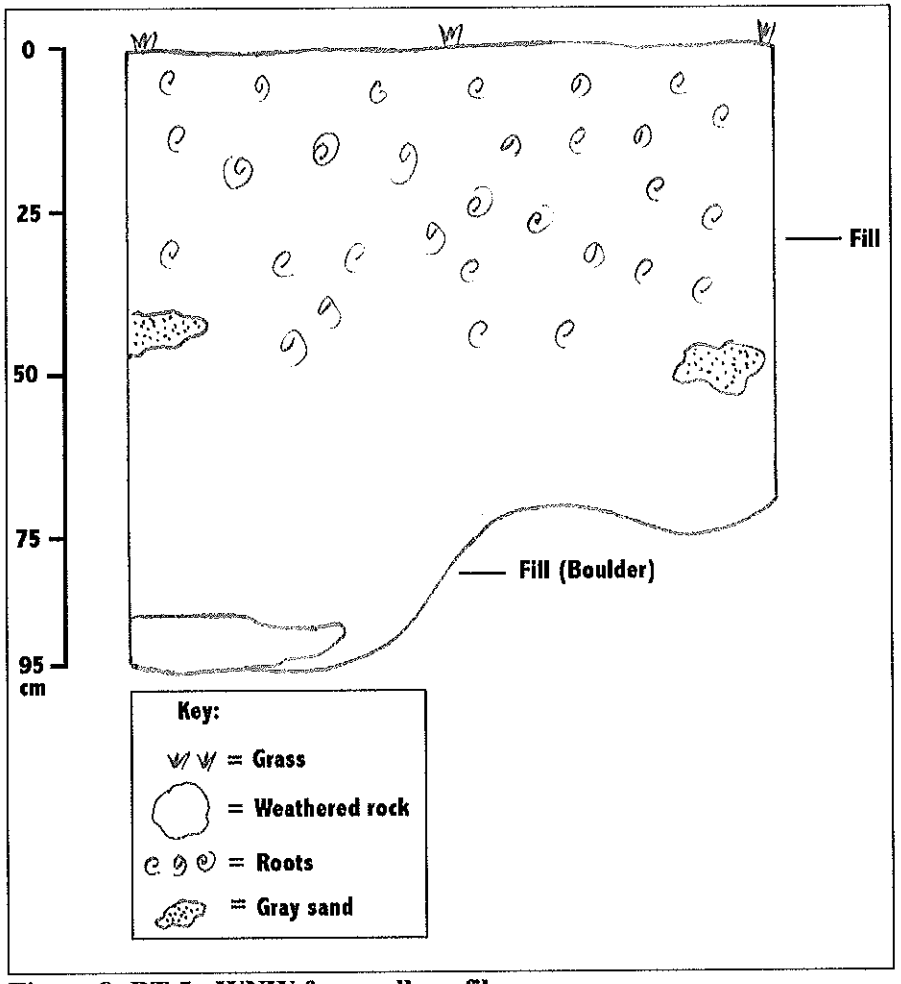


Figure 8: BT 5 - WNW face wall profile.

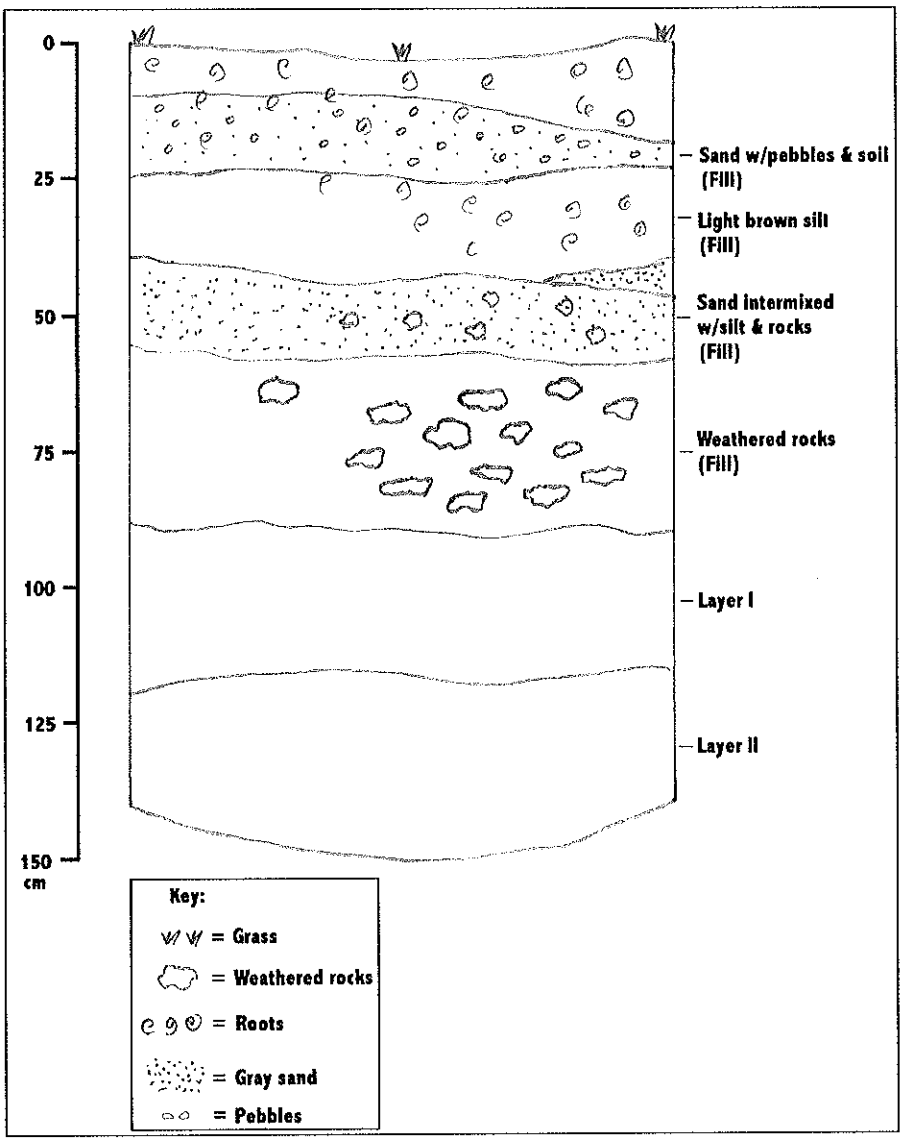


Figure 9: BT 6 - east face wall profile.

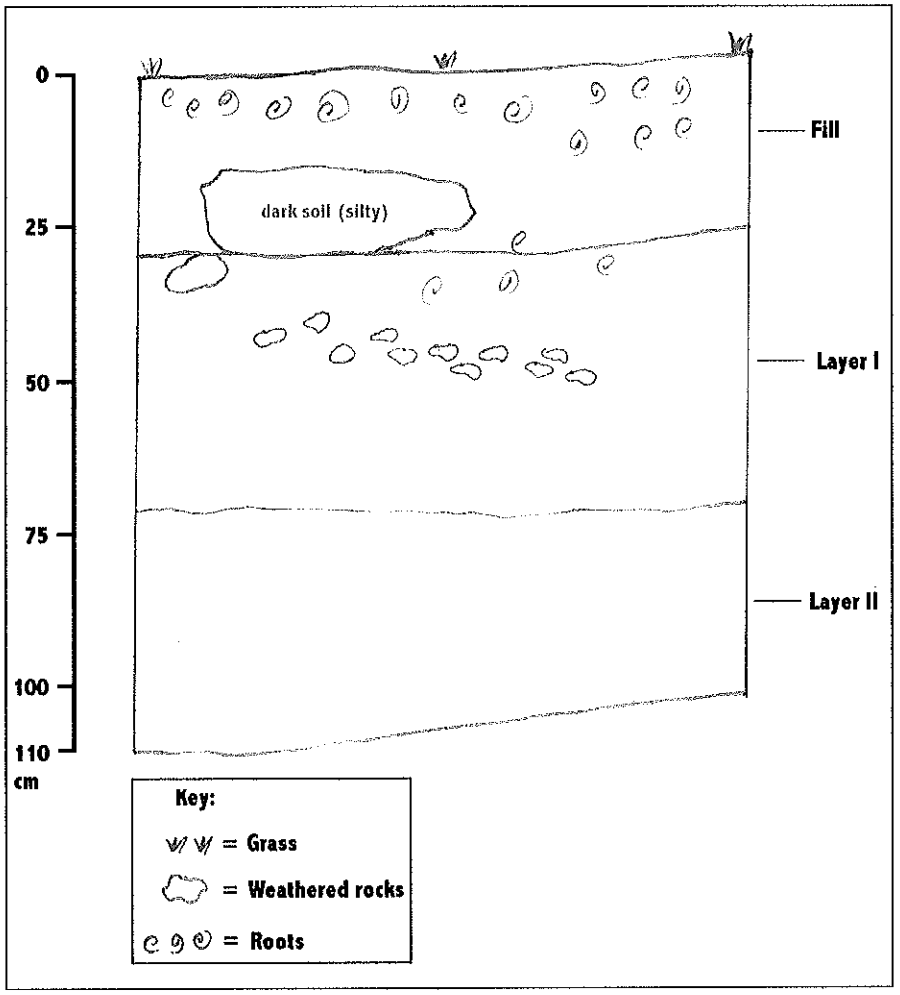


Figure 10: BT 7 - WNW face wall

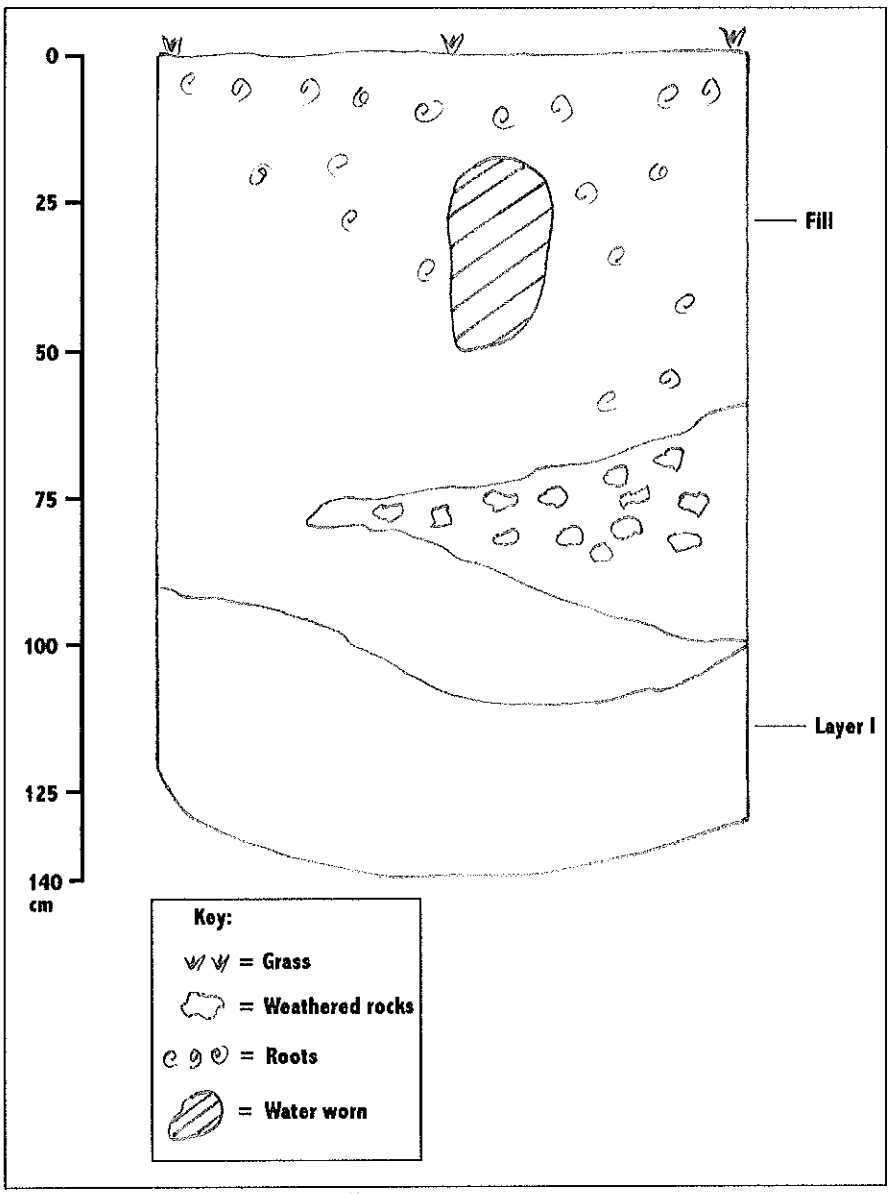


Figure 11: BT 8 - East face wall

APPENDIX F
Cultural Impact Assessment

A Cultural Impact Assessment on 8.27 Acres of Land in Kaʻonoʻulu Ahupuaʻa, Kula District, Island of Maui, Hawaiʻi (TMK:(2) 3-9-00, lots 157 and 158)

Prepared by:
Jill Engledow
April 2007
Reviewed November 2012

INTRODUCTION

The following report was originally prepared by writer Jill Engledow in 2007 for Betsill Brothers Construction Inc. In 2012, Engledow was asked to update the report. After reviewing the report, she determined that new information was unlikely to be found, and that the report and its conclusions still stand. Therefore, Engledow made no changes to the report below.

LOCATION OF PROPOSED PROJECT

The project area consists of 8.27 acres of land located makai of the Piʻilani Highway in Kīhei. It is within the moku (district) of Kula, in the ahupuaʻa of Kaʻonoʻulu. It is bounded on the mauka side by Piʻilani Highway, and on the makai side by an undeveloped road which is an extension of Kenolio Road. The parcel is surrounded by residential development on north, south, and west, with undeveloped land across the highway to the east . On the north end, a single dwelling separates the parcel from Kaʻonoʻulu Road. The north end is bounded by the dry Kulanihakoi Gulch.

PROPOSED ACTION

The site is to be developed as a multi-family residential project.

HISTORICAL SIGNIFICANCE

Archaeological studies of the site of Kaʻonoʻulu Phase IV have found no signs of permanent

habitation or agriculture on this parcel. Long-term cattle grazing may have wiped out any remnants of early human use of the site, and there does not appear to be historical record of people living or actively farming here. Over the centuries, however, people and animals probably crossed over this land many times because of its transitional location between the farmlands above and the seashore below.

The name Kaʻonoʻulu is usually translated as "the desire for breadfruit."[1] This land division extends from the sea up the side of Haleakalā, to the area known in contemporary times as Kula. [14] The parcel is in an arid region, with minimal vegetation. There is no record of the kinds of vegetation growing in this area. Before the introduction of grazing animals and invasive weeds, it is possible that native forest of koaiʻe (a small tree of the acacia family) and koʻoloa-ʻula (a shrub related to the hibiscus) grew all the way to the seashore, according to U.S. Geological Survey research biologist Art Medeiros.

E.S.C. Handy says in *The Hawaiian Planter* that "on the coast, where fishing was good, and the lower westward slopes of Haleakala a considerable population existed, fishing and raising occasional crops of potatoes along the coast, and cultivating large crops of potatoes inland, especially in the central and northeastern section including Keokea, Waiohuli, Koheo, Kaonoulu and Waiakoa, where rainfall drawn round the northwest slopes of Haleakala increases toward Makawao."[4]

Approximately one-half mile makai of this parcel, the Kōʻieʻie fishpond in the area known as Kalepolepo would have been part of the infrastructure that supported these people. It is the most significant archaeological site in the immediate area. The original date of construction is unknown. According to a December 1921 article in *Paradise of the Pacific* by Charles Wilcox, "In building the sea walls men were stationed in long lines, passing stones by hand from the rocky sidehills miles away to the workmen laying the courses for the walls in the sea." The fishpond was repaired several times over the next few centuries, first by ʻUmi-a-Liloa in the late 1500s, by Chief Kekaulike in the 1700s, by Kamehameha I in the early 1800s, and by prisoners from Kahoʻolawe under Governor Hoapili in the 1840s.[14]

A favorite of aliʻi, Kalepolepo was once the residence of Hewahewa, the powerful kahuna of Kamehameha I, according to the *Fishponds of Hawaiʻi* brochure published by the Hawaiian Islands Humpback Whale National Marine Sanctuary.[12]

Hawaiian scholar and minister David Malo moved to Kalepolepo in 1843 , when, according to Aubrey P. Janion, it was "a trading village of some 2,000 inhabitants." Malo preached under the trees, summoning his congregation with a huge conch shell. Villagers built a church of stone and coral at a site about one half-mile south of the Kaʻonoʻulu Phase IV project. [8] Today, the remains of that church are once more in use as Trinity Episcopal Church By The Sea, and the church has possession of Malo's conch shell, according to longtime church member Susie Davis.

Kalepolepo was the site of a store established in 1850 by cabinetmaker John Joseph Halstead to take advantage of the demand by California gold miners for Kula produce, particularly Irish potatoes. Halstead was married to ʻUwaikīkīlani, the granddaughter of Isaac Davis, an early haole retainer of Kamehameha I who married Hawaiʻi Island aliʻi wahine Nākai.[9]

Various records of life at the Halstead store give an idea of what the area may have been like at the time, and of the mauka-makai trade that took place.

"During the fifties Kalepolepo was not so barren looking a place," according to Charles Wilcox. "Coconut trees and kou trees grew beside pools of clear water, along the banks of which grew the taro. . ." Halstead built a three-story house/store all of koa, then one of the largest buildings on Maui. The store was on the beach, easily reached by sea captains seeking Halstead's merchandise and by the farmers bringing produce from the uplands. The area already was a shipping site for Kula vegetables. Even after California farmers began to grow food for the miners, and the potato boom ended, whaling captains and Maui shoppers continued to visit, and the Koa House remained a commercial and social center. Charles Wilcox describes Kalepolepo as "a thriving village, with two churches, one being a Mormon Church," which was a shipping port for Wailuku and Kula. "The big pond had not been filled up with sand and silt, but was still full of choice pond mullet and perhaps due to that kings and noted chiefs made of Kalepolepo a kind of retreat," Wilcox says.[14]

A visitor in 1864, quoted by Jenkins in *Hawaiian Furniture*, described a busy scene in a country store "here on this sandy beach, 10 miles from any village,"[9] which would seem to contradict the estimate of 2,000 inhabitants just two decades earlier, when Malo established his church. Perhaps the end of the California potato boom and the waning of the whaling era caused the population decline, along with the imported diseases that were devastating the native people.

Environmental changes also may have influenced people to leave the area.

"In the seventies and later," Wilcox wrote, "the Kula mountains had gradually become denuded of their forests, torrential winter rains were washing down earth from the uplands, filling with the silt the ponds at Kalepolepo. And cattle trampling down the brush and grass of the nearby fields caused sand dunes to drift, filling up the big Kalepolepo pond. . ." [14]

Traditional mauka-makai resource-exchange relationships continued as late as the turn of the 20th century, according to a reminiscence about that time by one of Halstead's great granddaughters, quoted in *Hawaiian Furniture* by Jenkins. "Twice a month, sometimes oftener, relatives from upcountry (the farming areas) came to visit and we loved their visits for they brought fresh vegetables, fresh fruit (peaches, oranges, bananas, papayas, figs), fresh beef, quarts of milk and delicious homemade butter. When the family left, they took fresh fish, dried fish, dried squid, shellfish, and jars of seaweed, a fair exchange of foodstuffs."[9]

The store closed in 1876, but the Koa House remained a landmark in the area. Halstead descendants lived in the house into the 1930s, and several are buried in the Trinity Church graveyard, including granddaughter Charlotte Halstead (1864-1937) and several individuals named Wilcox, including Elinor N. Wilcox (1861-1941), also a granddaughter. By 1946, the house had deteriorated so much that it was burned as a safety measure.[14]

In 1940, the federal government erected a building on the shore of the fishpond for U.S. Navy use. In 1956, the government purchased the land from Kaʻonoʻulu Ranch, and in 1971, turned it over to the National Oceanic and Atmospheric Association. In 1994 it became the headquarters of the Hawaiian Islands Humpback Whale National Marine Sanctuary. Work is now underway to restore the fishpond by the nonprofit organization ʻAoʻao O Nā Loko Iʻa O Maui.[7]

Historical records on the use of the Kaʻonoʻulu Phase IV project site are sparse. An 1880 map shows that the area was part of Land Commission Award 2227, Royal Patent 7447, awarded to Hewahewa (apparently not the kahuna Hewahewa, who had died in 1837, before

the 1848 Māhele [12]). The map also shows the Halstead store and Malo's church, but little else in the area.[1]

Pages that might give information about 20th century use of this parcel are missing from the field books in the the County of Maui Real Property Division. According to Kaʻonoʻulu Ranch owner Henry Rice, this parcel has been used only for grazing since at least as early as 1916, when Harold W. Rice acquired it with the purchase of Cornwell Ranch.

The Cornwell Ranch had belonged to William Cornwell, who held several positions under King Kalākaua and Queen Liliʻuokalani. After his death, his family sold the ranch to Rice, a Territorial senator who bought and consolidated a number of properties to create what was then one of the largest landholdings on the island. The ranch raised pork at a piggery at the site of the present Maui Lu Hotel, north of the Kaʻonoʻulu Phase IV site. It sold its beef and pork at the Kaʻonoʻulu Market in Wailuku, supplying much of the meat used on Maui and shipping beef to Honolulu as well.[2, 11]

Henry Rice says there was a fenced pasture just mauka of the Kaʻonoʻulu Phase īV parcel, where cattle on their way to Kula were held overnight after being driven from the ranch's West Maui lands.

In the early 20th century, Kīhei was thinly populated, with a narrow shoreline road surrounded by kiawe trees and a few homes and small stores scattered along the coast.

Kīhei began to change in the 1970s, after the County of Maui entered into a joint venture with several major developers to construct the Central Maui water transmission line. With water available, the growth of what had been a place of scrub land and kiawe paralleled that of the island as a whole. In the late 1970s, land surrounding in the immediate area of this parcel began to be developed into modern subdivisions.[4] Responding to the increasing need for residential development, Betsill Brothers Construction, Inc. acquired this parcel and the land around it and began to build single-family homes. This final parcel in the Kaʻonoʻulu development will provide approximately 160 residences in an affordable multifamily project.

SITE INSPECTION

The parcel has been and still is in use as a base yard during development of the surrounding area. It is covered by buffelgrass with occasional kiawe trees, with some mounds of rock accumulated during construction activities. There do not appear to be any remnants of cultural or historical features or trails, nor are there any native plants.

RESEARCH METHODS

Documentary research included Internet searches for specific names, such as Kaʻonoʻulu and Hewahewa, as well as searches of the Maui Historical Society finding aids and the Hawaiʻi State Archives and Bishop Museum websites, and visits to those offices and to the State Survey Division in Honolulu to examine historic maps**.** A range of books, articles and Internet sites, listed below, were consulted. Census records (at Ancestry.com) provided information primarily about the short-lived Kīhei Plantation, which was a considerable distance away from the subject area, and therefore not useful to this purpose. A visit to the Trinity By The Sea Church cemetery showed the continuing influence of the Halstead/Wilcox family and

identified the Kenolio name as a source for interviews.

Telephone contacts and interviews included:

- Susie Davis, a longtime member of Trinity, provided background on the Halstead/Wilcox and Kenolio family connections to the church, and on David Malo's conch shell.

- Art Medeiros, U.S. Geological Survey research biologist and expert on Hawaiian forests, provided an opinion on the possible plant life present in the subject area in pre-contact times.

- Kimokeo Kapahuleha, well known as a cultural practitioner in the Kīhei area, provided information summarized below.

- Henry Rice, owner of Kaʻonoʻulu Ranch, provided information about 20th Century use of the subject parcel and about the history of the ranch in the area.

- Katherine Kamaʻemaʻe Smith, author and researcher into the history of Honokahua, provided information about the descendants of Isaac Davis and Nākai, who included ʻUwaikīkīlani Halstead.

- Kenneth Apo, a descendant of the Halstead family, was unable to provide information from personal experience, but suggested the *Paradise of the Pacific* article.

- James Kenolio, contacted at his home on Oʻahu by telephone, provided information summarized below, and said he is the last in his generation. He suggested contacting the Akina family. A number of attempts to interview members of that family resulted in only one interview, below, with Hamby Akina Kahawai.

INTERVIEWS

Two former residents of the area and one person active in the restoration of Koʻieʻie fishpond were interviewed and provided the following statements. All interviews were by telephone. In addition, attempts were made to interview other members of the Akina family, also longtime Kīhei residents, but they did not respond to messages left at the family business on March 14, 19 and 26.

Kimokeo Kapahulehua
President of ʻAoʻao O Nā Loko Iʻa O Maui

Mr. Kapahulehua is active in cultural and ocean-related activities in the Kīhei area, and has been a leader in the restoration of Koʻieʻie fishpond. He said he does not believe construction

in the subject area will have any cultural or environmental impact because the area was "cleaned up" and left without native plants or remnants of ancient culture by ranching activities and possibly military use during World War II. While the area closer to the ocean and fishpond was busy with trading during the whaling era, he said the subject area seems to have been just transitional.

James Kenolio, retired from the U.S. Army
Former Kīhei resident

Mr. Kenolio grew up in a kamaʻāina family that lived in the area just above the old Kīhei School, now a community center. Kenolio Road stretches from that site to the subject area. Several members of the family are buried in the Trinity By The Sea graveyard, and Mr. Kenolio said his family donated the land for the Keolahou Church near the school. Mr. Kenolio lived there until he left in 1954 to join the service. He now lives on Oʻahu. Mr. Kenolio said his family and other families in the area harvested mullet from the fish pond, and there was considerable net fishing in the area. He does not know if there are any mauka landmarks used by fishers to locate fishing spots. He said that his grandparents picked wild plants that grew in the area for medical care of ailments like colds and boils. He could not recall the specific plant names, except for aloe vera and ʻawa, but noted that construction in the general area has completely changed the landscape and the plant life that he knew growing up. He said the family did not practice any traditional rituals associated with the gathering of medicinal plants. Mr. Kenolio said he does not know if people in his time ever crossed the ranch lands above the shoreline to reach the uplands of Kula.

Hamby Akina Kahawai, 69
Grew up in Kīhei

Mrs. Kahawai is a member of the Akina family, some of whom still live and do business in Kīhei. She now lives in Waimea on Hawaiʻi Island. Mrs. Kahawai said she does not have any information about the subject parcel and surrounding area, but said Kīhei in general was dominated by kiawe and cattle in her youth. Her family did not live a lifestyle that involved gathering activities. She said most of the people who lived in pre-development Kīhei and who might have information about cultural practices have passed on.

SUMMARY OF INTERVIEW RESULTS

All persons interviewed were consistent in their opinions that the proposed action planned for the property will not impact cultural or non-cultural access, gathering, protocols, practices or hunting.

CONSTRAINTS

The primary constraint to obtaining information about cultural practices and features

associated with the project area was finding individuals with longtime knowledge of such practices in this recently developed, highly transient area. The interviewer visited a local cemetery (finding the Kenolio family connection there), looked through tax office field books for possible longtime residents and asked the individuals interviewed to recommend others.

CONFIDENTIAL INFORMATION

There are no known conflicts or unresolved issues regarding this assessment.

CONCLUSION

After making a site inspection, interviewing people knowledgeable about the area and reviewing documentary research, it would appear that the primary cultural feature in the area is the Koʻieʻie Fishpond, now being restored by volunteers and offering cultural and environmental education to interested persons. The proposed action on the subject property does not interfere with this process, and the fishpond's proximity may in fact enrich the lives of residents of the proposed housing and bring new supporters to efforts to restore and preserve it.

PROJECT RESPONSE TO CULTURAL ASSESSMENT

Although there were no specific cultural activities found to be associated with this site, the project plan is designed with substantive shared community open space. We believe that community space and the way that homes relate to it is a way to incorporate subtle local sensibilities in this multi-family oriented development.

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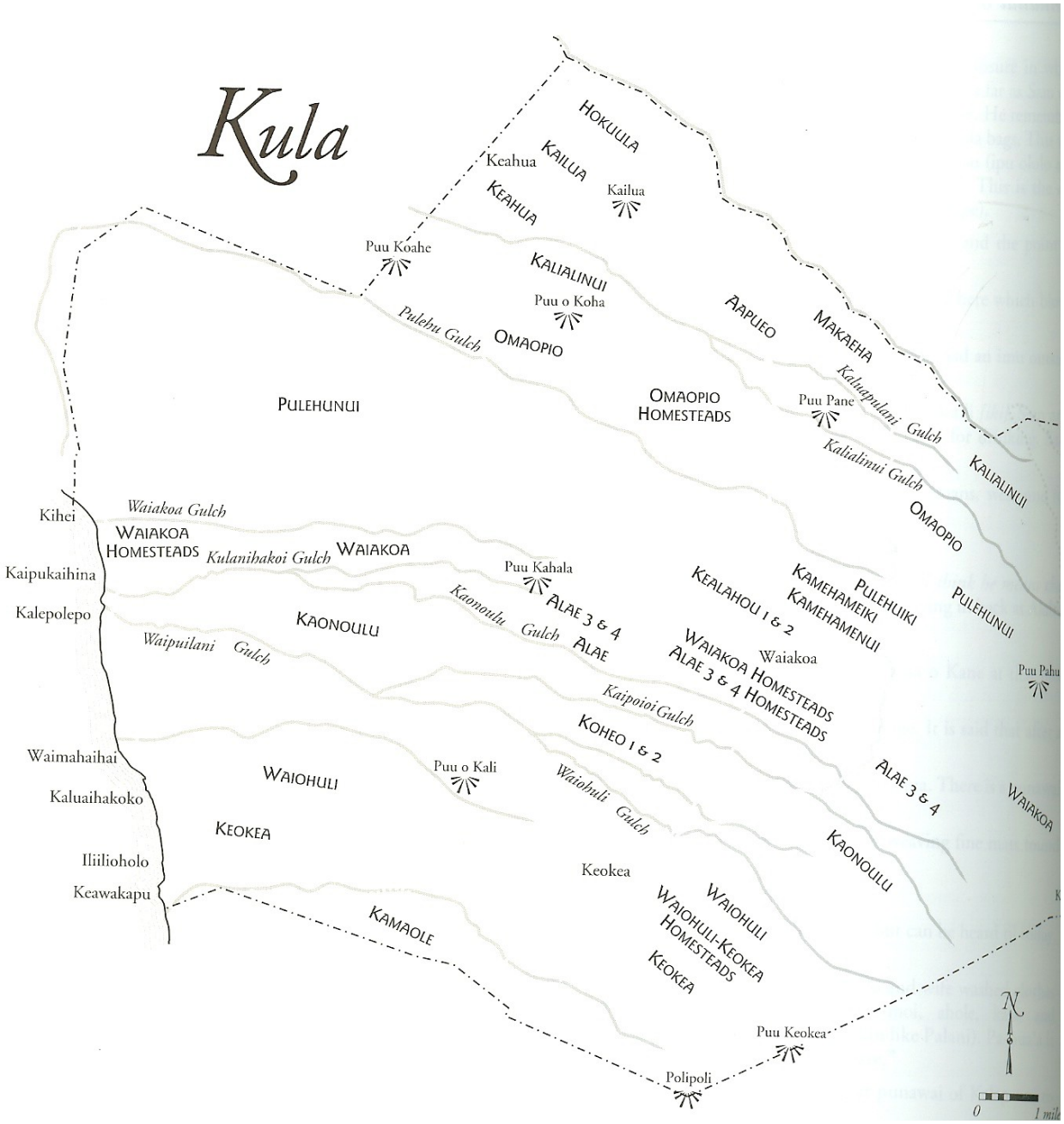

Map of Kula District taken from *Sites of Maui*, by Elspeth Sperling

APPENDIX G

Traffic Impact Assessment Report

Phillip Rowell and Associates
47-273 'D' Hui Iwa Street Kaneohe, Hawaii 96744 Phone: (808) 239-8206 FAX: (808) 239-4175 Email:prowell@hawii.rr.com

April 2, 2014

Shellan M. Rodriguez
Special Projects Manager
430 East State Street, Suite 100
Eagle, ID 83616

Re: **Traffic Impact Assessment Report**
Kenolio Apartments, An Affordable Housing Project, Kihei, Maui, Hawaii

Dear Shellan:

Phillip Rowell and Associates have completed the following Traffic Impact Assessment Report (TIAR) for Kenolio Apartments, a multi-family affordable housing project in the Kihei area of Maui. The report is presented in the following format:

A. Project location and Description
B. Purpose and Objective of Study
C. Study Approach
D. Description of Existing Roadways and Intersections
E. Existing Peak Hour Traffic Volumes
F. Public Transportation
G. Level-of-Service Concept
H. Existing (2013) Levels-of-Service
I. Existing Deficiencies
J. 2017 Background Traffic Conditions
M. Project Trip Generation
L. Background Plus Project Projections
M. 2017 Traffic Impact Assessment
O. Project Driveways
P. Summary and Recommendations

A. Project location and Description

The proposed project is located in the South Kihei area of Maui, between Piilani Highway and Kenolio Street and south of Kaonoulu Road. See Attachment A.

The proposed action is the construction of 186 affordable apartments.

A site plan is provided as Attachment B. Access and egress will be provided by two new driveways along the east side of Kenolio Street.

B. Purpose and Objective of Study

1. Describe the traffic characteristics of the proposed project.

2. Quantify and document the traffic related impacts of the proposed project.

3. If required, identify and evaluate traffic related improvements required to provide adequate access to and egress from the proposed project and to mitigate the project's traffic impacts.

C. Study Approach

1. A preliminary trip generation analysis was performed to determine the scope of the traffic analysis required and the intersections to be studied. This analysis estimated that the project could generate 103 trips during the morning peak hour and 127 trips during the afternoon peak hour. This implies that the scope of work should be limited to a "small development: traffic impact assessment." Accordingly, the study area includes the following intersections:

   a. Piilani Highway at Ohukai Street
   b. Piilani Highway at Kaiwahine Street and Uwapo Road
   c. Piilani Highway at Kaonoulu Street
   d. South Kihei Road at Kaonoulu Street
   e. Piilani Highway at Kulanihakoi Street
   f. Kaonoulu Street at Kenolio Road
   g. Kaonoulu Street at Alulike Street

2. A field reconnaissance was performed to confirm existing roadway cross-sections, intersection lane configurations, traffic control devices, and surrounding land uses.

3. Existing weekday morning and afternoon peak hour traffic volumes for the study intersections were obtained from manual traffic counts of the study intersections. Public schools were in session during the counts.

4. A level-of-service analysis of the study intersections was performed using the methodology described in the *Highway Capacity Manual* (HCM). The purpose of this analysis was to identify any existing traffic operating deficiencies.

5. A list of other known development projects within and adjacent to the study area that will impact traffic conditions at the study intersections was compiled. Estimated peak hour traffic volumes that the other know development projects will generate were estimated from data provided in the traffic impact studies for each project. Future traffic projections including traffic generated by the other known development project but without project generated traffic at the study intersections were estimated.

6. A level-of-service analysis of future traffic conditions including traffic generated by the other known developments at the study intersections without project generated traffic performed. This analysis was performed to estimate traffic operating levels-of-

service and identify any operational deficiencies that may exist whether the proposed project is constructed or not. This process insures that any required mitigation improvements will be assessed against the appropriate project.

7. Peak hour traffic volumes that the proposed project will generate were estimated using procedures described in the *Trip Generation Handbook* [1] and data provided in *Trip Generation*.[2] Project generated trips were distributed and assigned to the appropriate movements at the study intersections. Future traffic projections at the study intersections with project generated traffic were then estimated for two scenarios, without the North-South Collector and with the North-South Collector.

8. The impacts of traffic generated by the proposed project at the study intersections were quantified by analyzing the changes in peak hour traffic volumes and by performing a level-of-service analysis of future traffic conditions without and with project generated traffic.

D. Description of Existing Roadways and Intersections

The primary streets and roadways serving the project are Piilani Highway, South Kihei Road and Kaonoulu Street. These streets and the lane configurations of the study intersections are shown as Attachment C. Also shown are the methods of right-of-way control at the study intersections.

Existing Roadways

Piilani Highway is a major regional arterial located along the eastern boundary of the project. Piilani Highway is a four-lane, undivided highway with a north-south orientation connecting Mokulele Highway to the north with the Wailea Resort to the south. The posted speed limit is 40 miles per hour south of Ohukai Road and 45 miles per hour north of Ohukai Road.

Kaonoulu Street is located along the northern boundary of the project. Kaonoulu Street currently connects Piilani Highway with South Kihei Road. East of Alulike Street, Kaonoulu is a two-lane, two-way street with separate left turn lanes at intersections and parking along both sides. West of Alulike Street, there is no parking and the only left turn lane is at South Kihei Road. The posted speed limit is 20 miles per hour.

Currently, South Kihei Road is a two-lane, two-way roadway with a north-south orientation.

Ohukai Road is basically a two-lane, two-way street, but widens to provide two approach lanes as it approaches Piilani Highway. The posted speed limit is 20 miles per hour. Between South Kihei Road and Piilani Highway, adjacent development is residential. East of Piilani Highway, adjacent development is residential along the north side and commercial along the south side.

Kaiwahine Street is a two-lane, two-way residential collector street connecting the project with Piilani Highway. The posted speed limit is 20 miles per hour.

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[1] Institute of Transportation Engineers, *Trip Generation Handbook*, Washington, D.C., , p. 7-12

[2] Institute of Transportation Engineers, *Trip Generation, 8th Edition*, Washington, D.C., 2008

Uwapo Road is an extension of Kaiwahine Street west of Piilani Highway to South Kihei Road. Uwapo Road is a two-lane, two-way roadway. There is no development along the north side and there are multi-family residential unit along the south side. No parking is allowed along either side. The assumed speed limit is 20 miles per hour.

Existing Intersections

The intersection of Piilani Highway at Ohukai Road is located approximately 2,950 feet north of Kaonoulu Street. The intersection is a four-legged signalized intersection. The northbound and southbound approaches are Piilani Highway and the eastbound and westbound approaches are Ohukai Road. There are separate left turn lanes and separate right turn lanes along the northbound and southbound approaches of Piilani Highway. Left turns are protected. The eastbound and westbound approaches each have an optional left turn or through lane and a separate right turn lane. The eastbound and westbound approaches are split.

The intersection of Piilani Highway at Kaiwahine Street and Uwapo Road is located approximately 2,750 feet north of Ohukai Road along Piilani Highway. The intersection of a four-legged signalized intersection. The northbound and southbound approaches are Piilani Highway, the eastbound approach is Uwapo Road and the westbound approach is Kaiwahine Street. There are separate left turn lanes and separate right turn lanes along the northbound and southbound approaches of Piilani Highway. Left turns are protected. The eastbound and westbound approaches each have an optional left turn or through lane and a separate right turn lane. The eastbound and westbound left turns are permitted.

The intersection of Piilani Highway at Kaonoulu Street is a three-legged unsignalized intersection. The northbound and southbound approaches are Piilani Highway and the eastbound approach is Kaonoulu Street. The northbound approach has one left turn lane and two through lanes. The eastbound approach is the STOP signed controlled approach and has one left turn lane and one right lane. The right turn is channelized.

The intersection of Piilani Highway at Kulanihakoi Road is located approximately 2,100 feet south of Kaonoulu Street along Piilani Highway. The intersection is a three-legged unsignalized intersection. The northbound and southbound approaches are Piilani Highway. The northbound approach has one left turn lane and two through lanes. The southbound approach has two through lanes and one right turn lane. The eastbound approach is Kulanihakoi Road and is the STOP sign controlled approach. The Kulanihakoi Road approach has one left turn lane and one right turn lane. The eastbound to southbound right turns are channelized.

The intersection of South Kihei Road at Kaonoulu Street is located approximately 3,230 along Kaonoulu Street west of Piilani Highway. The intersection is a three legged, STOP sign controlled intersection. The northbound and southbound approaches are South Kihei Road. The northbound approach has one optional through or right turn lane. The southbound approach has one optional left turn or through lane. The westbound approach is Kaonoulu Street and is the controlled approach. The westbound approach has one left turn lane and one right turn lane.

The intersection of Kaonoulu Street at Kenolio Road is located approximately 500 feet along Kaonoulu Street west of Piilani Highway. The intersection is a four legged STOP sign controlled intersection. The eastbound and westbound approaches are Kaonoulu Street and the northbound and southbound approaches are Kenolio Road. The northbound and southbound approaches are

the controlled approaches. Each approach has a left turn lane and an optional through or right turn lane.

The intersection of Kaonoulu Street at Alulike Street is located approximately 830 feet west of Kenolio Street. The intersection is a four legged STOP sign controlled intersection. The eastbound and westbound approaches each have one left turn lane and an optional through or right turn lane. The northbound and southbound approaches are the controlled approaches and has one left turn, through or right turn lane.

E. Existing Peak Hour Traffic Volumes

1. Generally, the traffic counts were performed during May 2013. Follow up counts were performed during late October 2013.

2. The traffic counts include buses, trucks, motorcycles, mopeds and other large vehicles. Bicycles and pedestrians were not counted.

3. Generally, the weekday traffic counts were performed between 6:00 AM and 9:00 AM and between 3:00 PM and 6:00 PM on either a Tuesday or Thursday. Several of the intersections were recounted and the recounts were performed on other days because of scheduling or unusual traffic conditions in or adjacent to the intersection. Counts that were performed on days other than Tuesday or Thursday were compared to counts of adjacent intersections to confirm consistency. If the counts were inconsistent, the intersection was recounted again.

4. The traffic volumes shown are the peak hourly volume of the total intersection. The traffic volumes of adjacent intersections may not match the volumes shown for an adjacent intersection because the peak hours of the adjacent intersections may not coincide and there are driveways between the intersections.

5. Pedestrian activity was negligible at the study intersections during the traffic counts.

The traffic count summary worksheets are provided as Attachment D. The peak hour traffic volumes are summarized on Attachments E and F.

F. Public Transportation

A review of Maui Bus routes determined that at the time this report is being written, there are two bus routes operating along South Kihei Road. Route 10 operates between Queen Kaahumanu Center and Wailea Iki Drive. Route 15 operates between Maalaea Harbor Village and Piilani Shopping Center. Bus stops are located at the intersection of South Kihei Road at Kaonoulu Street.

G. Level-of-Service Concept

Signalized Intersections

"Level-of-Service" is a term which denotes any of an infinite number of combinations of traffic operating conditions that may occur on a given lane or roadway when it is subjected to various traffic volumes. Level-of-service (LOS) is a qualitative measure of the effect of a number of factors which include space, speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience.

There are six levels-of-service, A through F, which relate to the driving conditions from best to worst, respectively. The characteristics of traffic operations for each level-of-service are summarized in Table 1. In general, LOS A represents free-flow conditions with no congestion. LOS F, on the other hand, represents severe congestion with stop-and-go conditions. Level-of-Service D is typically considered acceptable for peak hour conditions in urban areas.[3]

Corresponding to each level-of-service shown in the table is a volume/capacity ratio. This is the ratio of either existing or projected traffic volumes to the capacity of the intersection. Capacity is defined as the maximum number of vehicles that can be accommodated by the roadway during a specified period of time. The capacity of a particular roadway is dependent upon its physical characteristics such as the number of lanes, the operational characteristics of the roadway (one-way, two-way, turn prohibitions, bus stops, etc.), the type of traffic using the roadway (trucks, buses, etc.) and turning movements.

Table 1 Level-of-Service Definitions for Signalized Intersections(1)

Level of Service	Interpretation	Volume-to-Capacity Ratio(2)	Stopped Delay (Seconds)
A	Uncongested operations; all vehicles clear in a single cycle.	0.000-0.700	<10.0
B			10.1 - 20.0
C	Light congestion; occasional backups on critical approaches.	0.701-0.800	20.1 - 35.0
D	Congestion on critical approaches but intersection functional. Vehicles must wait through more than one cycle during short periods. No long standing lines formed.	0.801-0.900	35.1 - 55.0
E	Severe congestion with some standing lines on critical approaches. Blockage of intersection may occur if signal does not provide protected turning movements.	0.901-1.000	55.1 - 80.0
F	Total breakdown with stop-and-go operation.	>1.001	>80.0

Notes:
(1) Source: *Highway Capacity Manual*, 2000.
(2) This is the ratio of the calculated critical volume to Level-of-Service E Capacity.

[3] Institute of Transportation Engineers, *Traffic Access and Impact Studies for Site Development, A Recommended Practice*, Washington, D.C., 1991, p.39.

Unsignalized Intersections

Like signalized intersections, the operating conditions of intersections controlled by stop signs can be classified by a level-of-service from A to F. However, the method for determining level-of-service for unsignalized intersections is based on the use of gaps in traffic on the major street by vehicles crossing or turning through that stream. Specifically, the capacity of the controlled legs of an intersection is based on two factors: 1) the distribution of gaps in the major street traffic stream, and 2) driver judgement in selecting gaps through which to execute a desired maneuver. The criteria for level-of-service at an unsignalized intersection is therefore based on delay of each turning movement. Table 2 summarizes the definitions for level-of-service and the corresponding delay.

Table 2 Level-of-Service Definitions for Unsignalized Intersections(1)

Level-of-Service	Expected Delay to Minor Street Traffic	Delay (Seconds)
A	Little or no delay	>10
B	Short traffic delays	10.1 to 15.0
C	Average traffic delays	15.1 to 25.0
D	Long traffic delays	25.1 to 35.0
E	Very long traffic delays	35.1 to 50.0
F	See note (2) below	>50.1

Notes:
(1) Source: *Highway Capacity Manual*, 2000.
(2) When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improvement of the intersection.

H. Existing (2013) Levels-of-Service

The existing levels-of-service of the signalized study intersection of Piilani Highway at Kanani Road are summarized in Table 3. Volume-to-capacity ratios, delays and levels-of-service are shown for the overall intersection and each lane group.

Table 3 Existing (2013) Levels-of-Service - Signalized Intersections

Intersection and Movement	AM Peak Hour			PM Peak Hour		
	V/C(1)	Delay(2)	LOS(3)	V/C	Delay	LOS
Piilani Highway at Ohukai Road	***Cycle Length = 125 Seconds(4)***			***Cycle Length = 150 Seconds***		
	0.81	***36.6***	***D***	***0.86***	***44.7***	***D***
Eastbound Left & Thru	0.72	61.1	E	**0.84**	**89.5**	**F**
Eastbound Right	0.05	46.9	D	0.06	58.9	E
Westbound Left & Thru	**0.92**	**82.3**	**F**	**0.89**	**84.2**	**F**
Westbound Right	0.12	44.6	D	0.12	51.2	D
Northbound Left	0.27	57.1	E	0.72	79.8	E
Northbound Thru	0.70	30.6	C	0.87	40.3	D
Northbound Right	0.03	19.6	B	0.05	20.3	C
Southbound Left	**0.82**	**82.6**	**F**	**0.82**	**80.2**	**F**
Southbound Thru	0.82	23.5	C	0.78	29.1	C
Southbound Right	0.04	6.7	A	0.05	16.5	B
Piilani Highway at Kaiwahine Street and Uwapo Road	***Cycle Length = 125 Seconds***			***Cycle Length = 150 Seconds***		
	0.58	***22.7***	***C***	***0.63***	***20.7***	***C***
Eastbound Left & Thru	0.76	64.9	E	0.65	73.1	E
Eastbound Right	0.07	43.1	D	0.05	58.4	E
Westbound Left & Thru	0.46	48.5	D	0.35	61.9	E
Eastbound Right	0.06	43.0	D	0.04	58.2	E
Northbound Left	0.25	36.2	D	0.46	40.1	D
Northbound Thru	0.56	23.5	C	0.62	19.7	B
Northbound Right	0.03	31.6	C	0.07	22.2	C
Southbound Left	0.32	57.4	E	0.55	67.9	E
Southbound Thru	0.53	10.3	B	0.56	9.9	A
Southbound Right	0.01	6.2	A	0.05	5.5	A

NOTES:
(1) Volume-to-Capacity ratio.
(2) Delay is in seconds per vehicle.
(3) Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is based on delay.
(4) Traffic signal cycle length determined by timing the traffic signal during peak hours.
(5) See Attachment G for Level-of-Service Worksheets for AM peak hour.
(6) See Attachment H for Level-of-Service Worksheets for PM peak hour.

The overall intersection of Piilani Highway at Ohukai Road operates at Level-of-Service D during both peak hours. The northbound through movement along Piilani Highway operates at Level-of-Service C during the morning peak hour and Level-of-Service D during the afternoon peak hour. The southbound through movement along Piilani Highway operates at Level-of-Service C during both peak hours.

The overall intersection of Piilani Highway at Kaiwahine Street and Uwapo Road operates at Level-of-Service C during both peak hours. The northbound through movement along Piilani Highway operates at Level-of-Service C during the morning peak hour and Level-of-Service B during the afternoon peak hour. The southbound through movement along Piilani Highway operates at Level-of-Service B during the morning peak hour and Level-of-Service A during the afternoon peak hour.

The results of the level-of-service analysis of the unsignalized study intersections are summarized in Table 4. For the unsignalized intersections, delays and levels-of-service of the controlled lanes groups are shown. The *Highway Capacity Manual* does not estimated delays or levels-of-service of uncontrolled lane groups. Also shown in the table are the estimated queue lengths. Synchro reports the queue lengths is feet. The queue lengths shown in the table are estimated vehicles using an average vehicle length of 25 feet.

Table 4 Existing (2013) Levels-of-Service - Unsignalized Intersections

	AM Peak Hour		PM Peak Hour	
Intersection and Movement	Delay [1]	LOS [2]	Delay	LOS
Piilani Highway at Kaonoulu Street	***11.5***	***B***	***3.6***	***A***
Eastbound Left	**72.3**	**F**	**65.8**	**F**
Eastbound Right	**122.6**	**F**	**44.9**	**E**
Northbound Left	20.7	C	22.9	C
South Kihei Road at Kaonoulu Street	***2.7***	***A***	***3.8***	***A***
Westbound Left	**29.6**	**D**	**56.6**	**F**
Westbound Right	13.5	B	13.9	B
Southbound Left	0.6	A	2.8	A
Piilani Highway at Kulanihakoi Street	***5.0***	***A***	***4.0***	***A***
Eastbound Left	**159.2**	**F**	**146.6**	**F**
Eastbound Right	44.2	E	23.0	C
Northbound Left	24.4	C	28.7	D
Kaonoulu Street at Kenolio Road	***7.5***	***A***	***5.9***	***A***
Eastbound Left	7.5	A	7.7	A
Westbound Left	7.4	A	7.4	A
Northbound Left	0.0	A	0.0	A
Northbound Thru & Right	9.1	A	10.6	B
Southbound Left	14.5	B	14.5	B
Southbound Thru & Right	9.1	A	10.7	B
Kaonoulu Street at Alulike Street	***3.8***	***A***	***4.3***	***A***
Eastbound Left	7.4	A	7.6	A
Westbound Left	7.4	A	7.5	A
Northbound Left, Thru & Right	10.2	B	11.3	B
Southbound Left, Thru & Right	9.0	A	9.8	A

NOTES:
(1) Delay is in seconds per vehicle.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is based on delay.
(3) See Attachment G for Level-of-Service Worksheets for AM peak hour.
(4) See Attachment H for Level-of-Service Worksheets for PM peak hour.

The overall intersection of Piilani Highway at Kaonoulu Street operates at Level-of-Service B during the morning peak hour and Level-of-Service A during the afternoon peak hour. The eastbound left turn operates at Level-of-Service F during both peak hours. The eastbound right turn operates at Level-of-Service F during the morning peak hour and Level-of-Service E during the afternoon peak hour. The northbound left turn operates at Level-of-Service C during both peak hours.

The overall intersection of South Kihei Road at Kaonoulu Street operates at Level-of-Service A during both peak hours. The westbound left turn operates at Level-of-Service D during the morning peak hour and Level-of-Service E during the afternoon peak hour. The westbound right turn

operates at Level-of-Service B during both peak hours and the southbound left turn operates at Level-of-Service A during both peak hours.

The overall intersection of Piilani Highway at Kulanihakoi Road operates at Level-of-Service A during both peak hours. The eastbound left turn operates at Level-of-Service F during both peak hour. The eastbound right turn operates at Level-of-Service E during the morning peak hour and Level-of-Service C during the afternoon peak hour. The northbound left turn operates at Level-of-Service C during the morning peak hour and Level-of-Service D during the afternoon peak hour.

The intersections of Kaonoulu Street at Kenolio Road and Kaonoulu Street at Alulike Street operate at Level-of-Service A during both peak periods. All lane groups operate at Level-of-Service A or B.

I. Existing Deficiencies

For signalized intersections, Level-of-Service D is the minimum acceptable Level-of-Service[4] and this standard is applicable to the overall intersection and major through movements. Minor movements, such as left turns, and minor side street approaches may operate at Level-of-Service E or F for short periods of time during the peak hours so that the overall intersection and major movements along the major highway will operate at Level-of-Service D, or better. All volume-to-capacity ratios must be 1.00 or less[5].

Using this standard, no deficiencies were identified at the signalized intersections.

A standard has not be established for unsignalized intersections. Therefore, we have used a standard that Level-of-Service D is an acceptable level-of-service for major controlled lane groups, such as left turns from a major street to a minor street. Side street approaches may operate at Level-of-Service E or F for short periods of time. This is determined from the delays of the individual lane groups. If the delay of any of the side street approaches appears to be so long that it will affect the overall level-of-service of the intersection, then mitigation measures should be accessed.

Using the above standards, the following deficiencies were identified:

a. Left turns from eastbound Kaonoulu Street to northbound Piilani Highway operate at Level-of-Service F during the morning and afternoon peak hours.

b. Right turns from eastbound Kaonoulu Street at southbound Piilani Highway operate at Level-of-Service F during the morning peak hour and Level-of-Service E during the afternoon peak hour.

c. Left turns from eastbound Kulanihakoi Road to northbound Piilani Highway operate at Level-of-Service F during both peak hours.

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[4] Institute of Transportation Engineers, *Transportation Impact Analyses for Site Development: A Recommended Practice*, 2006, page 60.

[5] Transportation Research Board, *Highway Capacity Manual*, Washington, D.C., 2000, p. 16-35.

None of the deficiencies are significant enough to impact of overall intersections levels-of-service. The intersections operate at Level-of-Service A to B. It should also be noted that both intersections will be signalized in the future. The intersection of Piilani Highway at Kaonoulu Street will be signalized as part of the Maui Lu Resort redevelopment and the intersection of Piilani Highway at Kulanihakoi Street will be signalized as part of the Kihei High School project.

J. 2017 Background Traffic Conditions

Horizon Year

The horizon year is the date for which future background traffic projections were estimated. These projections include traffic generated by other known projects within and adjacent to the study area and background traffic growth, for which a future year must be selected. For projects that will generate less than 500 peak hour trips, the suggested horizon year is the "anticipated opening year, assuming full build out and occupancy."[6] It is anticipated that the proposed project will be completed and occupied before 2017. Therefore, 2017 is used as one of the horizon years for this TIAR.

Background Traffic Growth

Future traffic growth consists of two components. The first is ambient background growth that is a result of regional growth and cannot be attributed to a specific project. This growth factor also considers traffic associated with minor, or small, projects for which no traffic data are available.

The *Maui Long Range Transportation Plan*[7] concluded that traffic in Maui would increase an average of 1.6% per year from 1990 to 2020. This growth rate was used to estimate the background growth between 2013 and the design years. The growth factor was calculated using the following formula:

$$F = (1 + i)^n$$

where F = Growth factor
i = Average annual growth rate, or 0.016
n = Growth period in years

This growth factor was applied to all traffic movements at the study intersections.

Related Projects

The second component in estimating background traffic volumes is traffic generated by other known development projects, also referred to as related projects. Related projects are defined as those projects in the immediate vicinity of the study project that would significantly impact traffic in the study area. Related projects are typically projects that are under construction or have been approved for construction, but often includes adjacent vacant parcels that have a high probability

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[6] Institute of Transportation Engineers, *Transportation and Land Development*, Washington, D.C., 2002, page 3-13

[7] Kaku Associates, *Maui Long Range Land Transportation Plan*, October 1996

of being developed within the design period. Related projects may be development projects or roadway improvements.

Kaiwahine Village

The proposed Kaiwahine Subdivision is located at the east end of Kaiwahine Drive and will consist of 120 multi-family units. The traffic assignments for the subdivision were obtained from the traffic study for the project[8].

Maui Lu Resort

Maui Lu Resort is located in the northeast quadrant of the intersection of South Kihei Road at Kaonoulu Street. The existing resort will be demolished and a 400 unit timeshare will be constructed. Each timeshare unit will have one lock off unit which may be used as a separate hotel room. As part of the Maui Lu project, the intersection of South Kihei Road at Kaonoulu Street will be signalized. A separate southbound to eastbound left turn lane will also be constructed. Groundbreaking is scheduled for 2014. The traffic assignments for the project were obtained from the traffic study for the project[9].

Kihei High School

The proposed Kihei High School will be located along the east side of Piilani Highway across from the Piilani Subdivision. According to the Environmental Impact Statement, the school will have a capacity of approximately 1600 students for grades 9 through 12. The development of the school will be in two phases with 800 students in each phase. Phase 1 will be completed in 2015 and Phase 2 in 2025.

Access and egress will be via the intersection of Piilani Highway at Kulanihakoi Road, which will be modified with an extension of Kulanihakoi Road across Piilani Highway. The intersection of Piilani Highway at Kulanihakoi Street will be signalized.

The number of trips that the high school will generate during weekday peak hours was obtained from the TIAR[10] for the project. Based on trip generation data provided in *Trip Generation*, the number of trips generated on a Saturday will be negligible.

The projects that were identified as related projects and the estimated number of peak hour trips generated by each are summarized in Table 5.

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[8] Phillip Rowell and Associates, *TIAR for Kaiwahine Village*, July 15, 2010

[9] Phillip Rowell and Associates, *TIAR for Maui Lu Resort*, March 7, 2007

[10] Wilson Okamoto Corporation, *Traffic Impact Report Kihei High School*, September 2011

Table 5 Trip Generation Summary of Related Projects

	Related Project	Description	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
A	Kaiwahine Village	120 Multi-Family	19	47	66	49	31	80
B	Maui Lu Resort	400 Timeshares + 400 Lock Off Units (Maximum)	245	140	385	205	230	435
C	Kihei High School (Phase 1)	800 Students Grades 9 thru 12	228	108	336	104	55	159
TOTALS FOR 2018			492	295	787	358	316	674

Traffic from these projects was assigned to the appropriate traffic movements at the study intersections. Background growth and trip assignments of the other known projects were added to the existing traffic volumes to estimate the background peak hour traffic projections. The resulting 2017 background traffic projections without project generated traffic are summarized on Attachments I and J. These projections assume that the peak hour of all the other known projects coincide with the existing peak hours. The result is a worse-case condition.

K. 2017 Background Levels-of Service

Table 6 summarizes the results of the level-of-service analysis of the signalized intersections for 2017 background without project generated traffic. Shown in the table are the volume-to-capacity ratios, average vehicle delays and levels-of-service of the overall intersection and all controlled lane groups. Also shown are the results of the level-of-service analysis with mitigation.

Table 6 2017 Background Levels-of-Service of Signalized Intersections

Intersection and Lane Group	AM Peak Hour						PM Peak Hour					
	2017 Without Project			2017 Without Project With Mitigation			2017 Without Project			2017 Without Project With Mitigation		
	V/C	Delay [1]	LOS [2]	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
Piilani Highway	***Signal Cycle Length = 125 Seconds***						***Signal Cycle Length = 150 Seconds***					
at Ohukai Road	***0.90***	***40.5***	***D***	***0.79***	***30.2***	***C***	***0.95***	***53.0***	***D***	***0.81***	***36.8***	***D***
Eastbound Left				0.47	51.8	D				0.58	67.5	E
Eastbound Left & Thru	0.82	71.1	E	0.47	51.7	D	**1.03**	**134.5**	**F**	0.58	67.6	E
Eastbound Right	0.06	46.6	D	0.06	47.6	D	0.06	58.6	E	0.06	59.7	E
Westbound Left				0.63	56.6	E				0.74	76.4	E
Westbound Left & Thru	0.97	94.1	F	0.65	57.9	E	0.93	90.3	F	0.76	78.1	E
Westbound Right	0.13	44.4	D	0.13	48.0	D	0.13	50.9	D	0.14	59.1	E
Northbound Left	0.29	67.7	E	0.29	61.0	E	0.77	79.0	E	0.74	82.2	F
Northbound Thru	0.77	31.9	C	0.69	24.3	C	0.96	51.4	D	0.82	31.6	C
Northbound Right	0.03	15.6	B	0.03	13.4	B	0.06	25.9	C	0.05	19.0	B
Southbound Left	0.87	89.9	F	0.49	66.9	E	0.87	91.0	F	0.49	71.3	E
Southbound Thru	0.92	28.8	C	0.85	20.8	C	0.87	32.9	C	0.76	20.9	C
Southbound Right	0.08	6.2	A	0.07	5.3	A	0.09	13.5	B	0.08	7.8	A

Table 6 (Continued) 2017 Background Levels-of-Service of Signalized Intersections

Piilani Highway at Kaiwahine Street	***Signal Cycle Length = 125 Seconds***						***Signal Cycle Length = 150 Seconds***					
	0.64	***25.8***	***C***	***0.64***	***23.9***	***C***	***0.69***	***24.1***	***C***	***0.69***	***21.5***	***C***
Eastbound Left & Thru	0.82	69.3	E	0.86	77.1	E	0.70	75.4	E	0.71	76.6	E
Eastbound Right	0.08	40.9	D	0.08	41.7	D	0.06	56.2	E	0.06	56.3	E
Westbound Left & Thru	0.61	52.2	D	0.66	56.7	E	0.47	61.9	E	0.47	62.1	E
Westbound Right	0.08	40.9	D	0.08	41.7	D	0.05	56.1	E	0.05	56.2	E
Northbound Left	0.28	37.9	D	0.28	38.5	D	0.48	40.5	D	0.48	48.0	D
Northbound Thru	0.63	27.2	C	0.63	21.8	C	0.70	23.7	C	0.69	17.4	B
Northbound Right	0.04	36.7	D	0.04	31.1	C	0.09	24.7	C	0.09	18.0	B
Southbound Left	0.39	57.9	E	0.39	57.9	E	0.64	70.4	E	0.68	73.9	E
Southbound Thru	0.62	13.2	B	0.61	12.6	B	0.64	12.5	B	0.64	12.4	B
Southbound Right	0.02	7.1	A	0.02	6.8	A	0.05	6.4	A	0.05	6.3	A
Piilani Highway at Kaonoulu Street	***Signal Cycle Length = 125 Seconds***						***Signal Cycle Length = 150 Seconds***					
	0.81	***15.2***	***B***	***0.81***	***15.1***	***B***	***0.75***	***10.7***	***B***	***0.75***	***10.6***	***B***
Eastbound Left	0.33	56.5	E	0.27	53.9	D	0.42	70.0	E	0.42	70.0	E
Eastbound Right	0.16	55.0	D	0.50	56.9	E	0.13	66.8	E	0.13	66.8	E
Northbound Left	0.64	59.8	E	0.66	61.8	E	0.72	68.4	E	0.72	68.4	E
Northbound Thru	0.38	2.1	A	0.39	2.6	A	0.57	2.7	A	0.57	2.7	A
Southbound Thru	0.69	14.0	B	0.70	12.9	B	0.64	6.0	A	0.64	5.6	A
Southbound Right	0.05	13.0	B	0.05	13.1	B	0.06	4.4	A	0.06	3.3	A
South Kihei Road at Kaonoulu Street	***Signal Cycle Length = 55 Seconds***						***Signal Cycle Length = 70 Seconds***					
	0.50	***5.9***	***A***	***0.50***	***5.9***	***A***	***0.85***	***10.7***	***B***	***0.85***	***10.7***	***B***
Westbound Left	0.38	24.6	C	0.38	24.6	C	0.29	19.1	B	0.29	19.1	B
Westbound Right	0.03	22.5	C	0.03	22.5	C	0.19	18.6	B	0.19	18.6	B
Northbound Thru & Right	0.52	4.2	A	0.52	4.2	A	0.75	11.8	B	0.75	11.8	B
Southbound Left	0.08	2.6	A	0.08	2.6	A	0.27	6.5	A	0.27	6.5	A
Southbound Thru	0.31	3.2	A	0.31	3.2	A	0.46	4.2	A	0.46	4.2	A
Piilani Highway at Kulanihakoi Road	***Signal Cycle Length = 125 Seconds***						***Signal Cycle Length = 150 Seconds***					
	0.78	***13.5***	***B***	***0.78***	***13.5***	***B***	***0.68***	***12.7***	***B***	***0.68***	***14.3***	***B***
Eastbound Left & Thru	0.34	43.5	D	0.34	43.5	D	0.51	72.3	E	0.51	72.3	E
Eastbound Right	0.09	41.4	D	0.09	41.4	D	0.07	65.8	E	0.07	65.8	E
Westbound Left & Thru	0.60	50.4	D	0.60	50.4	D	0.51	72.0	E	0.51	72.0	E
Westbound Right	0.02	40.8	D	0.02	40.8	D	0.01	65.3	E	0.01	65.3	E
Northbound Left	0.45	52.2	D	0.45	52.2	D	0.61	72.7	E	0.61	72.7	E
Northbound Thru	0.56	7.3	A	0.56	7.3	A	0.67	6.0	A	0.67	6.0	A
Northbound Right	0.09	4.5	A	0.09	4.5	A	0.02	2.2	A	0.02	2.2	A
Southbound Left	0.63	60.0	E	0.63	60.0	E	0.35	95.5	F	0.35	90.3	F
Southbound Thru	0.82	11.8	B	0.82	11.8	B	0.66	10.4	B	0.66	14.3	B
Southbound Right	0.02	4.0	A	0.02	4.0	A	0.06	3.9	A	0.06	5.2	A

NOTES:
(1) Delay is in seconds per vehicle.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is based on delay.
(3) See Appendix K for Level-of-Service Analysis Worksheets for Without Mitigation AM peak hour.
(4) See Appendix L for Level-of-Service Analysis Worksheets for Without Mitigation PM peak hour.
(5) See Appendix M for Level-of-Service Analysis Worksheets for With Mitigation AM peak hour.
(6) See Appendix N for Level-of-Service Analysis Worksheets for With Mitigation PM peak hour.

The overall intersection of Piilani Highway at Ohukai Road will operate at Level-of-Service D during both peak periods. During the morning peak hour, the westbound left and through and the southbound left will operate at Level-of-Service F. The northbound and southbound through movements along Piilani Highway will operate at Level-of-Service C. During the afternoon peak hour, the eastbound left and through, the westbound left and through and the southbound left will operate at Level-of-Service F. The northbound through movement along Piilani Highway will

operate at Level-of-Service D and the southbound through will operate at Level-of-Service C. The eastbound left and through lane group has a volume-to-capacity ratio of 1.09, indicating and capacity constraint.

The overall intersection of Piilani Highway at Kaiwahine Street and Uwapo Road will operate at Level-of-Service C during both peak periods. During the morning and afternoon peak hours, the northbound through movement along Piilani Highway will operate at Level-of-Service C and the southbound through movement will operate at Level-of-Service B. During the morning peak hour, the eastbound through and left and the southbound left will operate at Level-of-Service E. During the afternoon peak hour, the eastbound approaches, the westbound approaches and the southbound left will operate at Level-of-Service E. The volume-to-capacity ratios are low. Adding green time to these side street approaches did not improve the levels-of-service, confirming that the low levels-of-service are the result of the long traffic signal cycle length.

The overall intersection of Piilani Highway at Kaonoulu Street, which will be signalized as part of the Maui Lu Resort Redevelopment project, will operate at Level-of-Service B during both peak periods. During the morning peak hour, the northbound through movement will operate at Level-of-Service A and the northbound through movement will operate at Level-of-Service B. The eastbound left and the northbound left turn will operate at Level-of-Service E, but the volume-to-capacity ratios are 0.38 and 0.64, respectively. Adding green time to these movements did not improve the level-of-service, confirming that the low level-of-service is the result of the long traffic signal cycle length. During the afternoon peak hour, the northbound and southbound through movements along Piilani Highway will operate at Level-of-Service A. The eastbound left and right and the northbound left will operate at Level-of-Service E. The volume-to-capacity ratios are low. Adding green time to these side street approaches did not improve the levels-of-service, confirming that the low levels-of-service are the result of the long traffic signal cycle length.

The overall intersection of South Kihei Road at Kaonoulu Street, which will also be signalized as part of the Maui Lu Resort Redevelopment project, will operate at Level-of-Service A during the morning peak hour and Level-of-Service B during the afternoon peak hour. The northbound through and right lane group along South Kihei Road will operate at Level-of-Service A during the morning peak hour and Level-of-Service B during the afternoon peak hour. The southbound through movement will operate at Level-of-Service A during both peak hours. The westbound approaches will operate at Level-of-Service C during the morning peak hour and Level-of-Service B during the afternoon peak hour.

The overall intersection of Piilani Highway at Kulanihakoi Road will operate at Level-of-Service B during both peak periods. The northbound through movement along Piilani Highway will operate at Level-of-Service A during both peak hours and the southbound through movement will operate at Level-of-Service B during both peak hours. During the morning peak hour, the southbound left turn will operate at Level-of-Service E. All remaining movements will operate at Level-of-Service D, or better. During the afternoon peak hour, the southbound left turn will operate at Level-of-Service F. The volume-to-capacity ratio is 0.35, indicating that the low level-of-service is the result of the long traffic signal cycle length. The eastbound approaches, the westbound approaches and the northbound left turn will operate at Level-of-Service E. All have low volume-to-capacity ratios.

Table 7 summarizes the results of the level-of-service analysis of the unsignalized intersections along Kaonoulu Street (Kaonoulu Street at Kenolio Road and Kaonoulu Street at Alulike Street) for 2017 background without project traffic conditions. Shown in the table are the average vehicle delays and levels-of-service of the controlled movements. Delays and levels-of-service are not calculated for uncontrolled movements.

Table 7 2017 Background Levels-of-Service of Unsignalized Intersections

Intersection and Movement	AM Peak Hour		PM Peak Hour	
	Delay [1]	LOS [2]	Delay	LOS
Kaonoulu Street at Kenolio Road	***6.1***	***A***	***4.3***	***A***
Eastbound Left	7.6	A	7.8	A
Westbound Left	7.5	A	7.6	A
Northbound Left	0.0	A	0.0	A
Northbound Thru & Right	9.1	A	10.1	B
Southbound Left	15.1	C	14.9	B
Southbound Thru & Right	9.3	A	10.1	B
Kaonoulu Street at Alulike Street	***3.1***	***A***	***2.8***	***A***
Eastbound Left	7.5	A	7.7	A
Westbound Left	7.5	A	7.7	A
Northbound Left, Thru & Right	11.8	B	13.1	B
Southbound Left, Thru & Right	9.2	A	9.7	A

NOTES:
(1) Delay is in seconds per vehicle.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is based on delay.
(3) See Attachment K for Level-of-Service Worksheets for AM peak hour.
(4) See Attachment L for Level-of-Service Worksheets for PM peak hour.

The overall intersection of Kaonoulu Street at Kenolio Road will operate at Level-of-Service A during both peak hours. All lane groups will operate at Level-of-Service A or B, except for the southbound left turn, which will operate at Level-of-Service C during the morning peak hour.

The overall intersection of Kaonoulu Street at Alulike Street will operate at Level-of-Service A during both peak hours. All movements will operate at Level-of-Service A or B.

Attachment O illustrates the intersection configurations and right-of-way controls used for the level-of-service analysis of 2017 background conditions without project generated traffic. The roadway improvements that are proposed as part of the related projects are assumed to be in place for the level-of-service analysis since the project's traffic is included in the projections. These improvements include:

1. The intersection of South Kihei Road at Kaonoulu Street has been signalized and the southbound approach has been modified to provide a separate left turn lane. *These improvements are recommended as part of the Maui Lu Resort Redevelopment project.*

2. The intersection of Piilani Highway at Kaonoulu Street has been signalized. *This improvement is included because Maui Lu Resort is to participate in this improvement.*

3. The intersection of Piilani Highway at Kulanihakoi Road has been signalized, the northbound approach has been modified to provide a right turn only lane, the southbound approach has been modified to provide a left turn lane and the eastbound and westbound approached have been modified to provide an optional left turn or through lane and a right turn only lane. *These improvements are those recommended in the TIAR for the proposed Kihei High School to be located at this location.*

L. Mitigation Required for 2017 Background Conditions

Using the standards discussed in Chapter 2, additional improvements are required at the intersection of Piilani Highway at Ohukai Road. The southbound through movement will have a volume-to-capacity ratio of 1.01 during the morning peak hour. During the afternoon peak hour, the overall intersection will have an level-of-service of E. The eastbound left turn and through lane group will have a volume-to-capacity ratio of 1.09 and the northbound through lane group will have a volume-to-capacity ratio of 1.08. The eastbound left turn and through lane group will operate at Level-of-Service F and a volume-to-capacity ratio of 1.03, the westbound left and through will operate at Level-of-Service F and a volume-to-capacity ratio of 0.97 and 0.95 and the southbound left turn will operate at Level-of-Service F and a volume-to-capacity ratio of 0.87.

The following improvements are recommended to accommodate background growth and traffic generated by the related projects:

1. The eastbound approach should be modified to provide an additional separate left turn lane.

2. The westbound approach should be modified to provide an additional separate left turn lane.

3. The southbound approach should be modified to provide and additional separate left turn or thru lane.

The lane configuration and right-of-way controls for 2017 background without project conditions are shown as Attachment P. These improvements are required to mitigate the impacts of background growth and traffic generated by the related projects. The level-of-service resulting from these improvements are summarized in Table 6. Since the signals along Piilani Highway at interconnected, the improvements will affect the levels-of-service of the adjacent signalized intersections along Piilani Highway. Therefore, the results of the level-of-service analysis of all the signalized intersections are shown.

M. Project Trip Generation

Future traffic volumes that will be generated by the proposed project were estimated using the methodology described in the *Trip Generation Handbook*[11] and data provided in *Trip Generation*[12].

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[11] Institute of Transportation Engineers, *Trip Generation Handbook*, Washington, D.C., 2004, p. 7-12

[12] Institute of Transportation Engineers, *Trip Generation, 8th Edition,* Washington, D.C., 2003

This method uses trip generation equations or rates to estimate the number of trips that the project will generate during the peak hours of the project and along the adjacent street.

The proposed action is the construction of 186 affordable apartment units. Apartment units are defined by the Institute of Transportation Engineers as follows:

> *Apartments are rental dwelling units located within the same building with at least three other dwelling units, for example, quadraplexes and all types of apartment buildings.*[13]

Trip generation provides equations using the number of dwelling units as the independent variable.

Trip Generation provides rates and equations to estimate the number of peak hour trips during the peak hours of the adjacent street and the peak hours of the generator, which may or may not coincide. The AM peak hour of the adjacent street is typically between 7:00 AM and 9:00 AM and PM peak hour is between 4:00 PM and 6:00 PM, typical commute hours. *Trip Generation* does not note the peak hours of the generators. For this project, the trip generation equations for the peak hours of the generator have been used as the results are slightly higher than the results using the equations for the peak hours of the adjacent street

The trip generation equations used for the trip generation analysis and the results are summarized in Table 8. The trip generation analysis estimated that the project will generate a total of 103 trips during the morning peak hour and 127 trips during the afternoon peak hour.

Table 8 Trip Generation Analysis

Period & Direction		Apartments (Land Use Code 220)		
		Trips per Unit or Percent	Units	Trips
AM Peak Hour of Adjacent Street	Total	T = 0.49 (X) + 3.73	186	95
	Inbound	20%		19
	Outbound	80%		76
PM Peak Hour of Adjacent Street	Total	T = 0.55 (X) + 17.65		120
	Inbound	65%		78
	Outbound	35%		42
AM Peak Hour of Generator	Total	T = 0.54 (X) + 2.45		103
	Inbound	29%		30
	Outbound	71%		73
PM Peak Hour of Generator	Total	T = 0.60 (X) + 14.91		127
	Inbound	61%		77
	Outbound	39%		50

Notes:
(1) Source: Institute of Transportation Engineers, *Trip Generation 8th Edition*, 2008,
(2) T=trips, X=number of dwelling units

[13] Institute of Transportation Engineers, *Trip Generation*, Washington, D.C., 1997, p. 326

Project trips were distributed and assigned based on existing traffic patterns as estimated from the traffic counts. The inbound and out distributions are shown as Attachments Q and R. The resulting traffic assignments are shown as Attachments S and T.

L. Background Plus Project Projections

Background plus project traffic projections were estimated by superimposing the peak hourly traffic generated by the proposed project on the background (without project) peak hour traffic projections. This assumes that the peak hourly trips generated by the project coincide with the peak hour of the adjacent street. This represents a worse-case condition as it assumes that the peak hours of the intersections coincide with the peak hour of the study project.

The resulting 2016 background plus project peak hour traffic projections are shown as Attachments U and V.

M. 2017 Traffic Impact Assessment

The traffic impacts of the project were assessed by analyzing the changes in intersection approach volumes and levels-of-service at the study intersections.

Changes in Total Intersection Volumes

An analysis of the project's share of 2017 background plus project intersection approach volumes at the study intersections is summarized in Table 9. The table summarizes the project's share of total 2017 peak hour approach volumes at each intersection. Also shown are the percentages of 2017 background plus project traffic that is the result of background growth and traffic generated by related projects.

At the intersections along Piilani Highway at Ohukai Road, Kaiwahine Street and Kulanihakoi Road, project generated traffic will represents less than 1.0% of the peak hour traffic. At the intersection of Piilani Highway at Kaonoulu, Project generated traffic represents less than 2% of the peak hour traffic. These percentages are less that the 3% threshold the State of Hawaii Department of Transportation uses to determine whether an intersection should be included in a projects TIAR.

At the intersection of South Kihei Road at Kaonoulu Street, project generated traffic will represent 2.9% of the morning peak hour traffic and 2.6% of the afternoon peak hour traffic.

As noted earlier in this report, all project traffic will access and egress the project via the intersection of Kaonoulu Street at Kenolio Road. Project generated traffic will represent 16.4% of the morning peak hour traffic and 19.0% of the afternoon peak hour traffic at this intersection.

At the intersection of Kaonoulu Street at Alulike Street, project generated traffic will represent 9.4% of the morning peak hour traffic and 8.2% of the afternoon peak hour traffic.

Table 9 Analysis of Project's Share of Total 2017 Intersection Approach Volumes (1)

Intersection	Period	Existing	2017 Background	2017 Background Plus Project	Background Growth		Project Traffic	
					Trips	Percent of Total Traffic (2)	Trips	Percent of Total Traffic (2)
Piilani Highway at Ohukai Road	AM	3321	3687	3719	366	9.8%	32	0.9%
	PM	3688	4080	4119	392	9.5%	39	0.9%
Piilani Highway at Kaiwahine Street & Uwapo Road	AM	2939	3311	3337	372	11.1%	26	0.8%
	PM	3337	3725	3757	388	10.3%	32	0.9%
Piilani Highway at Kaonoulu Street	AM	2941	3144	3201	203	6.3%	57	1.8%
	PM	3288	3635	3705	347	9.4%	70	1.9%
S. Kihei Road at Kaonoulu Street	AM	1017	1187	1223	170	13.9%	36	2.9%
	PM	1472	1670	1715	198	11.5%	45	2.6%
Piilani Highway at Kulanihakoi Road	AM	3363	3791	3817	428	11.2%	26	0.7%
	PM	3486	3858	3890	372	9.6%	32	0.8%
Kaonoulu Street at Kenolio Road	AM	366	532	636	166	26.1%	104	16.4%
	PM	364	545	673	181	26.9%	128	19.0%
Kaonoulu Street at Alulike Street	AM	200	355	392	155	39.5%	37	9.4%
	PM	272	501	546	229	41.9%	45	8.2%

Notes:
(1) Volumes shown are total intersection approach volumes or projections.
(2) Percentage of total 2016 background plus project traffic.
(3) Data to be provided in final draft report.

Level-of-Service Analysis

The level-of-service analysis was performed for "without project" and "with project" conditions. The incremental difference the two conditions quantifies the impacts of the project generated traffic.

The results of the level-of-service analysis of the signalized intersections are summarized in Table 10. The volume-to-capacity ratios, delays and levels-of-service of the overall intersection and all lane groups are shown. Even though the level-of-service is defined by delay, the volume-to-capacity ratios are shown as it is a factor used to determine whether the delay of a particular traffic movement, or lane group, is the result of the traffic signal timing or the result of a capacity deficiency. The level-of-service analysis also used the existing traffic signal cycle lengths.

Table 10 2017 Background Plus Project Levels-of-Service of Signalized Intersections

Intersection and Lane Group	AM Peak Hour						PM Peak Hour					
	2017 Without Project With Mitigation			2017 With Project			2017 Without Project With Mitigation			2017 With Project		
	V/C[1]	Delay[2]	LOS[3]	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
Piilani Highway	***Signal Cycle Length = 125 Seconds***						***Signal Cycle Length = 150 Seconds***					
at Ohukai Road	***0.79***	***30.2***	***C***	***0.80***	***30.4***	***C***	***0.81***	***36.8***	***D***	***0.81***	***37.1***	***D***
Eastbound Left	0.47	51.8	D	0.47	51.8	D	0.58	67.5	E	0.58	67.5	E
Eastbound Left & Thru	0.47	51.7	D	0.47	51.7	D	0.58	67.6	E	0.58	67.6	E
Eastbound Right	0.06	47.6	D	0.06	47.6	D	0.06	59.7	E	0.06	59.7	E
Westbound Left	0.63	56.6	E	0.63	56.9	E	0.74	76.4	E	0.74	76.9	E
Westbound Left & Thru	0.65	57.9	E	0.65	57.8	E	0.76	78.1	E	0.76	78.3	E
Westbound Right	0.13	48.0	D	0.13	47.9	D	0.14	59.1	E	0.15	59.0	E
Northbound Left	0.29	61.0	E	0.29	60.3	E	0.74	82.2	F	0.74	83.3	F
Northbound Thru	0.69	24.3	C	0.70	24.7	C	0.82	31.6	C	0.83	32.1	C
Northbound Right	0.03	13.4	B	0.04	13.0	B	0.05	19.0	B	0.05	18.7	B
Southbound Left	0.49	66.9	E	0.49	66.9	E	0.49	71.3	E	0.49	71.5	E
Southbound Thru	0.85	20.8	C	0.85	21.1	C	0.76	20.9	C	0.77	21.3	C
Southbound Right	0.07	5.3	A	0.07	5.3	A	0.08	7.8	A	0.08	7.6	A
Piilani Highway	***Signal Cycle Length = 125 Seconds***						***Signal Cycle Length = 150 Seconds***					
at Kaiwahine Street	***0.64***	***23.9***	***C***	***0.67***	***24.0***	***C***	***0.69***	***21.5***	***C***	***0.70***	***21.6***	***C***
Eastbound Left & Thru	0.86	77.1	E	0.86	77.1	E	0.71	76.6	E	0.71	76.6	E
Eastbound Right	0.08	41.7	D	0.08	41.7	D	0.06	56.3	E	0.06	56.3	E
Westbound Left & Thru	0.66	56.7	E	0.66	56.7	E	0.47	62.1	E	0.47	62.1	E
Westbound Right	0.08	41.7	D	0.08	41.7	D	0.05	56.2	E	0.05	56.2	E
Northbound Left	0.28	38.5	D	0.28	38.2	D	0.48	48.0	D	0.48	47.9	D
Northbound Thru	0.63	21.8	C	0.63	22.2	C	0.69	17.4	B	0.70	17.6	B
Northbound Right	0.04	31.1	C	0.04	31.5	C	0.09	18.0	B	0.09	18.2	B
Southbound Left	0.39	57.9	E	0.39	57.9	E	0.68	73.9	E	0.68	73.9	E
Southbound Thru	0.61	12.6	B	0.62	12.6	B	0.64	12.4	B	0.65	12.6	B
Southbound Right	0.02	6.8	A	0.02	6.8	A	0.05	6.3	A	0.05	6.3	A
Piilani Highway	***Signal Cycle Length = 125 Seconds***						***Signal Cycle Length = 150 Seconds***					
at Kaonoulu Street	***0.81***	***15.1***	***B***	***0.82***	***16.4***	***B***	***0.75***	***10.6***	***B***	***0.77***	***11.6***	***B***
Eastbound Left	0.27	53.9	D	0.38	54.1	D	0.42	70.0	E	0.51	70.3	E
Eastbound Right	0.50	56.9	E	0.59	59.4	E	0.13	66.8	E	0.14	65.9	E
Northbound Left	0.66	61.8	E	0.69	63.2	E	0.72	68.4	E	0.74	67.6	E
Northbound Thru	0.39	2.6	A	0.39	2.9	A	0.57	2.7	A	0.57	3.0	A
Southbound Thru	0.70	12.9	B	0.71	13.7	B	0.64	5.6	A	0.66	6.4	A
Southbound Right	0.05	13.1	B	0.06	14.5	B	0.06	3.3	A	0.08	3.8	A
South Kihei Road	***Signal Cycle Length = 55 Seconds***						***Signal Cycle Length = 70 Seconds***					
at Kaonoulu Street	***0.50***	***5.9***	***A***	***0.53***	***6.5***	***A***	***0.85***	***10.7***	***B***	***0.87***	***11.1***	***B***
Westbound Left	0.38	24.6	C	0.41	23.1	C	0.29	19.1	B	0.33	19.7	B
Westbound Right	0.03	22.5	C	0.03	20.8	C	0.19	18.6	B	0.20	19.0	B
Northbound Thru & Right	0.52	4.2	A	0.55	4.7	A	0.75	11.8	B	0.77	12.3	B
Southbound Left	0.08	2.6	A	0.09	2.9	A	0.27	6.5	A	0.31	7.1	A
Southbound Thru	0.31	3.2	A	0.32	3.5	A	0.46	4.2	A	0.46	4.2	A

Table 10 (Continued) **2017 Background Plus Project Levels-of-Service of Signalized Intersections**

Piilani Highway at Kulanihakoi Road	*Signal Cycle Length = 125 Seconds*						*Signal Cycle Length = 150 Seconds*					
	0.78	***13.5***	***B***	***0.78***	***13.5***	***B***	***0.68***	***14.3***	***B***	***0.68***	***14.6***	***B***
Eastbound Left & Thru	0.34	43.5	D	0.34	43.6	D	0.51	72.3	E	0.51	72.3	E
Eastbound Right	0.09	41.4	D	0.19	42.3	D	0.07	65.8	E	0.07	65.8	E
Westbound Left & Thru	0.60	50.4	D	0.60	50.6	D	0.51	72.0	E	0.51	72.0	E
Westbound Right	0.02	40.8	D	0.02	41.0	D	0.01	65.3	E	0.01	65.3	E
Northbound Left	0.45	52.2	D	0.49	53.9	D	0.61	72.7	E	0.61	72.7	E
Northbound Thru	0.56	7.3	A	0.56	7.2	A	0.67	6.0	A	0.68	6.1	A
Northbound Right	0.09	4.5	A	0.09	4.5	A	0.02	2.2	A	0.02	2.2	A
Southbound Left	0.63	60.0	E	0.64	62.1	E	0.35	90.3	F	0.35	89.0	F
Southbound Thru	0.82	11.8	B	0.82	11.6	B	0.66	14.3	B	0.66	14.9	B
Southbound Right	0.02	4.0	A	0.02	3.9	A	0.06	5.2	A	0.06	6.2	A

NOTES:
1. V/C denotes ratio of volume to capacity.
2. Delay is in seconds per vehicle.
3. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.
4. See Attachment U for Level-of-Service Worksheets for the AM peak hour without project conditions.
5. See Attachment V for Level-of-Service Worksheets for the PM peak hour without project conditions.
6. See Attachment W for Level-of-Service Worksheets for the AM peak hour with project conditions.
7. See Attachment X for Level-of-Service worksheets for the PM peak hour with project conditions.

The conclusions of the level-of-service analysis are:

1. The overall intersection of Piilani Highway at Ohukai Road will operate at Level-of-Service C during the morning peak hour and Level-of-Service D during the afternoon peak hour, without and with project generated traffic. The northbound and southbound through movements along Piilani Highway will operate at Level-of-Service C, without and with project traffic. There is no change in the level-of-service of any lane groups as a result of project traffic.

   During the morning peak hour, the westbound left, the westbound left and through movement, the northbound left turn and the southbound left turn will operate at Level-of-Service E. These movements all have low volume-to-capacity ratios. Adding green time to these lane groups did not change the level-of-service, confirming that the low level-of-service is the result of the traffic signal cycle length.

   During the afternoon peak hour, the northbound left will operate at Level-of-Service F. The side street approaches of Ohukai Street and the southbound left turn will operate at Level-of-Service E. Adding green time to these lane groups did not change the level-of-service.

2. The overall intersection of Piilani Highway at Kaiwahine Street and Uwapo Road will operate at Level-of-Service C during the morning peak hour and Level-of-Service D during the afternoon peak hour, without and with project generated traffic. The northbound through movement along Piilani Highway will operate at Level-of-Service C during the morning peak hour and Level-of-Service B during the afternoon peak hour, without and with project traffic. The southbound through movement will operate at Level-of-Service B during both peak hours. There is no change in the level-of-service of any lane groups as a result of project traffic.

During the morning peak hour, the eastbound left and through, the westbound left and through and the southbound left turn will operate at Level-of-Service E. The volume-to-capacity ratios are low, indicating that the low level-of-service is the result of the traffic signal cycle length.

During the afternoon peak hour, the eastbound approaches along Uwapo Road, the eastbound approaches along Kaiwahine Street and the southbound left turn will operate at Level-of-Service E. All have low volume-to-capacity ratios, indicating that the low level-of-service is the result of the traffic signal cycle length.

3. The overall intersection of Piilani Highway at Kaonoulu Street will operate at Level-of-Service B during both peak hours, without and with project traffic. The northbound through movement along Piilani Highway will operate at Level-of-Service A during both peak hours. The southbound through movement along Piilani Highway will operate at Level-of-Service B during the morning peak hour and Level-of-Service A during the afternoon peak hour. There is no change in the level-of-service of any lane group as a result of project traffic.

   During the morning peak hour, the eastbound right turn and the northbound left turn will operate at Level-of-Service E, without and with project traffic, but the volume-to-capacity ratios are low.

   During the afternoon peak hour, the eastbound left turn, the eastbound right turn and the northbound left turn will operate at Level-of-Service E, without and with project traffic. The volume-to-capacity ratios are all low.

4. The overall intersection of South Kihei Road at Kaonoulu Street will operate at Level-of-Service A during the morning peak hour and Level-of-Service B during the afternoon peak hour. There is no change in the level-of-service of any lane group as a result of project traffic. During the morning peak hour, all lane groups will operate at Level-of-Service A or C. During the afternoon peak hour, all lane groups will operate at Level-of-Service A or B.

5. The overall intersection of Piilani Highway at Kulanihakoi Road will operate at Level-of-Service B during both peak hours, without and with project traffic. The northbound through movement will operate at Level-of-Service A, without and with project traffic, during both peak hours. The southbound though movement will operate at Level-of-Service B, without and with project traffic. There is no change in the level-of-service of any lane groups as a result of project traffic.

   During the morning peak hour, the southbound left will operate at Level-of-Service E, but with a low volume-to-capacity ratio. All other movements will operate at Level-of-Service D, or better.

   During the afternoon peak hour, the southbound left turn will operate at Level-of-Service F, but the volume-to-capacity ratio is 0.35, confirming that the low level-of-service is the result of the traffic signal cycle length. The project adds no traffic to this movement. The eastbound and westbound approaches and the northbound left turn will operate at Level-of-Service E. All these lane groups have level-of-service volume-to-capacity ratios.

The results of the level-of-service analysis of the unsignalized intersections are summarized in Table 11. Shown are the delays and levels-of-service of the overall intersection and each controlled lane group. The methodology for unsignalized intersections does not estimate delays and levels-of-service for uncontrolled movements.

Table 11 2017 Background Plus Project Levels-of-Service of Unsignalized Intersections

	AM Peak Hour				PM Peak Hour			
	Without Project		With Project		Without Project		With Project	
Intersection and Movement	Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS
Kaonoulu Street at Kenolio Road	***6.1***	***A***	***7.5***	***A***	***4.3***	***A***	***5.7***	***A***
Eastbound Left	7.6	A	7.6	A	7.8	A	7.8	A
Westbound Left	7.5	A	7.5	A	7.6	A	7.7	A
Northbound Left	0.0	A	11.9	B	0	A	14.2	B
Northbound Thru & Right	9.1	A	9.7	A	10.1	B	10.5	B
Southbound Left	15.1	C	18.8	C	14.9	B	19.2	C
Southbound Thru & Right	9.3	A	9.8	A	10.1	B	11.8	B
Kaonoulu Street at Alulike Street	***3.1***	***A***	***2.9***	***A***	***2.8***	***A***	***2.6***	***A***
Eastbound Left	7.5	A	7.5	A	7.7	A	7.8	A
Westbound Left	7.5	A	7.5	A	7.7	A	7.7	A
Northbound Left, Thru & Right	11.8	B	12.2	B	13.1	B	13.7	B
Southbound Left, Thru & Right	9.2	A	9.4	A	9.7	A	9.9	A

NOTES:
(1) Delay is in seconds per vehicle.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is based on delay.
(3) See Attachment K for Level-of-Service Worksheets for AM peak hour.
(4) See Attachment L for Level-of-Service Worksheets for PM peak hour.

The conclusions of the level-of-service analysis of the unsignalized intersections are:

1. The overall intersection of Kaonoulu Street at Kenolio Road will operate at Level-of-Service A, without and with project traffic. All lane groups will operate at Level-of-Service C, or better.

2. The overall intersection of Kaonoulu Street at Alulike Street will operate at Level-of-Service A during both peak hours, without and with project traffic. All lane groups will operate at Level-of-Service A or B.

N. Mitigation

As noted earlier, Level-of-Service D is the minimum acceptable Level-of-Service[14] for signalized intersections and that this standard is applicable to the overall intersection rather than each controlled lane group. Minor movements, such as left turns, and minor side street approaches may operate at Level-of-Service E or F for short periods of time during the peak hours so that the overall

[14] Institute of Transportation Engineers, *Transportation Impact Analyses for Site Development: A Recommended Practice*, 2006, page 60.

intersection and major movements along the major highway will operate at Level-of-Service D, or better. All volume-to-capacity ratios must be 1.00 or less[15].

A standard has not be established for unsignalized intersections. Therefore, we have used a standard that Level-of-Service D is an acceptable level-of-service for any major controlled lane groups, such as left turns from a major street to a minor street. Side street approaches may operate at Level-of-Service E or F for short periods of time. This is determined from the delays of he individual lane groups. If the delay of any of the side street approaches appears to be so long that it will affect the overall level-of-service of the intersection, then mitigation measures should be accessed.

Using this standard, no mitigation is recommended for the study intersections.

O. Project Driveways

The results of the level-of-service analysis of the project's driveways along Kenolio Road are summarized in Table 12. The level-of-service analysis assumed that the driveways will be unsignalized. All movements will be allowed at both driveways. Since the driveways will be unsignalized, delays, levels-of-service and 95th percentile queues are shown. The level-of-service analysis concluded that all movements will operate at Level-of-Service A. This implies good operating conditions, minimal delays and high levels-of-service at the project driveways.

Table 12 2017 Levels-of-Service at Project Driveways

	AM Peak Hour			PM Peak Hour		
Approach and Lane Group	Delay (1)	LOS (2)	95th Queue (3)	Delay	LOS	95th Queue
Kenolio Road at Drive A	***6.6***	***A***	***NC***	***5.9***	***A***	***NC***
Eastbound Left, Thru & Right	10.0	A	<1	10.4	B	<1
Westbound Left, Thru & Right	8.6	A	<1	8.5	A	<1
Northbound Left, Thru & Right	0.0	A	<1	0.0	A	<1
Southbound Left, Thru & Right	3.9	A	<1	4.5	A	<1
Kenolio Road at Drive B	***8.0***	***A***	***NC***	***7.7***	***A***	***NC***
Westbound Right	8.4	A	<1	8.4	A	<1
Southbound Left	7.2	A	<1	7.2	A	<1

NOTES:
(1) Delay is in seconds per vehicle.
(2) LOS denotes Level-of-Service.
(3) 95th Percentile as reported by Synchro. Assumed vehicle length is 25 feet.
(4) See Attachment N for Level-of-Service Worksheets.
(5) NC = Not Calculated

[15] Transportation Research Board, *Highway Capacity Manual*, Washington, D.C., 2000, p. 16-35.

P. Summary and Recommendations

1. The proposed project is summarized as follows:

    a. The project is located in the South Kihei area of Maui, between Piilani Highway and Kenolio Street and south of Kaonoulu Road.

    b. The proposed action is the construction of 186 affordable apartments.

    c. Access and egress will be provided by two new driveways along the east side of Kenolio Street.

    d. The project will be completed before or during 2017. Therefore, the design horizon year is 2017.

2. A level-of-service analysis of 2017 background conditions without project generated traffic concluded that the intersection of Piilani Highway at Ohukai Road should be improved. The following improvements are recommended to accommodate background growth and traffic generated by the related projects:

    a. The eastbound approach should be modified to provide an additional separate left turn lane.

    b. The westbound approach should be modified to provide an additional separate left turn lane.

    c. The southbound approach should be modified to provide and additional separate left turn or thru lane.

3. The trip generation analysis estimated that the project will generate a total of 103 trips during the morning peak hour and 127 trips during the afternoon peak hour.

4. The level-of-service analysis of the signalized intersections along Piilani Highway concluded that project generated traffic has a negligible impact on intersection. There is no change in the level-of-service of the overall intersections or any lane groups as a result of project generated traffic. Several of the side street approach and/or left turn from Piilani Highway will operate at Level-of-Service E or F, but these movements will have low volume-to-capacity ratios. Adding green time to these movements did not change the levels-of-service, indicating that the low levels-of-service are the result of the traffic signal cycle length.

5. The level-of-service analysis of the intersection of South Kihei Road at Kaonoulu Street concluded that project generated traffic has a negligible impact on this intersection. There is no change in the level-of-service of the overall intersection or any lane groups as a result of project generated traffic. All lane groups will operate at Level-of-Service C, or better, without and with project traffic.

6. The level-of-service analysis of the unsignalized intersections of Kaonoulu Street at Kenolio Road and Kaonoulu Street at Alulike Street concluded that all lane groups will operate at Level-of-Service C, or better, without and with project traffic.

7. A level-of-service analysis of the project's driveways along Kenolio Road concluded that all lane groups will operate at Level-of-Service A as unsignalized intersections. No separate left turn lanes will be required at the driveways. It was also assumed that all the driveways will be one lane wide.

8. The traffic study for Piilani Promenade, which will be located along the east side of Piilani Highway and across from the study project, will not be completed for several months, and then there will be the delay while the report is being reviewed by State of Hawaii Department of Transportation. Piilani Promenade will not be completed before 2018, one year after the design year for Kenolio Apartments. Primary access to and egress from Piilani Promenade will be via the intersection of Piilani Highway at Kaonoulu Street. Attachment Y is a schematic drawing of this intersection as currently planned to accommodate traffic generated by Piilani Promenade.

Respectfully submitted,
PHILLIP ROWELL AND ASSOCIATES

Phillip J. Rowell, P.E.
Principal

PHILLIP JAMES ROWELL
LICENSED PROFESSIONAL ENGINEER
No. 6676 - C
HAWAII U.S.A.

EXPIRATION DATE: 30 APRIL 2016

THIS WORK WAS PREPARED BY
ME OR UNDER MY DIRECT SUPERVISION

List of Attachments

A. Project Location Map

B. Preliminary Site Plan

C. Existing Intersection Lane Configurations and Right-of-Way Controls

D. Traffic Count Worksheets

E. Existing (2013) Peak Hour Traffic Volumes

F. Existing (2013) Peak Hour Traffic Volumes

G. Level-of-Service Worksheets for 2013 Traffic Volumes - AM Peak Hour

H. Level-of-Service Worksheets for 2013 Traffic Volumes - PM Peak Hour

I. 2017 AM Peak Hour Traffic Projections without Project Generated Traffic

J. 2017 PM Peak Hour Traffic Projections without Project Generated Traffic

K. Level-of-Service Worksheets for 2017 Background Traffic Projections without Project Generated Traffic Without Mitigation - AM Peak Hour

L. Level-of-Service Worksheets for 2017 Background Traffic Projections without Project Generated Traffic Without Mitigation - PM Peak Hour

M. Level-of-Service Worksheets for 2017 Background Traffic Projections without Project Generated Traffic With Mitigation - AM Peak Hour

N. Level-of-Service Worksheets for 2017 Background Traffic Projections without Project Generated Traffic With Mitigation - PM Peak Hour

O. 2017 Lane Configurations and Right-of-Way Controls Without Mitigation

P. 2017 Lane Configurations and Right-of-Way Controls With Mitigation

Q. Inbound Project Trip Distribution

R. Outbound Project Trip Distribution

S. Project Trip Assignments - AM Peak Hour

T. Project Trip Assignments - PM Peak Hour

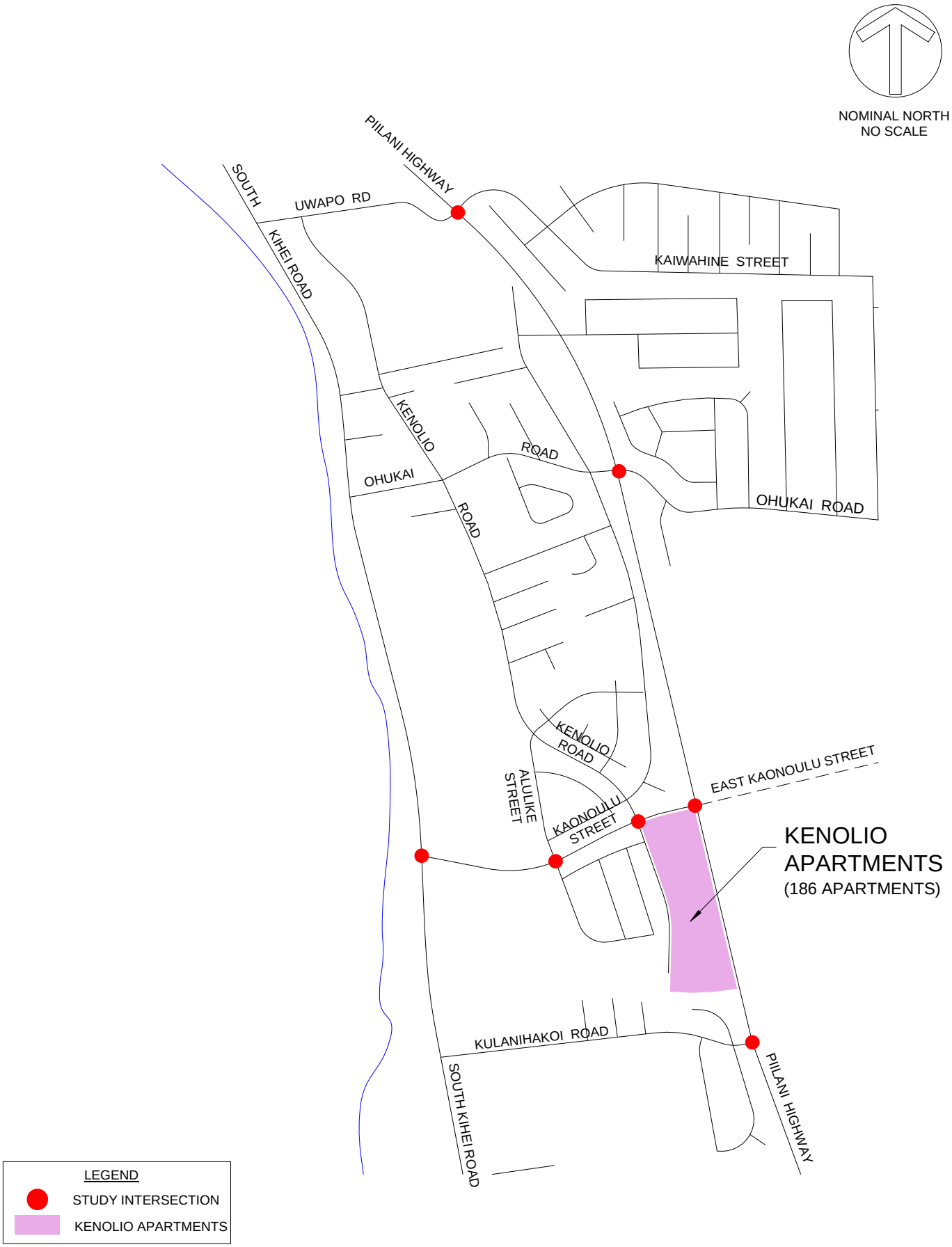
U. 2017 AM Peak Hour Traffic Projections with Project Generated Traffic

V. 2017 PM Peak Hour Traffic Projections with Project Generated Traffic

W. Level-of-Service Worksheets for 2017 Background Traffic Projections with Project Generated Traffic - AM Peak Hour

X. Level-of-Service Worksheets for 2017 Background Traffic Projections with Project Generated Traffic - PM Peak Hour

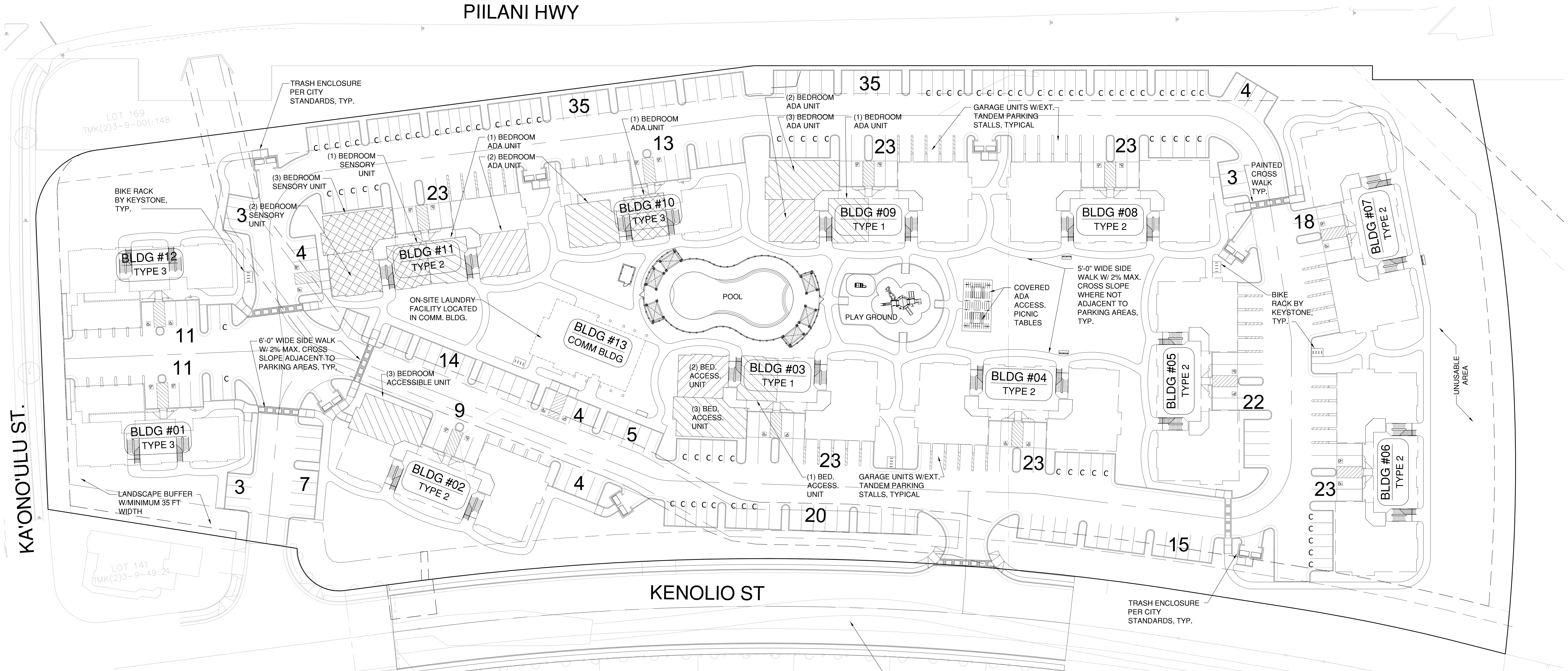
Y. Schematic Drawing of Piilani Highway at Kaonoulu Street With Piilani Promenade



Attachment A
PROJECT LOCATION

Phillip Rowell and Associates

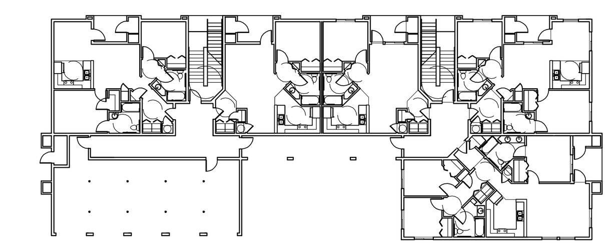
Attachment B
Preliminary Site Plan
(Provided By Others)



SITE PLAN

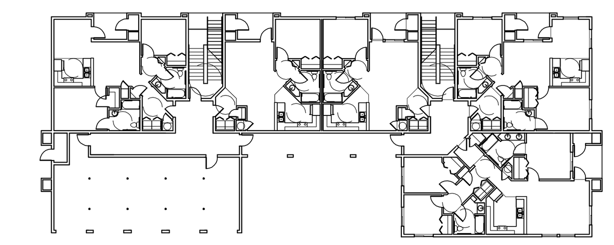
SCALE: 1" = 40'-0"

BLDG. TYPE 1



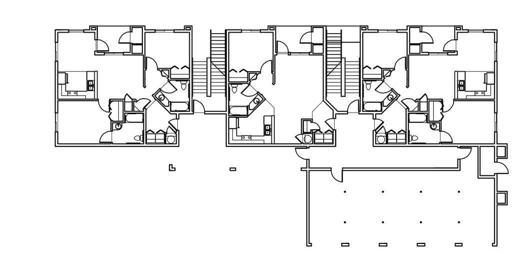
BUILDING TYPE 1 - (17) 1,2 & 3 BDRM UNITS
(2) BUILDINGS TOTAL
FOOTPRINT - 7,504 S.F.
MAXIMUM HEIGHT - 39'-0"±
(3) STORIES - MULTIFAMILY RESIDENTIAL
OCCUPANCY R-2 , FULLY SPRINKLERED PER NFPA 13-R
CONSTRUCTION TYPE: VB

BLDG. TYPE 2



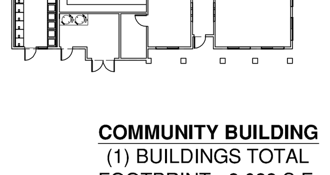
BUILDING TYPE 2 - (17) 1, 2 & 3 BDRM UNITS
(7) BUILDINGS TOTAL
FOOTPRINT - 7,504 S.F.
MAXIMUM HEIGHT - 39'-0"±
(3) STORIES - MULTIFAMILY RESIDENTIAL
OCCUPANCY R-2 , FULLY SPRINKLERED PER NFPA 13-R
CONSTRUCTION TYPE: VB

BLDG. TYPE 3



BUILDING TYPE 3 - (11)1, 2 & 3 BDRM UNITS
(3) BUILDINGS TOTAL
FOOTPRINT - 5,249 S.F.
MAXIMUM HEIGHT - 39'-0"±
(3) STORIES - MULTIFAMILY RESIDENTIAL
OCCUPANCY R-2 , FULLY SPRINKLERED PER NFPA 13-R
CONSTRUCTION TYPE: VB

COMMUNITY BUILDING



COMMUNITY BUILDING
(1) BUILDINGS TOTAL
FOOTPRINT - 3,033 S.F.
MAXIMUM HEIGHT - 35'-0"±
(1) STORY - OCCUPANCY B
FULLY SPRINKLERED PER NFPA 13-R
CONSTRUCTION TYPE: VB

PROJECT SITE

VICINITY MAP

N.T.S.

WEATHERED CEDAR DISTRESSED WOOD MONUMENT SIGN PER OWNER SPEC. (MIN. SIGN AREA 16 S.F.)

NOTE: MOUNT SECOND SIGN TO OPPOSITE SIDE OF 4 X 4 P.T. POST TO CREATE A TWO SIDED SIGN, SEE SITE PLAN FOR LOCATION AND ORIENTATION

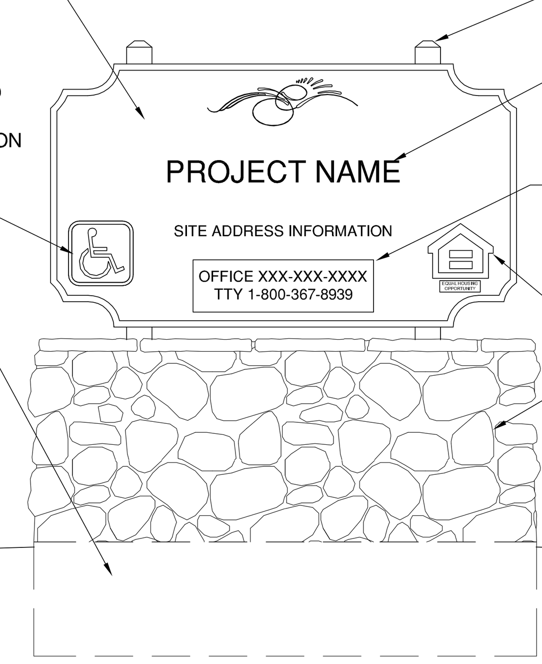
ACCESSIBLE SIGN LOGO (MIN. 5% SIGN AREA), HIGH CONTRAST

REINFORCED CONC. FOOTING

NOTE:
MONUMENT SIGNAGE TO BE UNDER SEPARATE PERMIT.

G.C. TO VERIFY MONUMENT SIGN DESIGN, LOCATION AND PROJECT NAME W/ OWNER PRIOR TO INSTALLATION. G.C. RESPONSIBLE FOR SUBMITTING AND OBTAINING ANY SIGN PERMITS AS REQUIRED BY LOCAL JURISDICTIONAL REQUIREMENTS

ALL LOGOS AND TEXT TO BE HIGH CONTRAST TO BACKGROUNDS.



BEVELED CAP, (2) 4x4 P.T. POST SECURED TO BASE

SEE TITLEBLOCK FOR PROJECT NAME, FONT TYPE AND SIZE BY OWNER

METAL PLACARD BY OWNER, TEXT WILL SHOW OFFICE TELEPHONE NUMBER AND TTY TELEPHONE NUMBER AS SHOWN

FAIR HOUSING LOGO (MIN. 5% SIGN AREA), HIGH CONTRAST

NATURAL STONE BASE "RIVERROCK" STYLE OR EQUAL TO MATCH ENTRY ELEMENT BASE AT BUILDING. INSTALL OVER SCRATCH COAT CEMENT STUCCO W/ APPROVED ANCHORS ON CONC. BASE AND FOUNDATION

1 / A1.1 MONUMENT SIGN

SCALE: 1/2"=1'-0"

APPLICANT
MAUI PACIFIC ASSOCIATES
DON SLATTERY
430 E. STATE STREET, SUITE 100
EAGLE, IDAHO 83616
(208)-461-0022 X3023

ACCESSIBILITY	# OF UNITS	PERCENTAGE
SECOND & THIRD FLOOR UNITS	118	63.44%
ADAPTABLE UNITS (ALL GROUND FLOOR UNITS REQ.)	54	29.03%
ACCESSIBLE UNITS (5% TOTAL)	10	5.38%
SENSORY IMPAIRED UNITS (2% TOTAL)	4	2.15%
TOTAL UNITS	186	100%

UNIT MIX SUMMARY	SQ. FOOTAGES	PERCENTAGE
(63) 1-BEDROOM UNITS	(63) X 679 S.F. = 42,777 S.F.	(33.87% OF TOTAL)
(72) 2-BEDROOM UNITS	(72) X 908 S.F. = 65,376 S.F.	(38.71% OF TOTAL)
(28) 2-BEDROOM UNITS	(28) X 1060 S.F.= 29,680 S.F.	(15.05% OF TOTAL)
(23) 3-BEDROOM UNITS	(23) X 1,141 S.F. = 26,243 S.F.	(12.37% OF TOTAL)
(186) UNITS TOTAL	42,777 S.F. + 65,376 S.F. + 29,680 + 26,243 = 164,076 S.F.	
TOTAL	164,076 S.F.	

PARKING STALLS REQUIRED: 186 X 2 (DWELLING UNITS) + 6 (COMM. BLDG.) = 378 STALLS
PARKING STALLS PROVIDED: 378 STALLS

COMPACT STALLS ALLOW (25%): 378 X 0.25 = 94.5 STALLS / COMPACT STALLS PROVIDED: 94 STALLS

ADA STALLS REQUIRED (PER TABLE 1106.1): 6 STALLS / ADA STALLS PROVIDED: 26 STALLS

SITE AREA / LOT COVERAGE / FAR CALCULATIONS

SITE AREA: 5.171 ACRES (LOT 1) + 3.103 ACRES (LOT 2) = 8.274 ACRES OR 8.274 ACRES X 43,560 SF = 360,415 SF

ALLOWABLE LOT COVERAGE: 25% OR 360,418 SF X 0.25 = 90,105 SF
ALLOWABLE FAR COVERAGE: 40% OR 360,418 SF X 0.40 = 144,167 SF

BUILDING LOT COVERAGE BY BUILDING TYPE & TOTAL LOT COVERAGE:

BUILDING TYPE #1: (2) BUILDINGS X 7504 SF = 15,008 SF
BUILDING TYPE #2: (7) BUILDINGS X 7504 SF = 52,528 SF
BUILDING TYPE #3: (3) BUILDINGS X 5249 SF = 15,747 SF
COMMUNITY BLDG: (1) BUILDING X 3033 SF = 3,033 SF
TOTAL LOT COVERAGE BY BUILDINGS 86,316 SF

FAR LOT COVERAGE BY BUILDING TYPE & TOTAL FAR LOT COVERAGE:

BUILDING TYPE #1: (2) BUILDINGS X 22,458 SF = 44,916 SF
BUILDING TYPE #2: (7) BUILDINGS X 22,166 SF = 155,162 SF
BUILDING TYPE #3: (3) BUILDINGS X 15,693 SF = 47,079 SF
COMMUNITY BLDG: (1) BUILDING X 3033 SF = 3,033 SF
TOTAL FAR LOT COVERAGE BY BUILDINGS 250,190 SF

REVISIONS

COPYRIGHT DATE
04/02/14

DRAWN BY
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PROJECT #
PWH12-37

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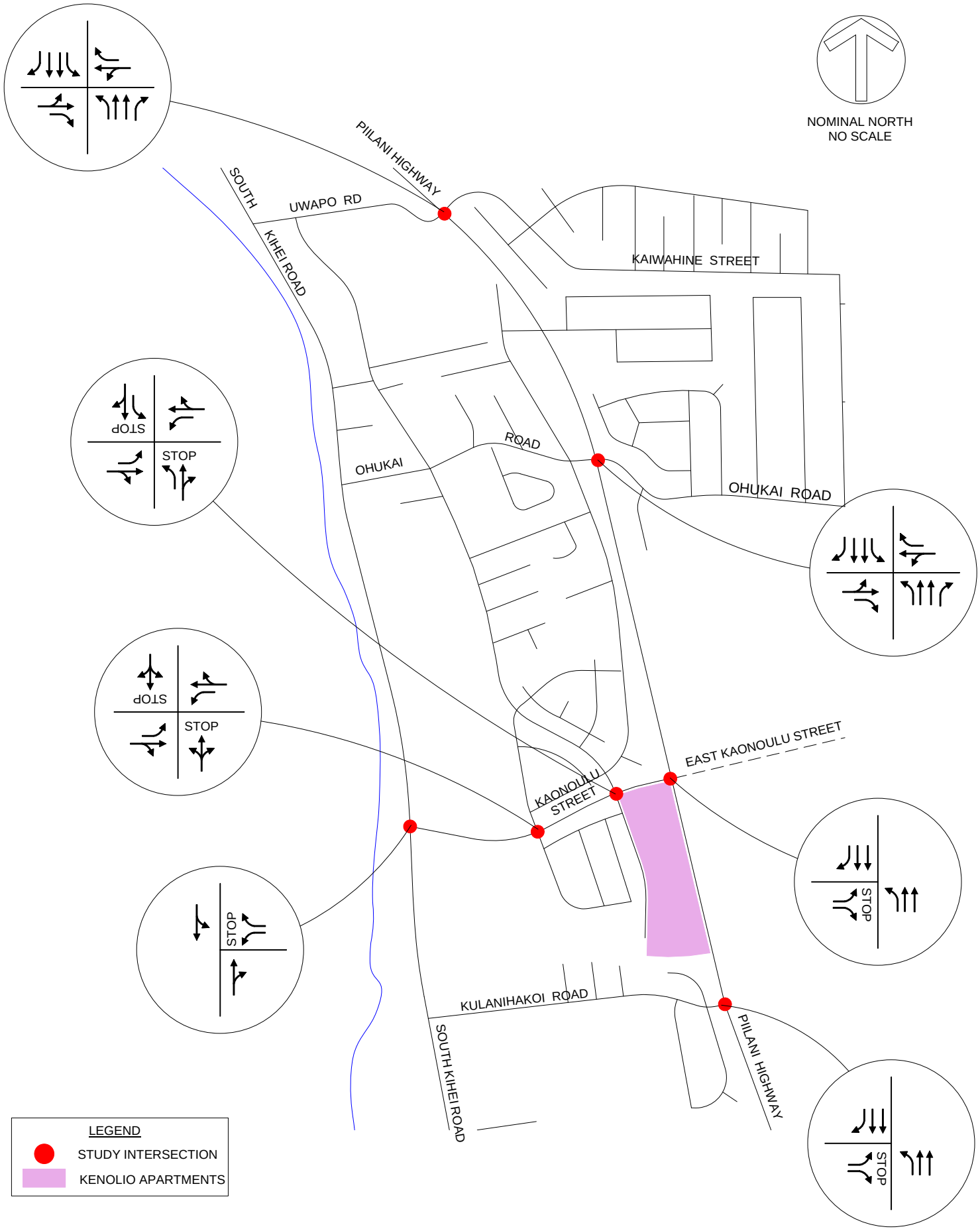
ALASKA - ARIZONA - CALIFORNIA - COLORADO - HAWAII - IDAHO - LOUISIANA - MONTANA - NEVADA - NORTH DAKOTA - OREGON - SOUTH DAKOTA - U.S.V.I. - UTAH - WASHINGTON - WYOMING

PROJECT
KENOLIO APARTMENTS

PROJECT ADDRESS
MAUI, HAWAII

A1.1

SCHEMATIC SET / NOT FOR CONSTRUCTION



Attachment C
EXISTING LANE CONFIGURATIONS AND RIGHT-OF-WAY CONTROLS

Phillip Rowell and Associates

Attachment D
Traffic Count Worksheets

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT: Kenolio Apartments
INTERSECTION: Piilani Highway at Ohukai Street
DAY & DATE: Thursday, May 9, 2013
START TIME: 6:00 am
END TIME: 9:00 am

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	6:00 am	3	149	20	20	5	23	3	121	0	3	8	12	367
2	6:15 am	7	202	15	26	6	30	1	136	6	6	10	12	457
3	6:30 am	8	254	19	35	5	35	2	183	4	12	13	30	600
4	6:45 am	10	282	32	38	2	26	12	218	3	23	17	29	692
5	7:00 am	8	230	25	54	8	40	5	257	11	19	16	26	699
6	7:15 am	5	228	30	49	11	50	6	201	7	27	20	16	650
7	7:30 am	8	438	45	42	14	57	12	332	6	32	34	21	1041
8	7:45 am	16	363	51	51	11	65	11	227	4	15	23	15	852
9	8:00 am	7	282	31	45	7	51	5	199	6	21	8	23	685
10	8:15 am	13	280	40	39	8	37	12	253	9	11	23	18	743
11	8:30 am	12	280	28	35	10	34	13	250	10	13	12	16	713
12	8:45 am	11	224	38	24	14	37	7	185	4	19	15	14	592
13	9:00 am													0
14	9:15 am													0
	Maximum:	16	438	51	51	14	65	12	332	9	32	34	23	1041

Hourly Volume of Each Movement

6:00 am	7:00 am	28	887	86	119	18	114	18	658	13	44	48	83	2116
6:15 am	7:15 am	33	968	91	153	21	131	20	794	24	60	56	97	2448
6:30 am	7:30 am	31	994	106	176	26	151	25	859	25	81	66	101	2641
6:45 am	7:45 am	31	1178	132	183	35	173	35	1008	27	101	87	92	3082
7:00 am	8:00 am	37	1259	151	196	44	212	34	1017	28	93	93	78	3242
7:15 am	8:15 am	36	1311	157	187	43	223	34	959	23	95	85	75	3228
7:30 am	8:30 am	44	1363	167	177	40	210	40	1011	25	79	88	77	3321
7:45 am	8:45 am	48	1205	150	170	36	187	41	929	29	60	66	72	2993
8:00 am	9:00 am	43	1066	137	143	39	159	37	887	29	64	58	71	2733
8:15 am	9:15 am													
8:30 am	9:30 am													
Peak Hour Volume		44	1363	167	177	40	210	40	1011	25	79	88	77	3321
Per Cent of Approach		3%	87%	11%	41%	9%	49%	4%	94%	2%	32%	36%	32%	
Peak Hour Factor:		0.69	0.78	0.82	0.87	0.71	0.81	0.83	0.76	0.69	0.62	0.65	0.84	0.8
Total Arrivals			1574			427			1076			244		
Total Departures			1265			295			1652			109		
Total			2839			722			2728			353		

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT: Kenolio Apartments
INTERSECTION: Piilani Highway at Ohukai Street
DAY & DATE: Thursday, May 9, 2013
START TIME: 3:00 pm
END TIME: 6:00 pm

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	3:00 pm	10	325	21	41	14	62	10	268	21	11	14	15	812
2	3:15 pm	12	269	32	35	13	43	12	234	21	11	14	17	713
3	3:30 pm	11	301	39	42	11	49	11	321	20	10	9	17	841
4	3:45 pm	11	297	37	40	22	59	11	313	30	19	14	24	877
5	4:00 pm	14	361	27	37	13	45	14	356	23	21	16	17	944
6	4:15 pm	22	324	37	44	15	46	22	346	18	19	23	23	939
7	4:30 pm	9	290	37	47	16	54	9	364	33	22	23	24	928
8	4:45 pm	11	263	25	47	14	55	11	264	26	17	25	20	778
9	5:00 pm	17	308	35	53	16	70	17	295	22	25	24	17	899
10	5:15 pm	14	340	29	33	15	48	14	322	26	17	18	10	886
11	5:30 pm	12	245	32	27	11	33	12	175	15	9	11	18	600
12	5:45 pm	13	286	30	29	13	38	13	250	22	9	16	20	739
13	6:00 pm													0
14	6:15 pm													0
	Maximum:	22	361	37	47	22	59	22	364	33	22	23	24	944

Hourly Volume of Each Movement

3:00 pm	4:00 pm	44	1192	129	158	60	213	44	1136	92	51	51	73	3243
3:15 pm	4:15 pm	48	1228	135	154	59	196	48	1224	94	61	53	75	3375
3:30 pm	4:30 pm	58	1283	140	163	61	199	58	1336	91	69	62	81	3601
3:45 pm	4:45 pm	56	1272	138	168	66	204	56	1379	104	81	76	88	3688
4:00 pm	5:00 pm	56	1238	126	175	58	200	56	1330	100	79	87	84	3589
4:15 pm	5:15 pm	59	1185	134	191	61	225	59	1269	99	83	95	84	3544
4:30 pm	5:30 pm	51	1201	126	180	61	227	51	1245	107	81	90	71	3491
4:45 pm	5:45 pm	54	1156	121	160	56	206	54	1056	89	68	78	65	3163
5:00 pm	6:00 pm	56	1179	126	142	55	189	56	1042	85	60	69	65	3124
5:15 pm	6:15 pm													
5:30 pm	6:30 pm													
Peak Hour Volume		56	1272	138	168	66	204	56	1379	104	81	76	88	3688
Per Cent of Approach		4%	87%	9%	38%	15%	47%	4%	90%	7%	33%	31%	36%	
Peak Hour Factor:		0.64	0.88	0.93	0.89	0.75	0.86	0.64	0.95	0.79	0.92	0.83	0.92	0.98

Total Arrivals	1466	438	1539	245
Total Departures	1635	270	1557	226
Total	3101	708	3096	471

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT: Kenolio Apartments
INTERSECTION: Piilani Highway at Kaiwahine Street and Uwapo Road
DAY & DATE: Friday, May 10, 2013
START TIME: 6:00 am
END TIME: 9:00 am

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	6:00 am	1	136	5	8	0	7	1	126	1	12	0	7	304
2	6:15 am	4	217	7	6	1	15	8	171	7	21	6	19	482
3	6:30 am	5	221	8	9	4	17	13	245	1	33	3	18	577
4	6:45 am	1	185	7	8	2	16	7	231	1	27	4	20	509
5	7:00 am	5	272	6	23	7	17	10	355	2	44	7	37	785
6	7:15 am	4	274	12	20	5	9	15	310	5	32	3	43	732
7	7:30 am	6	339	5	25	9	19	6	328	5	18	2	29	791
8	7:45 am	6	292	6	16	5	8	15	234	5	12	3	29	631
9	8:00 am	2	380	10	19	5	3	14	254	11	25	5	23	751
10	8:15 am	4	239	10	13	2	16	9	243	1	12	0	22	571
11	8:30 am	2	223	8	8	6	13	9	260	6	23	2	16	576
12	8:45 am	4	227	12	9	1	10	6	256	9	23	4	16	577
13	9:00 am													0
14	9:15 am													0
	Maximum:	6	339	12	25	9	19	15	355	5	44	7	43	791

Hourly Volume of Each Movement

6:00 am	7:00 am	11	759	27	31	7	55	29	773	10	93	13	64	1872
6:15 am	7:15 am	15	895	28	46	14	65	38	1002	11	125	20	94	2353
6:30 am	7:30 am	15	952	33	60	18	59	45	1141	9	136	17	118	2603
6:45 am	7:45 am	16	1070	30	76	23	61	38	1224	13	121	16	129	2817
7:00 am	8:00 am	21	1177	29	84	26	53	46	1227	17	106	15	138	2939
7:15 am	8:15 am	18	1285	33	80	24	39	50	1126	26	87	13	124	2905
7:30 am	8:30 am	18	1250	31	73	21	46	44	1059	22	67	10	103	2744
7:45 am	8:45 am	14	1134	34	56	18	40	47	991	23	72	10	90	2529
8:00 am	9:00 am	12	1069	40	49	14	42	38	1013	27	83	11	77	2475
8:15 am	9:15 am													
8:30 am	9:30 am													
Peak Hour Volume		21	1177	29	84	26	53	46	1227	17	106	15	138	2939
Per Cent of Approach		2%	96%	2%	52%	16%	33%	4%	95%	1%	41%	6%	53%	
Peak Hour Factor:		0.88	0.87	0.6	0.84	0.72	0.7	0.77	0.86	0.85	0.6	0.54	0.8	0.93
Total Arrivals			1227			163			1290			259		
Total Departures			1449			90			1336			64		
Total			2676			253			2626			323		

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT: Kenolio Apartments
INTERSECTION: Piilani Highway at Kaiwahine Street and Uwapo Road
DAY & DATE: Friday, May 10, 2013
START TIME: 3:00 pm
END TIME: 6:00 pm

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	3:00 pm	10	297	16	12	3	5	15	266	12	13	3	15	667
2	3:15 pm	15	332	17	10	4	7	13	317	7	19	4	20	765
3	3:30 pm	14	313	21	15	6	6	12	317	13	12	0	15	744
4	3:45 pm	14	327	24	14	8	5	27	326	11	12	1	23	792
5	4:00 pm	13	348	18	16	8	8	27	346	9	25	2	16	836
6	4:15 pm	20	339	23	15	15	7	24	382	14	21	4	21	885
7	4:30 pm	17	329	15	8	8	3	16	370	14	21	5	18	824
8	4:45 pm	19	306	13	13	18	11	18	315	6	18	3	18	758
9	5:00 pm	14	320	20	14	17	10	30	277	8	17	3	19	749
10	5:15 pm	15	331	17	19	16	6	20	307	12	20	3	11	777
11	5:30 pm	14	282	14	15	9	9	11	236	9	20	4	15	638
12	5:45 pm	17	295	22	13	11	7	15	213	5	16	6	15	635
13	6:00 pm													0
14	6:15 pm													0
	Maximum:	20	348	24	16	15	8	27	382	14	25	5	23	885

Hourly Volume of Each Movement

3:00 pm	4:00 pm	53	1269	78	51	21	23	67	1226	43	56	8	73	2968
3:15 pm	4:15 pm	56	1320	80	55	26	26	79	1306	40	68	7	74	3137
3:30 pm	4:30 pm	61	1327	86	60	37	26	90	1371	47	70	7	75	3257
3:45 pm	4:45 pm	64	1343	80	53	39	23	94	1424	48	79	12	78	3337
4:00 pm	5:00 pm	69	1322	69	52	49	29	85	1413	43	85	14	73	3303
4:15 pm	5:15 pm	70	1294	71	50	58	31	88	1344	42	77	15	76	3216
4:30 pm	5:30 pm	65	1286	65	54	59	30	84	1269	40	76	14	66	3108
4:45 pm	5:45 pm	62	1239	64	61	60	36	79	1135	35	75	13	63	2922
5:00 pm	6:00 pm	60	1228	73	61	53	32	76	1033	34	73	16	60	2799
5:15 pm	6:15 pm													
5:30 pm	6:30 pm													
Peak Hour Volume		64	1343	80	53	39	23	94	1424	48	79	12	78	3337
Per Cent of Approach		4%	90%	5%	46%	34%	20%	6%	91%	3%	47%	7%	46%	
Peak Hour Factor:		0.8	0.96	0.83	0.83	0.65	0.72	0.87	0.93	0.86	0.79	0.6	0.85	0.94

Total Arrivals	1487	115	1566	169
Total Departures	1555	186	1445	151
Total	3042	301	3011	320

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT: Kenolio Apartments
INTERSECTION: Piilani Highway at Kaonoulu Street
DAY & DATE: Thursday, May 16, 2013
START TIME: 6:00 am
END TIME: 9:00 am

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	6:00 am	1	129						131	8	14		2	285
2	6:15 am	1	254						138	4	17		3	417
3	6:30 am	1	253						211	5	29		7	506
4	6:45 am	2	285						237	12	30		9	575
5	7:00 am	6	316						344	8	43		10	727
6	7:15 am	3	285						226	8	51		6	579
7	7:30 am	4	455						380	25	77		15	956
8	7:45 am	4	366						232	18	36		7	663
9	8:00 am	7	356						259	16	32		2	672
10	8:15 am	4	343						251	9	36		7	650
11	8:30 am	6	268						227	8	28		5	542
12	8:45 am	5	303						236	9	37		3	593
13	9:00 am													0
14	9:15 am													0
	Maximum:	7	455						380	25	77		15	956

Hourly Volume of Each Movement

6:00 am	7:00 am	5	921	0	0	0	0	0	717	29	90	0	21	1783
6:15 am	7:15 am	10	1108	0	0	0	0	0	930	29	119	0	29	2225
6:30 am	7:30 am	12	1139	0	0	0	0	0	1018	33	153	0	32	2387
6:45 am	7:45 am	15	1341	0	0	0	0	0	1187	53	201	0	40	2837
7:00 am	8:00 am	17	1422	0	0	0	0	0	1182	59	207	0	38	2925
7:15 am	8:15 am	18	1462	0	0	0	0	0	1097	67	196	0	30	2870
7:30 am	8:30 am	19	1520	0	0	0	0	0	1122	68	181	0	31	2941
7:45 am	8:45 am	21	1333	0	0	0	0	0	969	51	132	0	21	2527
8:00 am	9:00 am	22	1270	0	0	0	0	0	973	42	133	0	17	2457
8:15 am	9:15 am													
8:30 am	9:30 am													
Peak Hour Volume		19	1520	0	0	0	0	0	1122	68	181	0	31	2941
Per Cent of Approach		1%	99%	0%	0%	0%	0%	0%	94%	6%	85%	0%	15%	
Peak Hour Factor:		0.68	0.84	0	0	0	0	0	0.74	0.68	0.59	0	0.52	0.77

Total Arrivals	1539	0	1190	212
Total Departures	1153	0	1701	87
Total	2692	0	2891	299

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT: Kenolio Apartments
INTERSECTION: Piilani Highway at Kaonoulu Street
DAY & DATE: Thursday, May 16, 2013
START TIME: 3:00 pm
END TIME: 6:00 pm

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	3:00 pm	12	320						359	22	29		4	746
2	3:15 pm	13	334						381	23	29		8	788
3	3:30 pm	10	381						401	20	25		5	842
4	3:45 pm	10	375						329	23	33		6	776
5	4:00 pm	7	335						380	22	28		4	776
6	4:15 pm	13	383						426	27	40		5	894
7	4:30 pm	11	334						357	29	22		5	758
8	4:45 pm	12	362						334	23	41		3	775
9	5:00 pm	6	366						414	20	38		9	853
10	5:15 pm	10	257						268	17	21		3	576
11	5:30 pm	9	288						232	22	28		6	585
12	5:45 pm	8	325						258	14	30		2	637
13	6:00 pm													0
14	6:15 pm													0
	Maximum:	13	383						426	27	40		6	894

Hourly Volume of Each Movement

3:00 pm	4:00 pm	45	1410	0	0	0	0	0	1470	88	116	0	23	3152
3:15 pm	4:15 pm	40	1425	0	0	0	0	0	1491	88	115	0	23	3182
3:30 pm	4:30 pm	40	1474	0	0	0	0	0	1536	92	126	0	20	3288
3:45 pm	4:45 pm	41	1427	0	0	0	0	0	1492	101	123	0	20	3204
4:00 pm	5:00 pm	43	1414	0	0	0	0	0	1497	101	131	0	17	3203
4:15 pm	5:15 pm	42	1445	0	0	0	0	0	1531	99	141	0	22	3280
4:30 pm	5:30 pm	39	1319	0	0	0	0	0	1373	89	122	0	20	2962
4:45 pm	5:45 pm	37	1273	0	0	0	0	0	1248	82	128	0	21	2789
5:00 pm	6:00 pm	33	1236	0	0	0	0	0	1172	73	117	0	20	2651
5:15 pm	6:15 pm													
5:30 pm	6:30 pm													
Peak Hour Volume		40	1474	0	0	0	0	0	1536	92	126	0	20	3288
Per Cent of Approach		3%	97%	0%	0%	0%	0%	0%	94%	6%	86%	0%	14%	
Peak Hour Factor:		0.77	0.96	0	0	0	0	0	0.9	0.85	0.79	0	0.83	0.92
Total Arrivals			1514			0			1628			146		
Total Departures			1556			0			1600			132		
Total			3070			0			3228			278		

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT: Kenolio Apartments
INTERSECTION: South Kihei Road at Kaonoulu Street
DAY & DATE: Thursday, May 16, 2013
START TIME: 6:00 am
END TIME: 9:00 am

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	6:00 am		32	0	7		6	4	59					108
2	6:15 am		40	1	8		5	5	74					133
3	6:30 am		77	4	5		9	7	124					226
4	6:45 am		69	5	12		10	6	105					207
5	7:00 am		59	4	8		14	8	108					201
6	7:15 am		93	3	6		22	16	158					298
7	7:30 am		80	1	9		18	14	99					221
8	7:45 am		87	4	4		17	13	142					267
9	8:00 am		99	0	9		11	16	96					231
10	8:15 am		93	5	6		8	19	106					237
11	8:30 am		82	3	4		12	15	116					232
12	8:45 am		66	2	6		11	18	88					191
13	9:00 am													0
14	9:15 am													0
	Maximum:		99	4	9		22	16	158					298

Hourly Volume of Each Movement

6:00 am	7:00 am	0	218	10	32	0	30	22	362	0	0	0	0	674
6:15 am	7:15 am	0	245	14	33	0	38	26	411	0	0	0	0	767
6:30 am	7:30 am	0	298	16	31	0	55	37	495	0	0	0	0	932
6:45 am	7:45 am	0	301	13	35	0	64	44	470	0	0	0	0	927
7:00 am	8:00 am	0	319	12	27	0	71	51	507	0	0	0	0	987
7:15 am	8:15 am	0	359	8	28	0	68	59	495	0	0	0	0	1017
7:30 am	8:30 am	0	359	10	28	0	54	62	443	0	0	0	0	956
7:45 am	8:45 am	0	361	12	23	0	48	63	460	0	0	0	0	967
8:00 am	9:00 am	0	340	10	25	0	42	68	406	0	0	0	0	891
8:15 am	9:15 am													
8:30 am	9:30 am													
Peak Hour Volume		0	359	8	28	0	68	59	495	0	0	0	0	1017
Per Cent of Approach		0%	98%	2%	29%	0%	71%	11%	89%	0%	0%	0%	0%	
Peak Hour Factor:		0	0.91	0.5	0.78	0	0.77	0.92	0.78	0	0	0	0	0.85

Total Arrivals	367	96	554	0
Total Departures	523	67	427	0
Total	890	163	981	0

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT: Kenolio Apartments
INTERSECTION: South Kihei Road at Kaonoulu Street
DAY & DATE: Thursday, May 16, 2013
START TIME: 3:00 pm
END TIME: 6:00 pm

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	3:00 pm		145	8	10		10	19	133					325
2	3:15 pm		116	3	4		13	23	127					286
3	3:30 pm		109	9	4		14	33	115					284
4	3:45 pm		131	8	8		9	32	140					328
5	4:00 pm		103	4	11		21	24	125					288
6	4:15 pm		135	7	5		21	23	119					310
7	4:30 pm		82	9	7		11	31	138					278
8	4:45 pm		148	10	7		9	31	127					332
9	5:00 pm		118	17	4		15	33	110					297
10	5:15 pm		149	10	6		14	30	126					335
11	5:30 pm		130	5	5		13	21	90					264
12	5:45 pm		98	2	7		11	22	104					244
13	6:00 pm													0
14	6:15 pm													0
	Maximum:		149	17	7		15	33	138					335

Hourly Volume of Each Movement

3:00 pm	4:00 pm	0	501	28	26	0	46	107	515	0	0	0	0	1223
3:15 pm	4:15 pm	0	459	24	27	0	57	112	507	0	0	0	0	1186
3:30 pm	4:30 pm	0	478	28	28	0	65	112	499	0	0	0	0	1210
3:45 pm	4:45 pm	0	451	28	31	0	62	110	522	0	0	0	0	1204
4:00 pm	5:00 pm	0	468	30	30	0	62	109	509	0	0	0	0	1208
4:15 pm	5:15 pm	0	483	43	23	0	56	118	494	0	0	0	0	1217
4:30 pm	5:30 pm	0	497	46	24	0	49	125	501	0	0	0	0	1242
4:45 pm	5:45 pm	0	545	42	22	0	51	115	453	0	0	0	0	1228
5:00 pm	6:00 pm	0	495	34	22	0	53	106	430	0	0	0	0	1140
5:15 pm	6:15 pm													
5:30 pm	6:30 pm													
Peak Hour Volume		0	497	46	24	0	49	125	501	0	0	0	0	1242
Per Cent of Approach		0%	92%	8%	33%	0%	67%	20%	80%	0%	0%	0%	0%	
Peak Hour Factor:		0	0.83	0.68	0.86	0	0.82	0.95	0.91	0	0	0	0	0.93

Total Arrivals	543	73	626	0
Total Departures	525	171	546	0
Total	1068	244	1172	0

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT: Kenolio Apartments
INTERSECTION: Piilani Highway at Kulanihakoi Street
DAY & DATE: Tuesday, May 14, 2013
START TIME: 6:00 am
END TIME: 9:00 am

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	6:00 am	1	189						104	0	11		6	311
2	6:15 am	0	251						167	3	13		9	443
3	6:30 am	5	265						184	4	20		19	497
4	6:45 am	10	303						216	2	18		10	559
5	7:00 am	6	420						316	6	28		17	793
6	7:15 am	6	511						366	5	28		11	927
7	7:30 am	10	480						302	2	31		13	838
8	7:45 am	14	415						313	18	37		8	805
9	8:00 am	17	362						235	21	41		11	687
10	8:15 am	15	398						266	7	32		14	732
11	8:30 am	7	282						270	9	25		9	602
12	8:45 am	8	309						250	12	23		9	611
13	9:00 am													0
14	9:15 am													0
	Maximum:	14	511						366	18	37		17	927

Hourly Volume of Each Movement

6:00 am	7:00 am	16	1008	0	0	0	0	0	671	9	62	0	44	1810
6:15 am	7:15 am	21	1239	0	0	0	0	0	883	15	79	0	55	2292
6:30 am	7:30 am	27	1499	0	0	0	0	0	1082	17	94	0	57	2776
6:45 am	7:45 am	32	1714	0	0	0	0	0	1200	15	105	0	51	3117
7:00 am	8:00 am	36	1826	0	0	0	0	0	1297	31	124	0	49	3363
7:15 am	8:15 am	47	1768	0	0	0	0	0	1216	46	137	0	43	3257
7:30 am	8:30 am	56	1655	0	0	0	0	0	1116	48	141	0	46	3062
7:45 am	8:45 am	53	1457	0	0	0	0	0	1084	55	135	0	42	2826
8:00 am	9:00 am	47	1351	0	0	0	0	0	1021	49	121	0	43	2632
8:15 am	9:15 am													
8:30 am	9:30 am													
Peak Hour Volume		36	1826	0	0	0	0	0	1297	31	124	0	49	3363
Per Cent of Approach		2%	98%	0%	0%	0%	0%	0%	98%	2%	72%	0%	28%	
Peak Hour Factor:		0.64	0.89	0	0	0	0	0	0.89	0.43	0.84	0	0.72	0.91
Total Arrivals			1862			0			1328			173		
Total Departures			1346			0			1950			67		
Total			3208			0			3278			240		

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT: Kenolio Apartments
INTERSECTION: Piilani Highway at Kulanihakoi Street
DAY & DATE: Tuesday, May 14, 2013
START TIME: 3:00 pm
END TIME: 6:00 pm

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	3:00 pm	17	284						339	20	27		11	698
2	3:15 pm	14	330						346	16	19		10	735
3	3:30 pm	21	366						397	15	25		4	828
4	3:45 pm	17	366						398	19	26		7	833
5	4:00 pm	25	426						413	23	28		14	929
6	4:15 pm	14	352						480	17	10		6	879
7	4:30 pm	25	364						395	21	26		14	845
8	4:45 pm	20	373						368	13	28		7	809
9	5:00 pm	28	420						413	21	31		9	922
10	5:15 pm	18	293						278	14	19		4	626
11	5:30 pm	22	354						322	11	17		7	733
12	5:45 pm	17	300						259	17	17		12	622
13	6:00 pm													0
14	6:15 pm													0
	Maximum:	25	426						480	23	28		14	929

Hourly Volume of Each Movement

3:00 pm	4:00 pm	69	1346	0	0	0	0	0	1480	70	97	0	32	3094
3:15 pm	4:15 pm	77	1488	0	0	0	0	0	1554	73	98	0	35	3325
3:30 pm	4:30 pm	77	1510	0	0	0	0	0	1688	74	89	0	31	3469
3:45 pm	4:45 pm	81	1508	0	0	0	0	0	1686	80	90	0	41	3486
4:00 pm	5:00 pm	84	1515	0	0	0	0	0	1656	74	92	0	41	3462
4:15 pm	5:15 pm	87	1509	0	0	0	0	0	1656	72	95	0	36	3455
4:30 pm	5:30 pm	91	1450	0	0	0	0	0	1454	69	104	0	34	3202
4:45 pm	5:45 pm	88	1440	0	0	0	0	0	1381	59	95	0	27	3090
5:00 pm	6:00 pm	85	1367	0	0	0	0	0	1272	63	84	0	32	2903
5:15 pm	6:15 pm													
5:30 pm	6:30 pm													
Peak Hour Volume		81	1508	0	0	0	0	0	1686	80	90	0	41	3486
Per Cent of Approach		5%	95%	0%	0%	0%	0%	0%	95%	5%	69%	0%	31%	
Peak Hour Factor:		0.81	0.88	0	0	0	0	0	0.88	0.87	0.8	0	0.73	0.94

Total Arrivals	1589	0	1766	131
Total Departures	1727	0	1598	161
Total	3316	0	3364	292

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT:	Kenolio Apartments
INTERSECTION:	Kaonoulu Street at Kenolio Road
DAY & DATE:	Friday, May 17, 2013
START TIME:	6:30 am
END TIME:	8:30 am

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
		Rt	Th	Lt	Rt	Th	Lt	Rt	Th	Lt	Rt	Th	Lt	
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	6:30 am	4	0	27	6	0	0	2	0	0	1	8	7	55
2	6:45 am	3	0	27	8	1	3	4	1	0	0	10	1	58
3	7:00 am	6	1	27	9	1	3	3	0	1	0	12	3	66
4	7:15 am	2	0	47	7	5	0	16	0	0	2	18	2	99
5	7:30 am	3	0	46	17	8	3	15	1	0	0	10	9	112
6	7:45 am	4	1	30	20	4	5	2	0	0	0	11	6	83
7	8:00 am	5	0	29	8	9	1	4	0	0	0	10	6	72
8	8:15 am	3	0	23	5	2	3	2	1	0	0	11	3	53
9	8:30 am													0
10	8:45 am													0
	Maximum:	5	1	47	20	9	5	16	1	0	2	18	9	112

Hourly Volume of Each Movement

6:30 am	7:30 am	15	1	128	30	7	6	25	1	1	3	48	13	278
6:45 am	7:45 am	14	1	147	41	15	9	38	2	1	2	50	15	335
7:00 am	8:00 am	15	2	150	53	18	11	36	1	1	2	51	20	360
7:15 am	8:15 am	14	1	152	52	26	9	37	1	0	2	49	23	366
7:30 am	8:30 am	15	1	128	50	23	12	23	2	0	0	42	24	320
7:45 am	8:45 am	12	1	82	33	15	9	8	1	0	0	32	15	208
8:00 am	9:00 am	8	0	52	13	11	4	6	1	0	0	21	9	125
Maximum Volume		14	1	152	52	26	9	37	1	0	2	49	23	366
Per Cent of Approach		8%	1%	91%	60%	30%	10%	97%	3%	0%	3%	66%	31%	
Peak Hour Factor:		0.7	0.25	0.81	0.65	0.72	0.45	0.58	0.25	0	0.25	0.68	0.64	0.82
Total Arrivals			167			87			38			74		
Total Departures			76			238			12			40		
Total			243			325			50			114		

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT:	Kenolio Apartments
INTERSECTION:	Kaonoulu Street at Kenolio Road
DAY & DATE:	Friday, May 17, 2013
START TIME:	3:30 pm
END TIME:	5:30 pm

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
		Rt	Th	Lt	Rt	Th	Lt	Rt	Th	Lt	Rt	Th	Lt	
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	3:30 pm	5	2	26	18	8	2	6	0	1	1	13	8	90
2	3:45 pm	3	1	27	19	12	6	7	1			8	5	89
3	4:00 pm	5	0	20	22	14	5	1	0			5	7	79
4	4:15 pm	1	3	31	19	12	3	4	2			10	12	97
5	4:30 pm	5	0	22	13	12	1	6	2		1	8	13	83
6	4:45 pm	3	2	23	19	7	2	6	1		1	36	5	105
7	5:00 pm	1	0	17	17	6	5	3	1		1	11	8	70
8	5:15 pm	4	0	15	9	7	2	0	0	1	0	9	13	60
9	5:30 pm													0
10	5:45 pm													0
11	6:00 pm													0
12	6:15 pm													0
	Maximum:	5	3	31	22	14	5	6	2		1	36	13	105

Hourly Volume of Each Movement

3:30 pm	4:30 pm	14	6	104	78	46	16	18	3	1	1	36	32	355
3:45 pm	4:45 pm	14	4	100	73	50	15	18	5	0	1	31	37	348
4:00 pm	5:00 pm	14	5	96	73	45	11	17	5	0	2	59	37	364
4:15 pm	5:15 pm	10	5	93	68	37	11	19	6	0	3	65	38	355
4:30 pm	5:30 pm	13	2	77	58	32	10	15	4	1	3	64	39	318
4:45 pm	5:45 pm	8	2	55	45	20	9	9	2	1	2	56	26	235
5:00 pm	6:00 pm	5	0	32	26	13	7	3	1	1	1	20	21	130
5:15 pm	6:15 pm	4	0	15	9	7	2	0	0	1	0	9	13	60
5:30 pm	6:30 pm	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum Volume		14	5	96	73	45	11	17	5	0	2	59	37	364
Per Cent of Approach		12%	4%	83%	57%	35%	9%	77%	23%	0%	2%	60%	38%	1
Peak Hour Factor:		0.7	0.42	0.77	0.83	0.8	0.55	0.71	0.63	0	0.5	0.41	0.71	0.87
Total Arrivals			115			129			22			98		
Total Departures			115			172			18			59		
Total			230			301			40			157		

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT:	Kenolio Apartments
INTERSECTION:	Kaonoulu Street at Alulike Street
DAY & DATE:	Thursday, February 25, 2010
START TIME:	6:30 am
END TIME:	9:00 am

15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
		Rt	Th	Lt	Rt	Th	Lt	Rt	Th	Lt	Rt	Th	Lt	
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	6:30 am	6	0	2	0	9	0	1	0	4	1	13	1	37
2	6:45 am	9	1	0	0	6	0	0	1	2	1	10	5	35
3	7:00 am	7	0	0	1	10	1	2	0	2	1	9	3	36
4	7:15 am	9	0	1	1	11	2	0	0	3	2	13	2	44
5	7:30 am	6	0	1	1	14	0	1	0	2	4	17	1	47
6	7:45 am	9	0	0	0	12	0	0	0	2	4	18	9	54
7	8:00 am	9	0	1	0	14	2	1	0	2	3	18	5	55
8	8:15 am	7	0	0	1	6	0	2	1	4	0	13	6	40
9	8:30 am	8	0	1	0	4	2	1	1	1	5	12	4	39
10	8:45 am	11	0	0	1	12	1	0	1	3	0	18	3	50
	Maximum:	9	0	1	1	14	2	1	0	3	4	18	9	55

Hourly Volume of Each Movement

6:30 am	7:30 am	31	1	3	2	36	3	3	1	11	5	45	11	152
6:45 am	7:45 am	31	1	2	3	41	3	3	1	9	8	49	11	162
7:00 am	8:00 am	31	0	2	3	47	3	3	0	9	11	57	15	181
7:15 am	8:15 am	33	0	3	2	51	4	2	0	9	13	66	17	200
7:30 am	8:30 am	31	0	2	2	46	2	4	1	10	11	66	21	196
7:45 am	8:45 am	33	0	2	1	36	4	4	2	9	12	61	24	188
8:00 am	9:00 am	35	0	2	2	36	5	4	3	10	8	61	18	184
Maximum Volume		33	0	3	2	51	4	2	0	9	13	66	17	200
Per Cent of Approach		92%	0%	8%	4%	89%	7%	18%	0%	82%	14%	69%	18%	
Peak Hour Factor:		0.92	0	0.75	0.5	0.91	0.5	0.5	0	0.75	0.81	0.92	0.47	0.91

Total Arrivals	36	57	11	96
Total Departures	19	71	17	93
Total	55	128	28	189

TRAFFIC COUNT SUMMARY WORKSHEET

PROJECT:	Kenolio Apartments
INTERSECTION:	Kaonoulu Street at Alulike Street
DAY & DATE:	Thursday, February 25
START TIME:	3:00 pm
END TIME:	6:00 pm

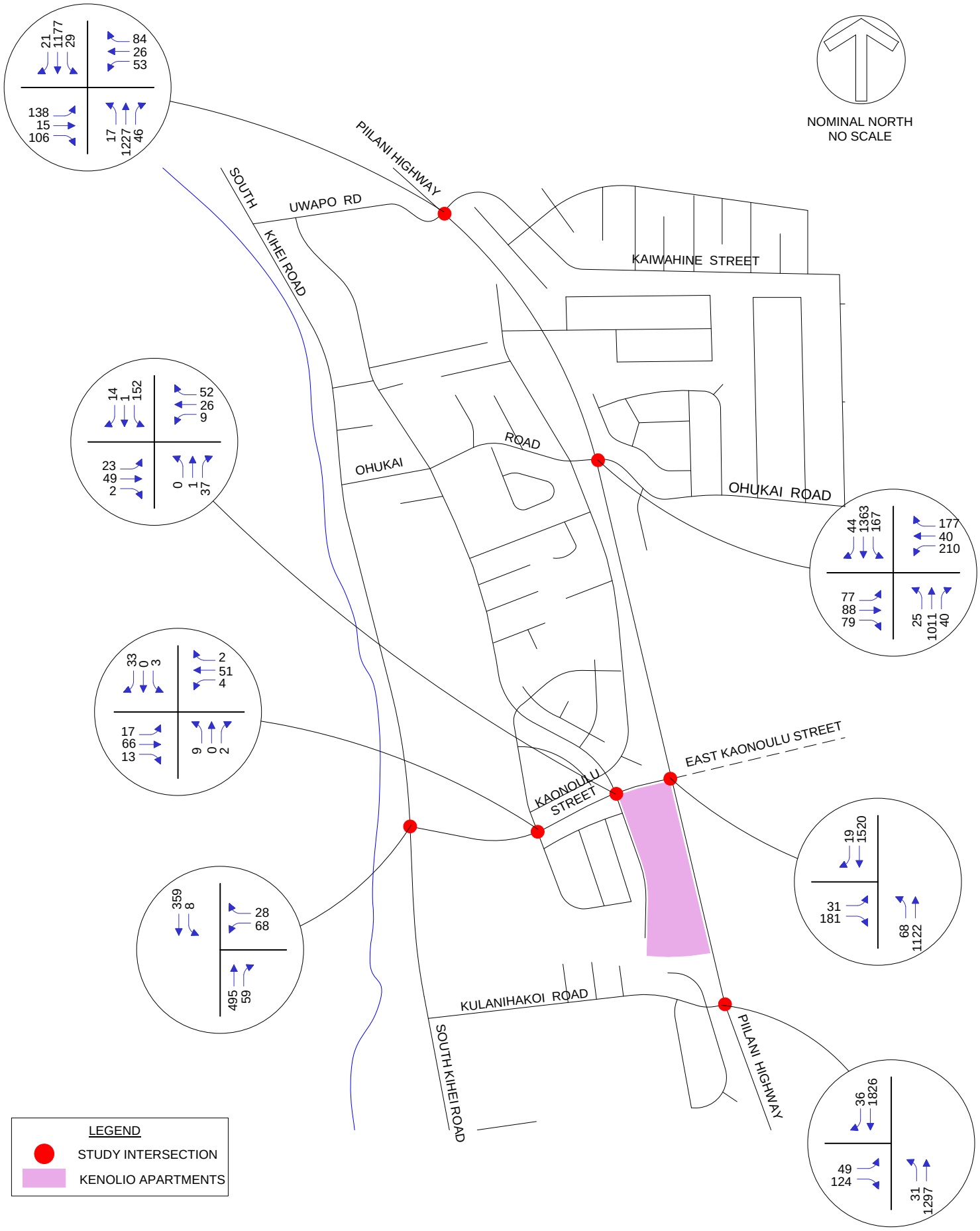
15-Minute Volumes Beginning at:

		North Approach			East Approach			South Approach			West Approach			
		Rt	Th	Lt	Rt	Th	Lt	Rt	Th	Lt	Rt	Th	Lt	
Interval	Start Time	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1	3:00 pm	9	0	1	0	14	1	0	2	5	1	22	13	68
2	3:15 pm	8	1	0	1	13	1	0	0	4	6	15	7	56
3	3:30 pm	6	0	0	0	11	3	0	0	2	3	14	6	45
4	3:45 pm	11	0	0	1	6	1	2	0	2	2	11	12	48
5	4:00 pm	7	0	0	0	21	1	0	0	0	7	16	14	66
6	4:15 pm	11	0	1	1	15	0	0	1	2	2	24	17	74
7	4:30 pm	5	1	1	4	8	0	0	0	1	5	22	15	62
8	4:45 pm	7	0	1	1	12	1	2	0	0	2	29	15	70
9	5:00 pm	8	1	1	0	13	0	0	0	3	1	16	16	59
10	5:15 pm	7	0	0	0	6	0	0	0	2	7	15	13	50
11	5:30 pm	8	0	0	1	4	0	1	0	1	6	15	11	47
12	5:45 pm	11	0	0	3	13	2	1	0	2	2	19	12	65
	Maximum:	11	1	1	4	21	1	2	1	2	7	29	17	74

Hourly Volume of Each Movement

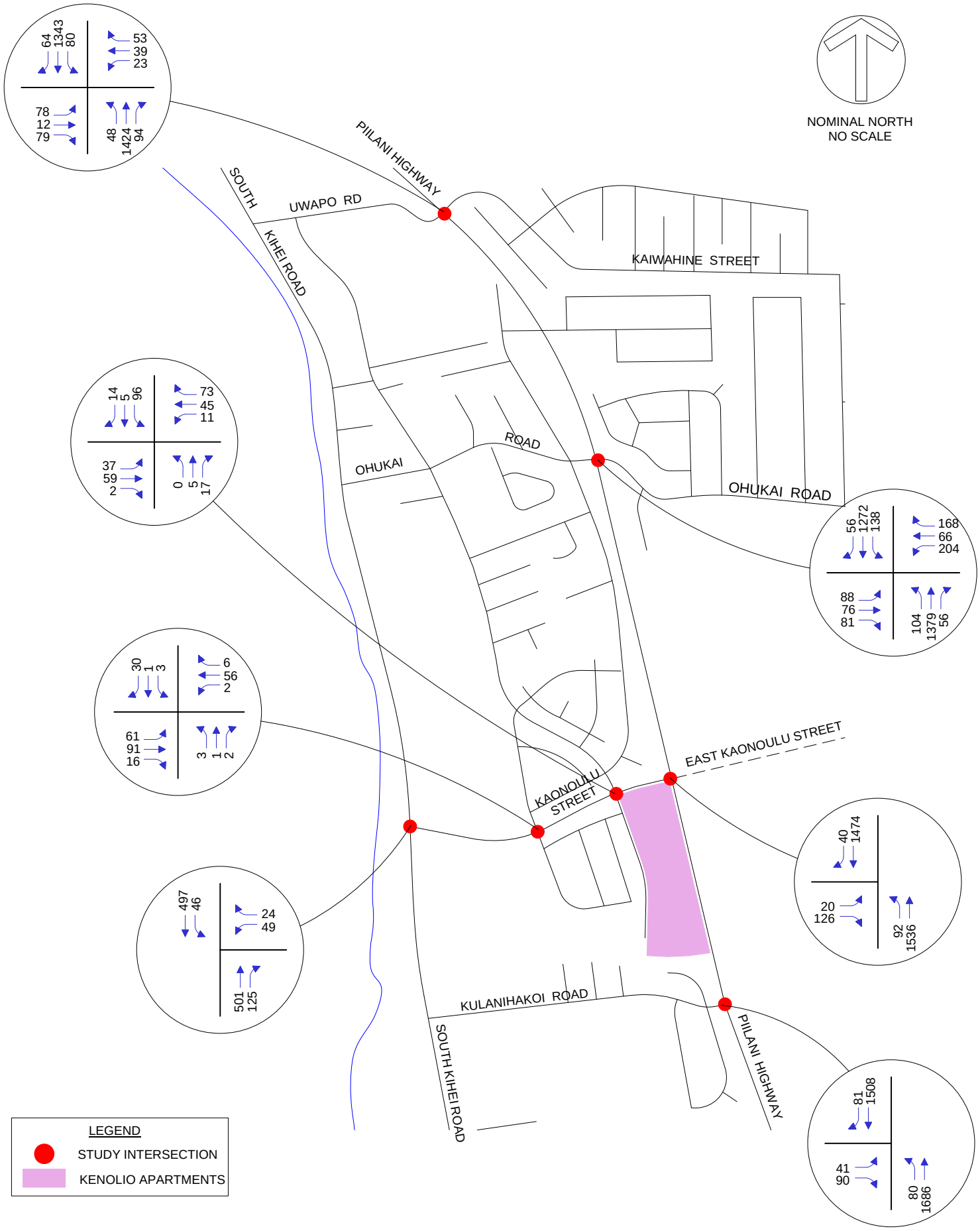
3:00 pm	4:00 pm	34	1	1	2	44	6	2	2	13	12	62	38	217
3:15 pm	4:15 pm	32	1	0	2	51	6	2	0	8	18	56	39	215
3:30 pm	4:30 pm	35	0	1	2	53	5	2	1	6	14	65	49	233
3:45 pm	4:45 pm	34	1	2	6	50	2	2	1	5	16	73	58	250
4:00 pm	5:00 pm	30	1	3	6	56	2	2	1	3	16	91	61	272
4:15 pm	5:15 pm	31	2	4	6	48	1	2	1	6	10	91	63	265
4:30 pm	5:30 pm	27	2	3	5	39	1	2	0	6	15	82	59	241
4:45 pm	5:45 pm	30	1	2	2	35	1	3	0	6	16	75	55	226
5:00 pm	6:00 pm	34	1	1	4	36	2	2	0	8	16	65	52	221
Maximum Volume		30	1	3	6	56	2	2	1	3	16	91	61	272
Per Cent of Approach		88%	3%	9%	9%	88%	3%	33%	17%	50%	10%	54%	36%	1
Peak Hour Factor:		0.68	0.25	0.75	0.38	0.67	0.5	0.25	0.25	0.38	0.57	0.78	0.9	0.92

Total Arrivals	34	64	6	168
Total Departures	68	96	19	89
Total	102	160	25	257



Attachment E
EXISTING (2013) AM PEAK HOUR VOLUMES

Phillip Rowell and Associates



Attachment F
EXISTING (2013) PM PEAK HOUR VOLUMES

Phillip Rowell and Associates

Attachment G
Level-of-Service Worksheets for 2013 Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1820	1583		1788	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.98	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1820	1583		1788	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	77	88	79	210	40	177	25	1011	40	167	1363	44
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	84	96	86	228	43	192	27	1099	43	182	1482	48
RTOR Reduction (vph)	0	0	74	0	0	160	0	0	23	0	0	17
Lane Group Flow (vph)	0	180	12	0	271	32	27	1099	20	182	1482	31
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Actuated Green, G (s)		16.2	16.2		19.7	19.7	6.0	54.5	54.5	14.6	63.1	63.1
Effective Green, g (s)		17.2	17.2		20.7	20.7	7.0	55.5	55.5	15.6	64.1	64.1
Actuated g/C Ratio		0.14	0.14		0.17	0.17	0.06	0.44	0.44	0.12	0.51	0.51
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		250	218		296	262	99	1571	703	221	1815	812
v/s Ratio Prot		c0.10			c0.15		0.02	0.31		c0.10	c0.42	
v/s Ratio Perm			0.05			0.12			0.03			0.03
v/c Ratio		0.72	0.05		0.92	0.12	0.27	0.70	0.03	0.82	0.82	0.04
Uniform Delay, d1		51.6	46.8		51.3	44.4	56.6	28.0	19.6	53.4	25.5	15.1
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.19	0.77	0.43
Incremental Delay, d2		9.5	0.1		31.1	0.2	0.5	2.6	0.1	19.2	3.9	0.1
Delay (s)		61.1	46.9		82.3	44.6	57.1	30.6	19.6	82.6	23.5	6.7
Level of Service		E	D		F	D	E	C	B	F	C	A
Approach Delay (s)		56.5			66.7			30.8			29.3	
Approach LOS		E			E			C			C	

Intersection Summary

HCM Average Control Delay	36.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1780	1583		1802	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.64	1.00		0.58	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1198	1583		1072	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	138	10	106	53	26	84	17	1227	46	29	1177	21
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	150	11	115	58	28	91	18	1334	50	32	1279	23
RTOR Reduction (vph)	0	0	95	0	0	75	0	0	16	0	0	7
Lane Group Flow (vph)	0	161	20	0	86	16	18	1334	34	32	1279	16
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Actuated Green, G (s)		21.0	21.0		21.0	21.0	4.0	83.0	83.0	6.0	85.0	85.0
Effective Green, g (s)		22.0	22.0		22.0	22.0	5.0	84.0	84.0	7.0	86.0	86.0
Actuated g/C Ratio		0.18	0.18		0.18	0.18	0.04	0.67	0.67	0.06	0.69	0.69
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		4.0	4.0		4.0	4.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		211	279		189	279	71	2378	1064	99	2435	1089
v/s Ratio Prot							0.01	c0.38		c0.02	0.36	
v/s Ratio Perm		c0.13	0.07		0.08	0.06			0.03			0.01
v/c Ratio		0.76	0.07		0.46	0.06	0.25	0.56	0.03	0.32	0.53	0.01
Uniform Delay, d1		49.0	43.0		46.1	42.9	58.2	10.8	6.9	56.7	9.5	6.1
Progression Factor		1.00	1.00		1.00	1.00	0.61	2.11	4.59	1.00	1.00	1.00
Incremental Delay, d2		15.9	0.2		2.4	0.1	0.5	0.7	0.0	0.7	0.8	0.0
Delay (s)		64.9	43.1		48.5	43.0	36.2	23.5	31.6	57.4	10.3	6.2
Level of Service		E	D		D	D	D	C	C	E	B	A
Approach Delay (s)		55.8			45.7			24.0			11.4	
Approach LOS		E			D			C			B	

Intersection Summary

HCM Average Control Delay	22.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.6%	ICU Level of Service	B
Analysis Period (min)	15		

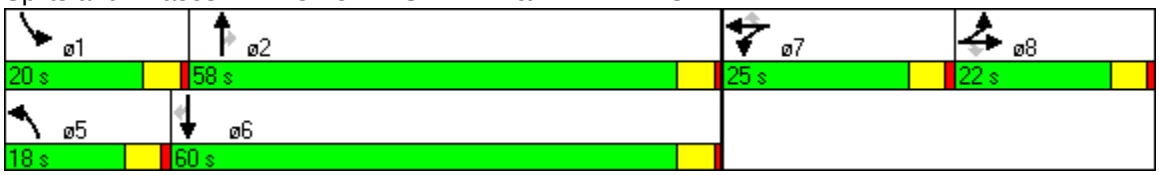
c Critical Lane Group

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	88	79	40	177	25	1011	40	167	1363	44
Lane Group Flow (vph)	180	86	271	192	27	1099	43	182	1482	48
Turn Type		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases	8		7		5	2		1	6	
Permitted Phases		8		7			2			6
Detector Phases	8	8	7	7	5	2	2	1	6	6
Minimum Initial (s)	15.0	15.0	10.0	10.0	10.0	25.0	25.0	13.0	22.0	22.0
Minimum Split (s)	22.0	22.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (s)	22.0	22.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (%)	17.6%	17.6%	20.0%	20.0%	14.4%	46.4%	46.4%	16.0%	48.0%	48.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
v/c Ratio	0.72	0.29	0.92	0.45	0.17	0.70	0.06	0.82	0.79	0.06
Control Delay	65.7	12.3	83.8	9.8	54.8	31.3	6.7	86.7	23.4	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.7	12.3	83.8	9.8	54.8	31.3	6.7	86.7	23.4	3.6
Queue Length 50th (ft)	140	0	217	0	21	378	1	123	565	5
Queue Length 95th (ft)	#230	48	#376	66	51	461	23	#271	678	m9
Internal Link Dist (ft)	459		456			2865			2675	
Turn Bay Length (ft)										
Base Capacity (vph)	262	302	300	426	198	1571	725	227	1871	854
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.28	0.90	0.45	0.14	0.70	0.06	0.80	0.79	0.06

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 125
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: OHUKAI STREET & PIILANI HIGHWAY

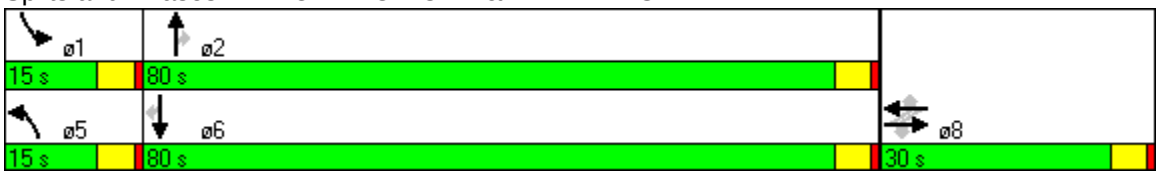


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	138	10	106	53	26	84	17	1227	46	29	1177	21
Lane Group Flow (vph)	0	161	115	0	86	91	18	1334	50	32	1279	23
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Detector Phases	8	8	8	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	25.0	25.0	10.0	25.0	25.0
Minimum Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	80.0	80.0	15.0	80.0	80.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	80.0	80.0	15.0	80.0	80.0
Total Split (%)	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	12.0%	64.0%	64.0%	12.0%	64.0%	64.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio		0.75	0.31		0.41	0.26	0.12	0.55	0.05	0.21	0.51	0.02
Control Delay		60.1	9.0		48.4	9.6	33.6	25.6	12.5	56.5	10.7	3.7
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		60.1	9.0		48.4	9.6	33.6	25.6	12.5	56.5	10.7	3.7
Queue Length 50th (ft)		122	0		61	0	13	410	10	24	191	0
Queue Length 95th (ft)		199	50		112	45	m22	523	m27	58	380	11
Internal Link Dist (ft)		530			620			2675			2120	
Turn Bay Length (ft)												
Base Capacity (vph)		253	420		250	401	156	2434	1104	156	2519	1133
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.64	0.27		0.34	0.23	0.12	0.55	0.05	0.21	0.51	0.02

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 125
Offset: 50 (40%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: UWAPO ROAD & PIILANI HIGHWAY



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	31	181	68	1122	1520	19
Peak Hour Factor	0.52	0.59	0.68	0.74	0.84	0.68
Hourly flow rate (vph)	60	307	100	1516	1810	28
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	3					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2768	905	1837			
vC1, stage 1 conf vol	1810					
vC2, stage 2 conf vol	958					
vCu, unblocked vol	2768	905	1837			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3	2.2			
p0 queue free %	45	0	69			
cM capacity (veh/h)	109	279	328			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	60	307	100	758	758	905	905	28
Volume Left	60	0	100	0	0	0	0	0
Volume Right	0	307	0	0	0	0	0	28
cSH	109	279	328	1700	1700	1700	1700	1700
Volume to Capacity	0.55	1.10	0.31	0.45	0.45	0.53	0.53	0.02
Queue Length 95th (ft)	64	314	32	0	0	0	0	0
Control Delay (s)	72.3	122.6	20.7	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	F	C					
Approach Delay (s)	114.4		1.3			0.0		
Approach LOS	F							

Intersection Summary			
Average Delay	11.5		
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	68	28	495	59	8	359
Peak Hour Factor	0.77	0.78	0.78	0.92	0.50	0.91
Hourly flow rate (vph)	88	36	635	64	16	395
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1093	667			699	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1093	667			699	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	62	92			98	
cM capacity (veh/h)	233	459			898	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	88	36	699	411
Volume Left	88	0	0	16
Volume Right	0	36	64	0
cSH	233	459	1700	898
Volume to Capacity	0.38	0.08	0.41	0.02
Queue Length 95th (ft)	42	6	0	1
Control Delay (s)	29.6	13.5	0.0	0.6
Lane LOS	D	B		A
Approach Delay (s)	25.0		0.0	0.6
Approach LOS	C			

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	49	124	31	1297	1826	36
Peak Hour Factor	0.72	0.84	0.43	0.89	0.89	0.64
Hourly flow rate (vph)	68	148	72	1457	2052	56
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	2					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2925	1026	2108			
vC1, stage 1 conf vol	2052					
vC2, stage 2 conf vol	873					
vCu, unblocked vol	2925	1026	2108			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3	2.2			
p0 queue free %	13	36	72			
cM capacity (veh/h)	78	232	257			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	68	148	72	729	729	1026	1026	56
Volume Left	68	0	72	0	0	0	0	0
Volume Right	0	148	0	0	0	0	0	56
cSH	78	232	257	1700	1700	1700	1700	1700
Volume to Capacity	0.87	0.64	0.28	0.43	0.43	0.60	0.60	0.03
Queue Length 95th (ft)	111	96	28	0	0	0	0	0
Control Delay (s)	159.2	44.2	24.4	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	E	C					
Approach Delay (s)	80.5		1.2			0.0		
Approach LOS	F							

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	23	49	2	9	26	52	0	1	37	152	1	14
Peak Hour Factor	0.64	0.68	0.25	0.45	0.72	0.65	0.42	0.25	0.58	0.81	0.25	0.70
Hourly flow rate (vph)	36	72	8	20	36	80	0	4	64	188	4	20
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	116			80			246	304	76	326	268	76
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	116			80			246	304	76	326	268	76
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			99			100	99	94	67	99	98
cM capacity (veh/h)	1473			1518			670	586	985	567	614	985

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	36	80	20	116	0	68	188	24
Volume Left	36	0	20	0	0	0	188	0
Volume Right	0	8	0	80	0	64	0	20
cSH	1473	1700	1518	1700	1700	947	567	895
Volume to Capacity	0.02	0.05	0.01	0.07	0.00	0.07	0.33	0.03
Queue Length 95th (ft)	2	0	1	0	0	6	36	2
Control Delay (s)	7.5	0.0	7.4	0.0	0.0	9.1	14.5	9.1
Lane LOS	A		A		A	A	B	A
Approach Delay (s)	2.3		1.1		9.1		13.9	
Approach LOS					A		B	

Intersection Summary			
Average Delay	7.5		
Intersection Capacity Utilization	29.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	17	66	13	4	51	2	9	0	2	3	0	33
Peak Hour Factor	0.47	0.92	0.65	0.50	0.91	0.50	0.56	0.25	0.25	0.38	0.25	0.75
Hourly flow rate (vph)	36	72	20	8	56	4	16	0	8	8	0	44
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	60			92			270	230	82	226	238	58
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	60			92			270	230	82	226	238	58
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			99			97	100	99	99	100	96
cM capacity (veh/h)	1543			1503			638	651	978	707	644	1008

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	36	92	8	60	24	52
Volume Left	36	0	8	0	16	8
Volume Right	0	20	0	4	8	44
cSH	1543	1700	1503	1700	722	947
Volume to Capacity	0.02	0.05	0.01	0.04	0.03	0.05
Queue Length 95th (ft)	2	0	0	0	3	4
Control Delay (s)	7.4	0.0	7.4	0.0	10.2	9.0
Lane LOS	A		A		B	A
Approach Delay (s)	2.1		0.9		10.2	9.0
Approach LOS					B	A

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	17.8%	ICU Level of Service	A
Analysis Period (min)	15		

Attachment H
Level-of-Service Worksheets for 2013 Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1814	1583		1795	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.97	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1814	1583		1795	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	88	76	81	204	66	168	104	1379	56	138	1272	56
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	96	83	88	222	72	183	113	1499	61	150	1383	61
RTOR Reduction (vph)	0	0	78	0	0	149	0	0	20	0	0	21
Lane Group Flow (vph)	0	179	10	0	294	34	113	1499	41	150	1383	40
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Actuated Green, G (s)		16.6	16.6		26.6	26.6	12.2	72.2	72.2	14.6	74.6	74.6
Effective Green, g (s)		17.6	17.6		27.6	27.6	13.2	73.2	73.2	15.6	75.6	75.6
Actuated g/C Ratio		0.12	0.12		0.18	0.18	0.09	0.49	0.49	0.10	0.50	0.50
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		213	186		330	291	156	1727	773	184	1784	798
v/s Ratio Prot		c0.10			c0.16		0.06	c0.42		c0.08	0.39	
v/s Ratio Perm			0.06			0.12			0.04			0.04
v/c Ratio		0.84	0.06		0.89	0.12	0.72	0.87	0.05	0.82	0.78	0.05
Uniform Delay, d1		64.8	58.8		59.7	51.0	66.6	34.1	20.2	65.8	30.3	18.9
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.92	0.86	0.86
Incremental Delay, d2		24.6	0.1		24.5	0.2	13.2	6.2	0.1	19.8	2.9	0.1
Delay (s)		89.5	58.9		84.2	51.2	79.8	40.3	20.3	80.2	29.1	16.5
Level of Service		F	E		F	D	E	D	C	F	C	B
Approach Delay (s)		79.4			71.6			42.2			33.4	
Approach LOS		E			E			D			C	

Intersection Summary

HCM Average Control Delay	44.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1785	1583		1829	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.67	1.00		0.84	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1239	1583		1574	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	78	12	79	23	39	53	48	1424	94	80	1343	64
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	85	13	86	25	42	58	52	1548	102	87	1460	70
RTOR Reduction (vph)	0	0	76	0	0	51	0	0	22	0	0	18
Lane Group Flow (vph)	0	98	10	0	67	7	52	1548	80	87	1460	52
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Actuated Green, G (s)		17.3	17.3		17.3	17.3	8.5	105.4	105.4	12.3	109.2	109.2
Effective Green, g (s)		18.3	18.3		18.3	18.3	9.5	106.4	106.4	13.3	110.2	110.2
Actuated g/C Ratio		0.12	0.12		0.12	0.12	0.06	0.71	0.71	0.09	0.73	0.73
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		4.0	4.0		4.0	4.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		151	193		192	193	112	2510	1123	157	2600	1163
v/s Ratio Prot							0.03	c0.44		c0.05	c0.41	
v/s Ratio Perm		c0.08	0.05		0.04	0.04			0.06			0.04
v/c Ratio		0.65	0.05		0.35	0.04	0.46	0.62	0.07	0.55	0.56	0.05
Uniform Delay, d1		62.8	58.2		60.4	58.1	67.8	11.3	6.7	65.5	9.0	5.5
Progression Factor		1.00	1.00		1.00	1.00	0.58	1.69	3.32	1.00	1.00	1.00
Incremental Delay, d2		10.3	0.2		1.5	0.1	0.6	0.6	0.1	2.4	0.9	0.1
Delay (s)		73.1	58.4		61.9	58.2	40.1	19.7	22.2	67.9	9.9	5.5
Level of Service		E	E		E	E	D	B	C	E	A	A
Approach Delay (s)		66.2			60.2			20.4			12.8	
Approach LOS		E			E			C			B	

Intersection Summary

HCM Average Control Delay	20.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		

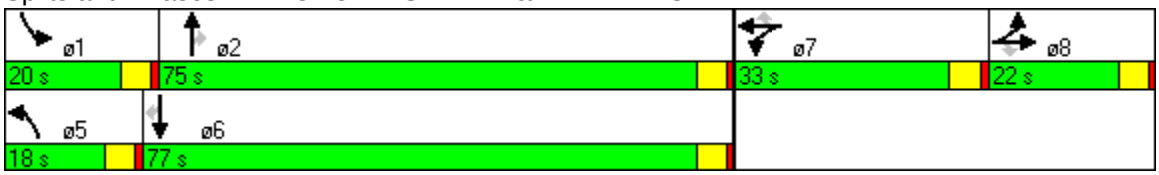
c Critical Lane Group

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	76	81	66	168	104	1379	56	138	1272	56
Lane Group Flow (vph)	179	88	294	183	113	1499	61	150	1383	61
Turn Type		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases	8		7		5	2		1	6	
Permitted Phases		8		7			2			6
Detector Phases	8	8	7	7	5	2	2	1	6	6
Minimum Initial (s)	15.0	15.0	10.0	10.0	10.0	25.0	25.0	13.0	22.0	22.0
Minimum Split (s)	22.0	22.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (s)	22.0	22.0	33.0	33.0	18.0	75.0	75.0	20.0	77.0	77.0
Total Split (%)	14.7%	14.7%	22.0%	22.0%	12.0%	50.0%	50.0%	13.3%	51.3%	51.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
v/c Ratio	0.84	0.33	0.89	0.42	0.73	0.87	0.08	0.82	0.77	0.07
Control Delay	92.7	14.6	81.2	9.4	87.3	41.2	9.9	85.3	29.9	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	92.7	14.6	81.2	9.4	87.3	41.2	9.9	85.3	29.9	7.3
Queue Length 50th (ft)	174	0	281	0	109	694	11	145	633	20
Queue Length 95th (ft)	#303	55	#437	68	#196	806	39	#257	734	m35
Internal Link Dist (ft)	459		456			2865			2675	
Turn Bay Length (ft)										
Base Capacity (vph)	218	267	347	454	165	1728	793	189	1785	819
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.82	0.33	0.85	0.40	0.68	0.87	0.08	0.79	0.77	0.07

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: OHUKAI STREET & PIILANI HIGHWAY

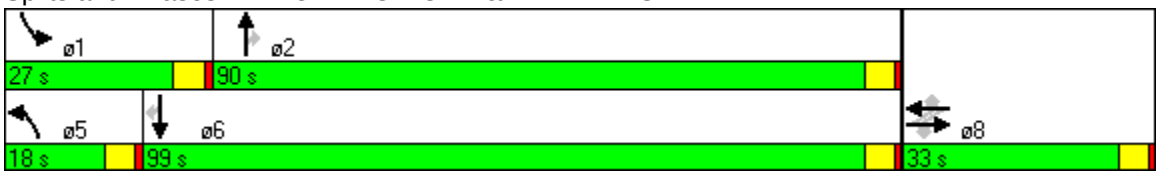


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	78	12	79	23	39	53	48	1424	94	80	1343	64
Lane Group Flow (vph)	0	98	86	0	67	58	52	1548	102	87	1460	70
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Detector Phases	8	8	8	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	25.0	25.0	10.0	25.0	25.0
Minimum Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	80.0	80.0	15.0	80.0	80.0
Total Split (s)	33.0	33.0	33.0	33.0	33.0	33.0	18.0	90.0	90.0	27.0	99.0	99.0
Total Split (%)	22.0%	22.0%	22.0%	22.0%	22.0%	22.0%	12.0%	60.0%	60.0%	18.0%	66.0%	66.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio		0.62	0.32		0.34	0.24	0.38	0.62	0.09	0.55	0.56	0.06
Control Delay		65.9	11.8		60.1	13.6	41.2	21.8	9.9	68.3	11.0	2.1
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		65.9	11.8		60.1	13.6	41.2	21.8	9.9	68.3	11.0	2.1
Queue Length 50th (ft)		93	0		61	0	47	451	30	84	318	1
Queue Length 95th (ft)		150	50		106	41	m57	589	m44	140	480	19
Internal Link Dist (ft)		530			620			2675			2120	
Turn Bay Length (ft)												
Base Capacity (vph)		251	375		316	353	165	2510	1145	271	2622	1190
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.39	0.23		0.21	0.16	0.32	0.62	0.09	0.32	0.56	0.06

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 50 (33%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: UWAPO ROAD & PIILANI HIGHWAY



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	20	126	92	1536	1474	40
Peak Hour Factor	0.52	0.59	0.68	0.74	0.84	0.68
Hourly flow rate (vph)	38	214	135	2076	1755	59
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	3					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	3063	877	1814			
vC1, stage 1 conf vol	1755					
vC2, stage 2 conf vol	1308					
vCu, unblocked vol	3063	877	1814			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3	2.2			
p0 queue free %	60	27	60			
cM capacity (veh/h)	96	291	335			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	38	214	135	1038	1038	877	877	59
Volume Left	38	0	135	0	0	0	0	0
Volume Right	0	214	0	0	0	0	0	59
cSH	96	291	335	1700	1700	1700	1700	1700
Volume to Capacity	0.40	0.73	0.40	0.61	0.61	0.52	0.52	0.03
Queue Length 95th (ft)	41	133	47	0	0	0	0	0
Control Delay (s)	65.8	44.9	22.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	E	C					
Approach Delay (s)	48.1		1.4			0.0		
Approach LOS	E							

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	49	24	501	125	46	497
Peak Hour Factor	0.77	0.78	0.78	0.92	0.50	0.91
Hourly flow rate (vph)	64	31	642	136	92	546
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1440	710			778	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1440	710			778	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	51	93			89	
cM capacity (veh/h)	130	433			839	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	64	31	778	638
Volume Left	64	0	0	92
Volume Right	0	31	136	0
cSH	130	433	1700	839
Volume to Capacity	0.49	0.07	0.46	0.11
Queue Length 95th (ft)	56	6	0	9
Control Delay (s)	56.6	13.9	0.0	2.8
Lane LOS	F	B		A
Approach Delay (s)	42.7		0.0	2.8
Approach LOS	E			

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	41	90	80	1686	1508	81
Peak Hour Factor	0.72	0.84	0.43	0.89	0.89	0.64
Hourly flow rate (vph)	57	107	186	1894	1694	127
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL					
Median storage veh)	2					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	3014	847	1821			
vC1, stage 1 conf vol	1694					
vC2, stage 2 conf vol	1319					
vCu, unblocked vol	3014	847	1821			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3	2.2			
p0 queue free %	22	65	44			
cM capacity (veh/h)	73	305	332			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	57	107	186	947	947	847	847	127
Volume Left	57	0	186	0	0	0	0	0
Volume Right	0	107	0	0	0	0	0	127
cSH	73	305	332	1700	1700	1700	1700	1700
Volume to Capacity	0.78	0.35	0.56	0.56	0.56	0.50	0.50	0.07
Queue Length 95th (ft)	93	38	81	0	0	0	0	0
Control Delay (s)	146.6	23.0	28.7	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	C	D					
Approach Delay (s)	65.9		2.6			0.0		
Approach LOS	F							

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	37	59	2	11	45	73	0	5	17	96	5	14
Peak Hour Factor	0.64	0.68	0.25	0.45	0.72	0.65	0.42	0.25	0.58	0.81	0.25	0.70
Hourly flow rate (vph)	58	87	8	24	62	112	0	20	29	119	20	20
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	175			95			348	430	91	409	378	119
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	175			95			348	430	91	409	378	119
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			98			100	96	97	76	96	98
cM capacity (veh/h)	1402			1499			551	488	967	497	522	933

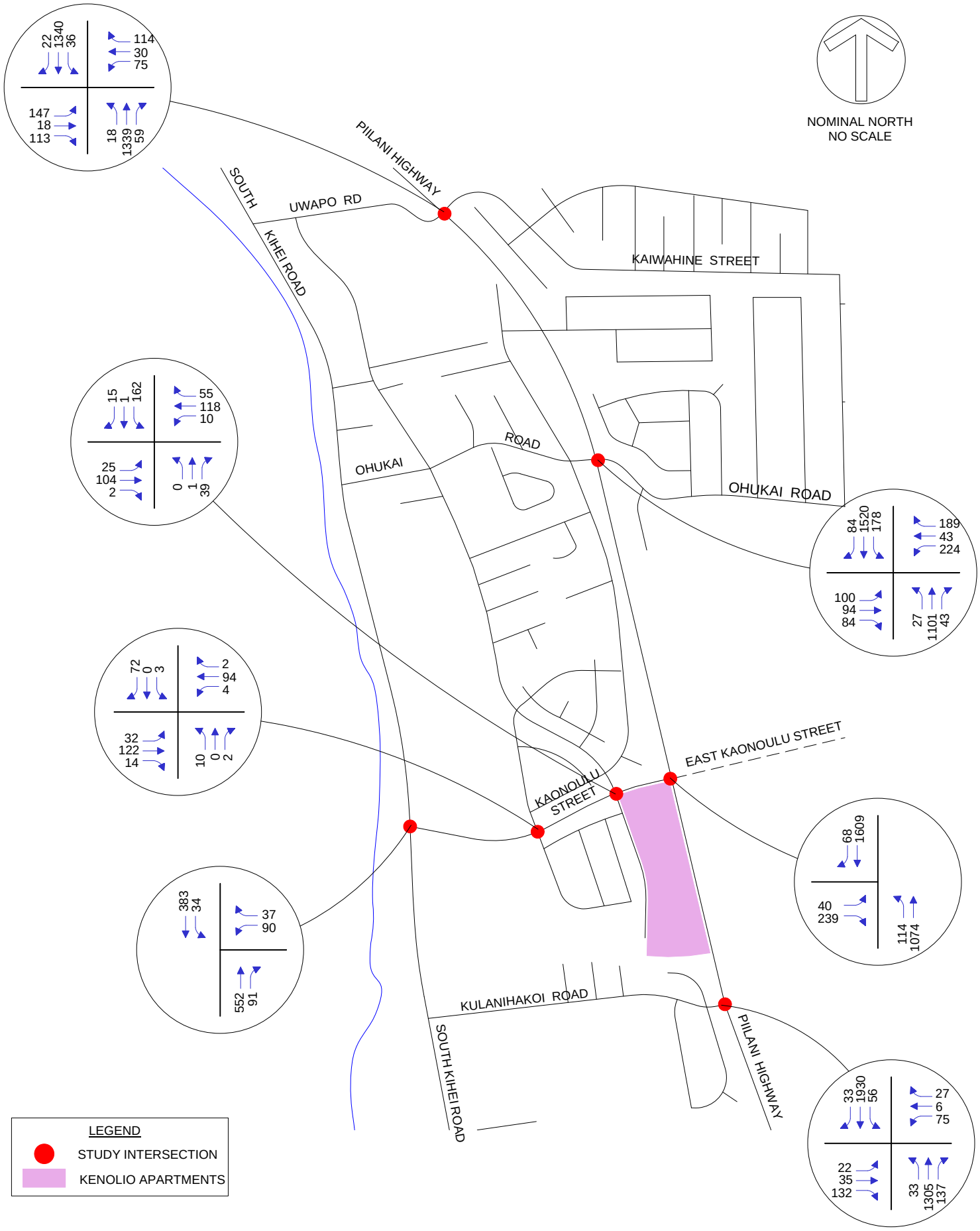
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	58	95	24	175	0	49	119	40
Volume Left	58	0	24	0	0	0	119	0
Volume Right	0	8	0	112	0	29	0	20
cSH	1402	1700	1499	1700	1700	692	497	670
Volume to Capacity	0.04	0.06	0.02	0.10	0.00	0.07	0.24	0.06
Queue Length 95th (ft)	3	0	1	0	0	6	23	5
Control Delay (s)	7.7	0.0	7.4	0.0	0.0	10.6	14.5	10.7
Lane LOS	A		A		A	B	B	B
Approach Delay (s)	2.9		0.9		10.6		13.5	
Approach LOS					B		B	

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	27.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	61	91	16	2	56	6	3	1	2	3	1	30
Peak Hour Factor	0.47	0.92	0.65	0.50	0.91	0.50	0.56	0.25	0.25	0.38	0.25	0.75
Hourly flow rate (vph)	130	99	25	4	62	12	5	4	8	8	4	40
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	74			124			482	452	111	444	459	68
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	74			124			482	452	111	444	459	68
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	91			100			99	99	99	98	99	96
cM capacity (veh/h)	1526			1463			440	459	942	482	455	996

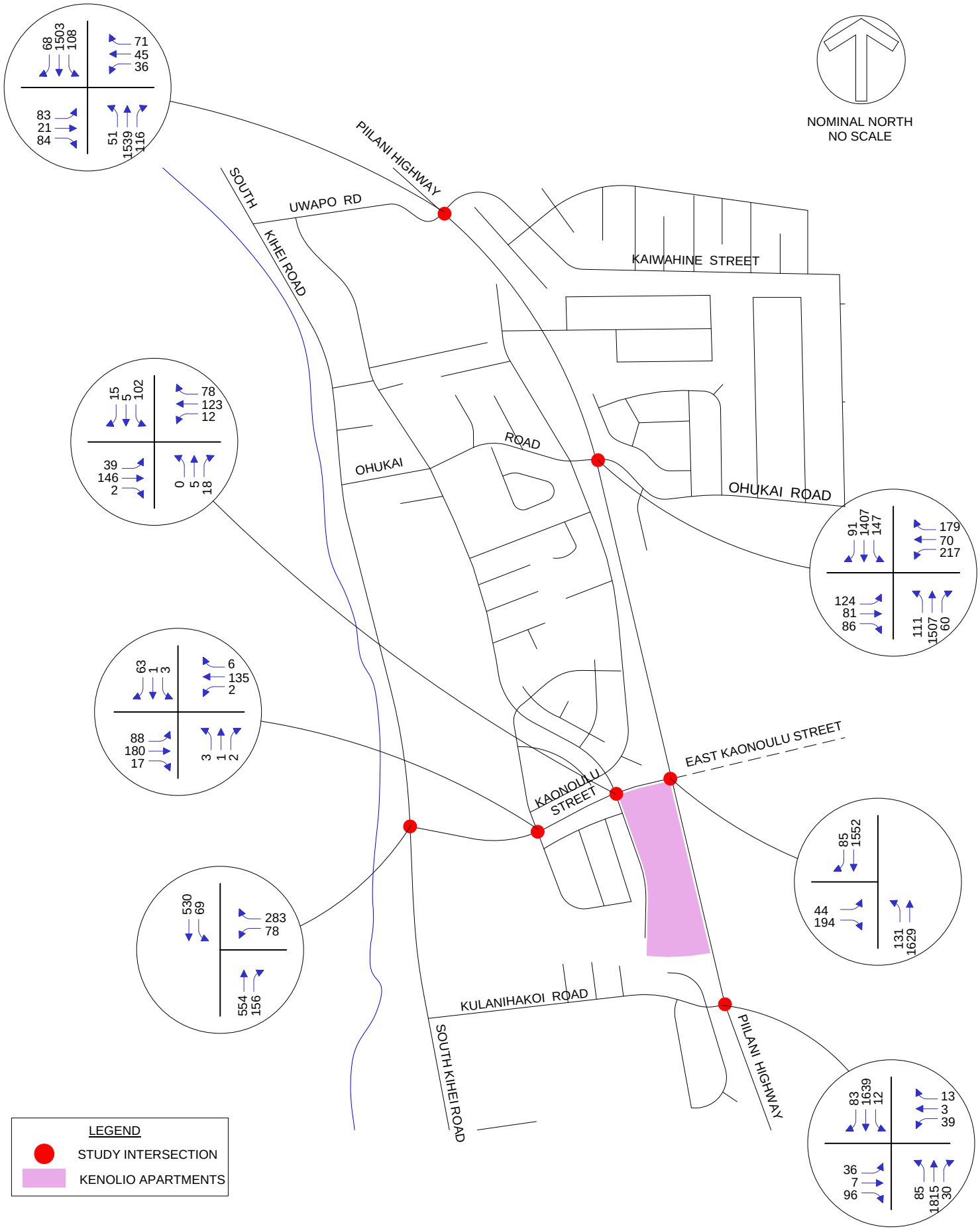
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	130	124	4	74	17	52
Volume Left	130	0	4	0	5	8
Volume Right	0	25	0	12	8	40
cSH	1526	1700	1463	1700	591	794
Volume to Capacity	0.09	0.07	0.00	0.04	0.03	0.07
Queue Length 95th (ft)	7	0	0	0	2	5
Control Delay (s)	7.6	0.0	7.5	0.0	11.3	9.8
Lane LOS	A		A		B	A
Approach Delay (s)	3.9		0.4		11.3	9.8
Approach LOS					B	A

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	20.0%	ICU Level of Service	A
Analysis Period (min)	15		



Attachment I
2017 AM PEAK HOUR PROJECTIONS WITHOUT PROJECT TRAFFIC

Phillip Rowell and Associates



Attachment J
2017 PM PEAK HOUR PROJECTIONS WITHOUT PROJECT TRAFFIC

Phillip Rowell and Associates

Attachment K
Level-of-Service Worksheets for 2017 Background Projections
Without Project Generated Traffic Without Mitigation
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1816	1583		1788	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.97	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1816	1583		1788	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	100	94	84	224	43	189	27	1101	43	178	1520	84
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	102	91	243	47	205	29	1197	47	193	1652	91
RTOR Reduction (vph)	0	0	78	0	0	171	0	0	24	0	0	30
Lane Group Flow (vph)	0	211	13	0	290	34	29	1197	23	193	1652	61
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Actuated Green, G (s)		16.6	16.6		20.0	20.0	6.0	53.8	53.8	14.6	62.4	62.4
Effective Green, g (s)		17.6	17.6		21.0	21.0	7.0	54.8	54.8	15.6	63.4	63.4
Actuated g/C Ratio		0.14	0.14		0.17	0.17	0.06	0.44	0.44	0.12	0.51	0.51
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		256	223		300	266	99	1551	694	221	1795	803
v/s Ratio Prot		c0.12			c0.16		0.02	0.34		c0.11	c0.47	
v/s Ratio Perm			0.06			0.13			0.03			0.06
v/c Ratio		0.82	0.06		0.97	0.13	0.29	0.77	0.03	0.87	0.92	0.08
Uniform Delay, d1		52.2	46.5		51.7	44.2	56.6	29.8	20.0	53.7	28.5	15.8
Progression Factor		1.00	1.00		1.00	1.00	1.19	0.95	0.77	1.19	0.72	0.39
Incremental Delay, d2		18.9	0.1		42.5	0.2	0.6	3.6	0.1	26.2	8.3	0.2
Delay (s)		71.1	46.6		94.1	44.4	67.7	31.9	15.6	89.9	28.8	6.2
Level of Service		E	D		F	D	E	C	B	F	C	A
Approach Delay (s)		63.7			73.6			32.1			33.9	
Approach LOS		E			E			C			C	

Intersection Summary

HCM Average Control Delay	40.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1783	1583		1799	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.59	1.00		0.51	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1106	1583		943	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	147	18	113	75	30	114	18	1339	59	36	1340	22
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	20	123	82	33	124	20	1455	64	39	1457	24
RTOR Reduction (vph)	0	0	98	0	0	99	0	0	22	0	0	8
Lane Group Flow (vph)	0	180	25	0	115	25	20	1455	42	39	1457	16
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Actuated Green, G (s)		23.9	23.9		23.9	23.9	4.0	80.1	80.1	6.0	82.1	82.1
Effective Green, g (s)		24.9	24.9		24.9	24.9	5.0	81.1	81.1	7.0	83.1	83.1
Actuated g/C Ratio		0.20	0.20		0.20	0.20	0.04	0.65	0.65	0.06	0.66	0.66
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		4.0	4.0		4.0	4.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		220	315		188	315	71	2296	1027	99	2353	1052
v/s Ratio Prot							0.01	0.41		c0.02	c0.41	
v/s Ratio Perm		c0.16	0.08		0.12	0.08			0.04			0.02
v/c Ratio		0.82	0.08		0.61	0.08	0.28	0.63	0.04	0.39	0.62	0.02
Uniform Delay, d1		47.9	40.7		45.6	40.7	58.3	13.1	7.9	57.0	11.9	7.1
Progression Factor		1.00	1.00		1.00	1.00	0.64	2.01	4.63	1.00	1.00	1.00
Incremental Delay, d2		21.4	0.1		6.6	0.1	0.5	0.9	0.1	0.9	1.2	0.0
Delay (s)		69.3	40.9		52.2	40.9	37.9	27.2	36.7	57.9	13.2	7.1
Level of Service		E	D		D	D	D	C	D	E	B	A
Approach Delay (s)		57.8			46.3			27.7			14.2	
Approach LOS		E			D			C			B	

Intersection Summary

HCM Average Control Delay	25.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Volume (vph)	40	239	114	1074	1609	68
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	260	124	1167	1749	74
RTOR Reduction (vph)	0	241	0	0	0	17
Lane Group Flow (vph)	43	19	124	1167	1749	57
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	9.2	9.2	13.8	107.8	90.0	90.0
Effective Green, g (s)	9.2	9.2	13.8	107.8	90.0	90.0
Actuated g/C Ratio	0.07	0.07	0.11	0.86	0.72	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	130	117	195	3052	2548	1140
v/s Ratio Prot	0.02		c0.07	0.33	c0.49	
v/s Ratio Perm		0.16				0.05
v/c Ratio	0.33	0.16	0.64	0.38	0.69	0.05
Uniform Delay, d1	55.0	54.3	53.2	1.8	9.7	5.1
Progression Factor	1.00	1.00	1.00	1.00	1.37	2.54
Incremental Delay, d2	1.5	0.7	6.6	0.4	0.7	0.0
Delay (s)	56.5	55.0	59.8	2.1	14.0	13.0
Level of Service	E	D	E	A	B	B
Approach Delay (s)	55.2			7.7	14.0	
Approach LOS	E			A	B	

Intersection Summary

HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1827		1770	1863
Flt Permitted	0.95	1.00	1.00		0.34	1.00
Satd. Flow (perm)	1770	1583	1827		630	1863
Volume (vph)	90	37	552	91	34	383
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	40	600	99	37	416
RTOR Reduction (vph)	0	34	7	0	0	0
Lane Group Flow (vph)	98	6	692	0	37	416
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	9.0	9.0	44.5		44.5	44.5
Effective Green, g (s)	9.0	9.0	44.5		44.5	44.5
Actuated g/C Ratio	0.15	0.15	0.72		0.72	0.72
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	259	232	1322		456	1348
v/s Ratio Prot	c0.06		c0.38			0.22
v/s Ratio Perm		0.03			0.06	
v/c Ratio	0.38	0.03	0.52		0.08	0.31
Uniform Delay, d1	23.7	22.5	3.8		2.5	3.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9	0.0	0.4		0.1	0.1
Delay (s)	24.6	22.5	4.2		2.6	3.2
Level of Service	C	C	A		A	A
Approach Delay (s)	24.0		4.2			3.1
Approach LOS	C		A			A

Intersection Summary

HCM Average Control Delay	5.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1827	1583		1781	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.86	1.00		0.70	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1606	1583		1300	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	22	35	132	75	6	27	33	1305	137	56	1930	33
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	24	38	143	82	7	29	36	1418	149	61	2098	36
RTOR Reduction (vph)	0	0	127	0	0	26	0	0	42	0	0	9
Lane Group Flow (vph)	0	62	16	0	89	3	36	1418	107	61	2098	27
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		11.8	11.8		11.8	11.8	4.7	74.2	74.2	5.7	75.2	75.2
Effective Green, g (s)		11.8	11.8		11.8	11.8	4.7	74.2	74.2	5.7	75.2	75.2
Actuated g/C Ratio		0.11	0.11		0.11	0.11	0.05	0.72	0.72	0.05	0.73	0.73
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		183	180		148	180	80	2532	1133	97	2566	1148
v/s Ratio Prot							0.02	0.40		c0.03	c0.59	
v/s Ratio Perm		0.04	0.09		0.07	0.02			0.09			0.02
v/c Ratio		0.34	0.09		0.60	0.02	0.45	0.56	0.09	0.63	0.82	0.02
Uniform Delay, d1		42.4	41.1		43.7	40.8	48.2	7.0	4.5	48.0	9.6	4.0
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.1	0.2		6.7	0.0	4.0	0.3	0.0	12.1	2.1	0.0
Delay (s)		43.5	41.4		50.4	40.8	52.2	7.3	4.5	60.0	11.8	4.0
Level of Service		D	D		D	D	D	A	A	E	B	A
Approach Delay (s)		42.0			48.1			8.0			13.0	
Approach LOS		D			D			A			B	

Intersection Summary

HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	103.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.0%	ICU Level of Service	D
Analysis Period (min)	15		

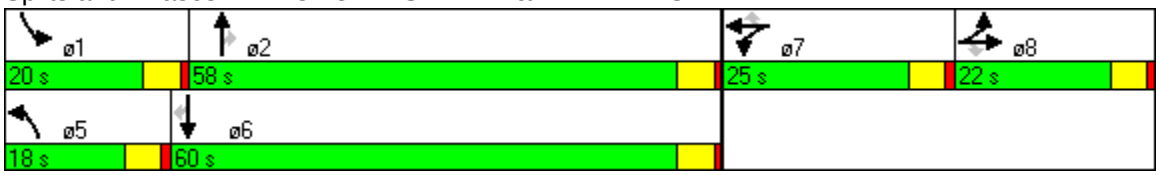
c Critical Lane Group

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	94	84	43	189	27	1101	43	178	1520	84
Lane Group Flow (vph)	211	91	290	205	29	1197	47	193	1652	91
Turn Type		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases	8		7		5	2		1	6	
Permitted Phases		8		7			2			6
Detector Phases	8	8	7	7	5	2	2	1	6	6
Minimum Initial (s)	15.0	15.0	10.0	10.0	10.0	25.0	25.0	13.0	22.0	22.0
Minimum Split (s)	22.0	22.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (s)	22.0	22.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (%)	17.6%	17.6%	20.0%	20.0%	14.4%	46.4%	46.4%	16.0%	48.0%	48.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
v/c Ratio	0.82	0.30	0.97	0.47	0.19	0.77	0.07	0.87	0.89	0.11
Control Delay	75.2	12.2	96.0	9.8	64.8	32.5	5.7	91.4	27.6	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	75.2	12.2	96.0	9.8	64.8	32.5	5.7	91.4	27.6	3.1
Queue Length 50th (ft)	167	0	236	0	24	435	2	137	685	5
Queue Length 95th (ft)	#293	49	#413	67	56	524	15	#294	#866	m14
Internal Link Dist (ft)	459		456			2865			2675	
Turn Bay Length (ft)										
Base Capacity (vph)	262	306	300	437	198	1552	718	227	1851	857
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.81	0.30	0.97	0.47	0.15	0.77	0.07	0.85	0.89	0.11

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 125
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: OHUKAI STREET & PIILANI HIGHWAY

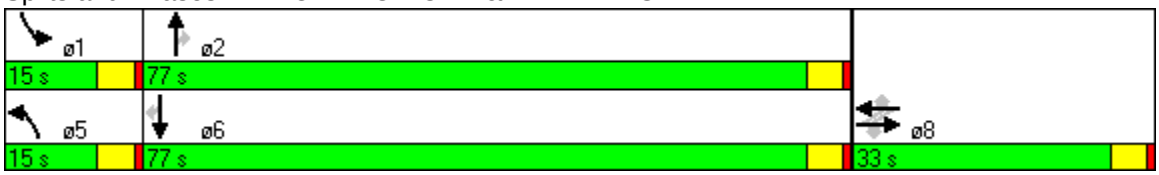


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	147	18	113	75	30	114	18	1339	59	36	1340	22
Lane Group Flow (vph)	0	180	123	0	115	124	20	1455	64	39	1457	24
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Detector Phases	8	8	8	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	25.0	25.0	10.0	25.0	25.0
Minimum Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	80.0	80.0	15.0	80.0	80.0
Total Split (s)	33.0	33.0	33.0	33.0	33.0	33.0	15.0	77.0	77.0	15.0	77.0	77.0
Total Split (%)	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%	12.0%	61.6%	61.6%	12.0%	61.6%	61.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio		0.80	0.30		0.55	0.30	0.13	0.62	0.06	0.25	0.60	0.02
Control Delay		60.6	8.1		50.6	8.1	35.2	29.5	12.7	57.6	13.6	4.1
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		60.6	8.1		50.6	8.1	35.2	29.5	12.7	57.6	13.6	4.1
Queue Length 50th (ft)		136	0		82	0	16	492	14	30	266	0
Queue Length 95th (ft)		#224	50		144	50	m23	601	m31	67	499	12
Internal Link Dist (ft)		530			620			2675			2120	
Turn Bay Length (ft)												
Base Capacity (vph)		264	462		245	462	156	2353	1074	156	2438	1098
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.68	0.27		0.47	0.27	0.13	0.62	0.06	0.25	0.60	0.02

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 125
Offset: 50 (40%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: UWAPO ROAD & PIILANI HIGHWAY



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	40	239	114	1074	1609	68
Lane Group Flow (vph)	43	260	124	1167	1749	74
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	25.0	25.0	25.0	100.0	75.0	75.0
Total Split (%)	20.0%	20.0%	20.0%	80.0%	60.0%	60.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Min	C-Min	C-Min
v/c Ratio	0.33	0.73	0.64	0.38	0.69	0.06
Control Delay	54.6	10.7	56.7	2.4	16.1	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.6	10.7	56.7	2.4	16.1	6.7
Queue Length 50th (ft)	34	0	97	65	454	14
Queue Length 95th (ft)	69	81	156	135	m507	m16
Internal Link Dist (ft)	253			2017	2865	
Turn Bay Length (ft)						
Base Capacity (vph)	297	482	297	3053	2549	1157
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.54	0.42	0.38	0.69	0.06

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 125
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: KAONOULU STREET & PIILANI HIGHWAY

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	90	37	552	34	383
Lane Group Flow (vph)	98	40	699	37	416
Turn Type		Perm		Perm	
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phases	8	8	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	35.0	35.0	35.0
Total Split (%)	36.4%	36.4%	63.6%	63.6%	63.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Min	Min	Min
v/c Ratio	0.36	0.14	0.53	0.11	0.31
Control Delay	14.8	6.8	6.1	4.6	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.8	6.8	6.1	4.6	4.3
Queue Length 50th (ft)	20	0	71	3	36
Queue Length 95th (ft)	55	18	175	13	86
Internal Link Dist (ft)	290		106		222
Turn Bay Length (ft)					
Base Capacity (vph)	456	437	1355	350	1374
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.21	0.09	0.52	0.11	0.30

Intersection Summary

Cycle Length: 55
Actuated Cycle Length: 62.4
Natural Cycle: 55
Control Type: Actuated-Uncoordinated

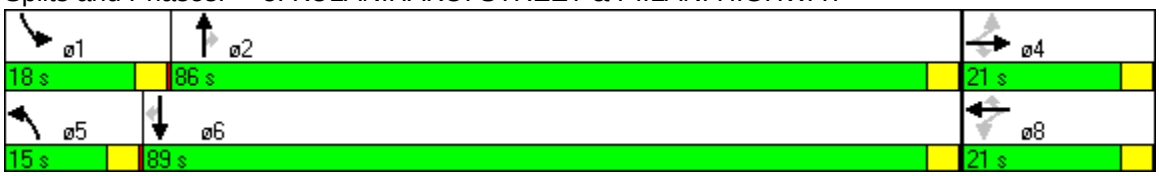
Splits and Phases: 4: KAONOULU STREET & SOUTH KIHEI ROAD

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	35	132	75	6	27	33	1305	137	56	1930	33
Lane Group Flow (vph)	0	62	143	0	89	29	36	1418	149	61	2098	36
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Detector Phases	4	4	4	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	8.0	20.0	20.0	8.0	20.0	20.0
Total Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	15.0	86.0	86.0	18.0	89.0	89.0
Total Split (%)	16.8%	16.8%	16.8%	16.8%	16.8%	16.8%	12.0%	68.8%	68.8%	14.4%	71.2%	71.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	Min
v/c Ratio		0.33	0.46		0.60	0.14	0.28	0.55	0.13	0.41	0.81	0.03
Control Delay		47.9	11.0		52.3	17.6	53.8	9.0	1.4	52.5	13.7	2.5
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		47.9	11.0		52.3	17.6	53.8	9.0	1.4	52.5	13.7	2.5
Queue Length 50th (ft)		42	0		62	0	25	244	0	43	504	1
Queue Length 95th (ft)		91	60		124	29	63	377	22	92	763	12
Internal Link Dist (ft)		212			205			1849			2017	
Turn Bay Length (ft)												
Base Capacity (vph)		269	381		215	286	184	2647	1221	229	2692	1212
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.23	0.38		0.41	0.10	0.20	0.54	0.12	0.27	0.78	0.03

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 102.2
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 5: KULANIHAKOI STREET & PIILANI HIGHWAY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	25	104	2	10	118	55	0	1	39	162	1	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	113	2	11	128	60	0	1	42	176	1	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)		817			333							
pX, platoon unblocked												
vC, conflicting volume	188			115			335	378	114	390	349	158
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	188			115			335	378	114	390	349	158
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			99			100	100	95	67	100	98
cM capacity (veh/h)	1386			1474			594	539	938	531	559	887

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	27	115	11	188	0	43	176	17
Volume Left	27	0	11	0	0	0	176	0
Volume Right	0	2	0	60	0	42	0	16
cSH	1386	1700	1474	1700	1700	921	531	856
Volume to Capacity	0.02	0.07	0.01	0.11	0.00	0.05	0.33	0.02
Queue Length 95th (ft)	1	0	1	0	0	4	36	2
Control Delay (s)	7.6	0.0	7.5	0.0	0.0	9.1	15.1	9.3
Lane LOS	A		A		A	A	C	A
Approach Delay (s)	1.5		0.4		9.1		14.6	
Approach LOS					A		B	

Intersection Summary			
Average Delay	6.1		
Intersection Capacity Utilization	38.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	32	122	14	4	94	2	10	0	2	3	0	72
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	133	15	4	102	2	11	0	2	3	0	78
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)		370			780							
pX, platoon unblocked												
vC, conflicting volume	104			148			399	323	140	316	329	103
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	104			148			399	323	140	316	329	103
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			98	100	100	99	100	92
cM capacity (veh/h)	1487			1434			505	579	908	622	574	952

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	35	148	4	104	13	82
Volume Left	35	0	4	0	11	3
Volume Right	0	15	0	2	2	78
cSH	1487	1700	1434	1700	545	932
Volume to Capacity	0.02	0.09	0.00	0.06	0.02	0.09
Queue Length 95th (ft)	2	0	0	0	2	7
Control Delay (s)	7.5	0.0	7.5	0.0	11.8	9.2
Lane LOS	A		A		B	A
Approach Delay (s)	1.4		0.3		11.8	9.2
Approach LOS					B	A

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		

Attachment L
Level-of-Service Worksheets for 2017 Background Projections
Without Project Generated Traffic Without Mitigation
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1808	1583		1795	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.97	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1808	1583		1795	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	124	81	86	217	70	179	111	1507	60	147	1407	91
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	135	88	93	236	76	195	121	1638	65	160	1529	99
RTOR Reduction (vph)	0	0	82	0	0	155	0	0	20	0	0	32
Lane Group Flow (vph)	0	223	11	0	312	40	121	1638	45	160	1529	67
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Actuated Green, G (s)		17.0	17.0		27.2	27.2	12.4	71.2	71.2	14.6	73.4	73.4
Effective Green, g (s)		18.0	18.0		28.2	28.2	13.4	72.2	72.2	15.6	74.4	74.4
Actuated g/C Ratio		0.12	0.12		0.19	0.19	0.09	0.48	0.48	0.10	0.50	0.50
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		217	190		337	298	158	1703	762	184	1755	785
v/s Ratio Prot		c0.12			c0.17		0.07	c0.46		c0.09	0.43	
v/s Ratio Perm			0.06			0.12			0.04			0.06
v/c Ratio		1.03	0.06		0.93	0.13	0.77	0.96	0.06	0.87	0.87	0.09
Uniform Delay, d1		66.0	58.5		59.9	50.7	66.8	37.6	20.8	66.2	33.5	19.9
Progression Factor		1.00	1.00		1.00	1.00	0.95	1.03	1.24	0.97	0.83	0.67
Incremental Delay, d2		68.5	0.1		30.4	0.2	15.3	12.8	0.1	26.8	5.1	0.2
Delay (s)		134.5	58.6		90.3	50.9	79.0	51.4	25.9	91.0	32.9	13.5
Level of Service		F	E		F	D	E	D	C	F	C	B
Approach Delay (s)		112.1			75.2			52.3			37.0	
Approach LOS		F			E			D			D	

Intersection Summary

HCM Average Control Delay	53.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	84.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1791	1583		1822	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.62	1.00		0.73	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1157	1583		1360	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	83	21	84	36	45	71	51	1539	116	108	1503	68
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	23	91	39	49	77	55	1673	126	117	1634	74
RTOR Reduction (vph)	0	0	78	0	0	66	0	0	29	0	0	18
Lane Group Flow (vph)	0	113	13	0	88	11	55	1673	97	117	1634	56
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Actuated Green, G (s)		19.9	19.9		19.9	19.9	8.7	100.7	100.7	14.4	106.4	106.4
Effective Green, g (s)		20.9	20.9		20.9	20.9	9.7	101.7	101.7	15.4	107.4	107.4
Actuated g/C Ratio		0.14	0.14		0.14	0.14	0.06	0.68	0.68	0.10	0.72	0.72
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		4.0	4.0		4.0	4.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		161	221		189	221	114	2399	1073	182	2534	1133
v/s Ratio Prot							0.03	c0.47		c0.07	0.46	
v/s Ratio Perm		c0.10	0.06		0.06	0.05			0.08			0.05
v/c Ratio		0.70	0.06		0.47	0.05	0.48	0.70	0.09	0.64	0.64	0.05
Uniform Delay, d1		61.6	56.0		59.4	55.9	67.7	14.8	8.3	64.7	11.2	6.3
Progression Factor		1.00	1.00		1.00	1.00	0.59	1.56	2.98	1.00	1.00	1.00
Incremental Delay, d2		13.8	0.1		2.5	0.1	0.5	0.7	0.1	5.7	1.3	0.1
Delay (s)		75.4	56.2		61.9	56.1	40.5	23.7	24.7	70.4	12.5	6.4
Level of Service		E	E		E	E	D	C	C	E	B	A
Approach Delay (s)		66.8			59.2			24.3			16.0	
Approach LOS		E			E			C			B	

Intersection Summary

HCM Average Control Delay	24.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Volume (vph)	44	194	131	1629	1552	85
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	211	142	1771	1687	92
RTOR Reduction (vph)	0	197	0	0	0	17
Lane Group Flow (vph)	48	14	142	1771	1687	75
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	9.7	9.7	16.8	132.3	111.5	111.5
Effective Green, g (s)	9.7	9.7	16.8	132.3	111.5	111.5
Actuated g/C Ratio	0.06	0.06	0.11	0.88	0.74	0.74
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	114	102	198	3121	2631	1177
v/s Ratio Prot	0.03		c0.08	0.50	c0.48	
v/s Ratio Perm		0.13				0.06
v/c Ratio	0.42	0.13	0.72	0.57	0.64	0.06
Uniform Delay, d1	67.5	66.2	64.3	2.1	9.4	5.2
Progression Factor	1.00	1.00	0.92	0.99	0.57	0.83
Incremental Delay, d2	2.5	0.6	9.1	0.6	0.6	0.1
Delay (s)	70.0	66.8	68.4	2.7	6.0	4.4
Level of Service	E	E	E	A	A	A
Approach Delay (s)	67.4			7.5	5.9	
Approach LOS	E			A	A	

Intersection Summary

HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.97		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1807		1770	1863
Flt Permitted	0.95	1.00	1.00		0.18	1.00
Satd. Flow (perm)	1770	1583	1807		332	1863
Volume (vph)	78	283	554	156	69	530
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	85	308	602	170	75	576
RTOR Reduction (vph)	0	256	14	0	0	0
Lane Group Flow (vph)	85	52	758	0	75	576
Turn Type		Perm			pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8			6	
Actuated Green, G (s)	8.6	8.6	28.5		34.5	34.5
Effective Green, g (s)	8.6	8.6	28.5		34.5	34.5
Actuated g/C Ratio	0.17	0.17	0.56		0.68	0.68
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	298	266	1008		280	1258
v/s Ratio Prot	0.05		c0.43		0.01	c0.31
v/s Ratio Perm		0.19			0.17	
v/c Ratio	0.29	0.19	0.75		0.27	0.46
Uniform Delay, d1	18.6	18.3	8.6		6.0	3.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.5	0.4	3.2		0.5	0.3
Delay (s)	19.1	18.6	11.8		6.5	4.2
Level of Service	B	B	B		A	A
Approach Delay (s)	18.7		11.8			4.4
Approach LOS	B		B			A

Intersection Summary

HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	51.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1789	1583		1780	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.73	1.00		0.71	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1362	1583		1315	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	36	7	96	39	3	13	85	1815	30	12	1639	83
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	39	8	104	42	3	14	92	1973	33	13	1782	90
RTOR Reduction (vph)	0	0	97	0	0	13	0	0	5	0	0	16
Lane Group Flow (vph)	0	47	7	0	45	1	92	1973	28	13	1782	74
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		10.1	10.1		10.1	10.1	12.9	124.8	124.8	3.1	115.0	115.0
Effective Green, g (s)		10.1	10.1		10.1	10.1	12.9	124.8	124.8	3.1	115.0	115.0
Actuated g/C Ratio		0.07	0.07		0.07	0.07	0.09	0.83	0.83	0.02	0.77	0.77
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		92	107		89	107	152	2944	1317	37	2713	1214
v/s Ratio Prot							c0.05	c0.56		0.01	0.50	
v/s Ratio Perm		0.03	0.07		0.03	0.01			0.02			0.06
v/c Ratio		0.51	0.07		0.51	0.01	0.61	0.67	0.02	0.35	0.66	0.06
Uniform Delay, d1		67.6	65.5		67.5	65.3	66.1	4.8	2.2	72.5	8.2	4.3
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.26	1.15	0.89
Incremental Delay, d2		4.7	0.3		4.5	0.0	6.7	1.2	0.0	4.5	1.0	0.1
Delay (s)		72.3	65.8		72.0	65.3	72.7	6.0	2.2	95.5	10.4	3.9
Level of Service		E	E		E	E	E	A	A	F	B	A
Approach Delay (s)		67.8			70.4			8.9			10.7	
Approach LOS		E			E			A			B	

Intersection Summary

HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	81	86	70	179	111	1507	60	147	1407	91
Lane Group Flow (vph)	223	93	312	195	121	1638	65	160	1529	99
Turn Type		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases	8		7		5	2		1	6	
Permitted Phases		8		7			2			6
Detector Phases	8	8	7	7	5	2	2	1	6	6
Minimum Initial (s)	15.0	15.0	10.0	10.0	10.0	25.0	25.0	13.0	22.0	22.0
Minimum Split (s)	22.0	22.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (s)	22.0	22.0	33.0	33.0	18.0	75.0	75.0	20.0	77.0	77.0
Total Split (%)	14.7%	14.7%	22.0%	22.0%	12.0%	50.0%	50.0%	13.3%	51.3%	51.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
v/c Ratio	1.03	0.34	0.92	0.43	0.77	0.96	0.08	0.87	0.87	0.12
Control Delay	131.3	14.5	87.8	10.0	85.0	51.6	13.3	93.2	33.6	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	131.3	14.5	87.8	10.0	85.0	51.6	13.3	93.2	33.6	6.0
Queue Length 50th (ft)	~232	0	302	3	107	812	14	143	749	36
Queue Length 95th (ft)	#407	56	#478	74	#216	#982	m46	#283	862	m37
Internal Link Dist (ft)	459		456			2865			2675	
Turn Bay Length (ft)										
Base Capacity (vph)	217	272	347	460	165	1703	781	189	1756	817
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.03	0.34	0.90	0.42	0.73	0.96	0.08	0.85	0.87	0.12

Intersection Summary

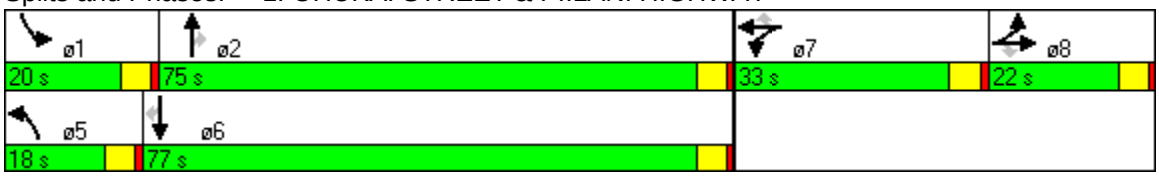
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 135
Control Type: Actuated-Coordinated

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: OHUKAI STREET & PIILANI HIGHWAY

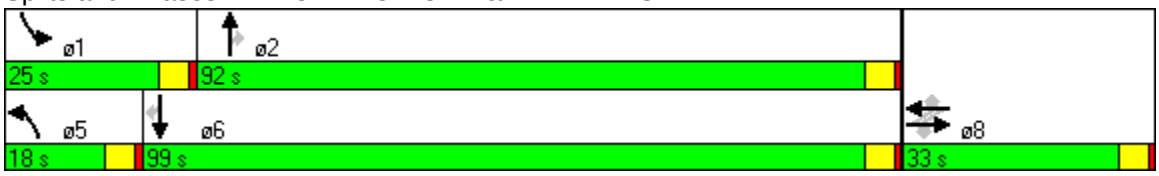


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	83	21	84	36	45	71	51	1539	116	108	1503	68
Lane Group Flow (vph)	0	113	91	0	88	77	55	1673	126	117	1634	74
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Detector Phases	8	8	8	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	25.0	25.0	10.0	25.0	25.0
Minimum Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	80.0	80.0	15.0	80.0	80.0
Total Split (s)	33.0	33.0	33.0	33.0	33.0	33.0	18.0	92.0	92.0	25.0	99.0	99.0
Total Split (%)	22.0%	22.0%	22.0%	22.0%	22.0%	22.0%	12.0%	61.3%	61.3%	16.7%	66.0%	66.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio		0.66	0.31		0.41	0.27	0.40	0.70	0.11	0.64	0.64	0.06
Control Delay		66.8	11.1		59.7	11.7	41.2	26.7	11.4	70.4	14.0	2.9
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		66.8	11.1		59.7	11.7	41.2	26.7	11.4	70.4	14.0	2.9
Queue Length 50th (ft)		107	0		80	0	47	517	42	112	417	3
Queue Length 95th (ft)		168	50		131	46	m57	m631	m46	176	630	24
Internal Link Dist (ft)		530			620			2675			2120	
Turn Bay Length (ft)												
Base Capacity (vph)		237	379		301	368	165	2401	1103	248	2559	1162
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.48	0.24		0.29	0.21	0.33	0.70	0.11	0.47	0.64	0.06

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 50 (33%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: UWAPO ROAD & PIILANI HIGHWAY



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	44	194	131	1629	1552	85
Lane Group Flow (vph)	48	211	142	1771	1687	92
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	28.0	28.0	28.0	122.0	94.0	94.0
Total Split (%)	18.7%	18.7%	18.7%	81.3%	62.7%	62.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Min	C-Min	C-Min
v/c Ratio	0.42	0.71	0.72	0.57	0.64	0.08
Control Delay	67.7	11.9	63.3	2.9	6.8	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.7	11.9	63.3	2.9	6.8	2.2
Queue Length 50th (ft)	46	0	137	139	168	1
Queue Length 95th (ft)	89	82	204	257	287	m7
Internal Link Dist (ft)	253			2017	2865	
Turn Bay Length (ft)						
Base Capacity (vph)	283	431	283	3122	2631	1194
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.49	0.50	0.57	0.64	0.08

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

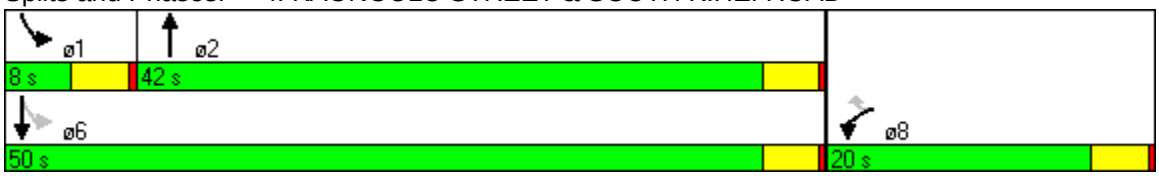
Splits and Phases: 3: KAONOULU STREET & PIILANI HIGHWAY

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	78	283	554	69	530
Lane Group Flow (vph)	85	308	772	75	576
Turn Type		Perm		pm+pt	
Protected Phases	8		2	1	6
Permitted Phases		8		6	
Detector Phases	8	8	2	1	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	8.0	20.0
Total Split (s)	20.0	20.0	42.0	8.0	50.0
Total Split (%)	28.6%	28.6%	60.0%	11.4%	71.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lead/Lag			Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	
Recall Mode	None	None	Min	None	Min
v/c Ratio	0.28	0.58	0.74	0.25	0.47
Control Delay	21.8	6.0	12.4	5.6	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	21.8	6.0	12.4	5.6	5.5
Queue Length 50th (ft)	23	0	158	5	57
Queue Length 95th (ft)	65	58	364	20	155
Internal Link Dist (ft)	290		106		222
Turn Bay Length (ft)					
Base Capacity (vph)	517	680	1181	297	1371
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.16	0.45	0.65	0.25	0.42

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 49.9
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 4: KAONOULU STREET & SOUTH KIHEI ROAD

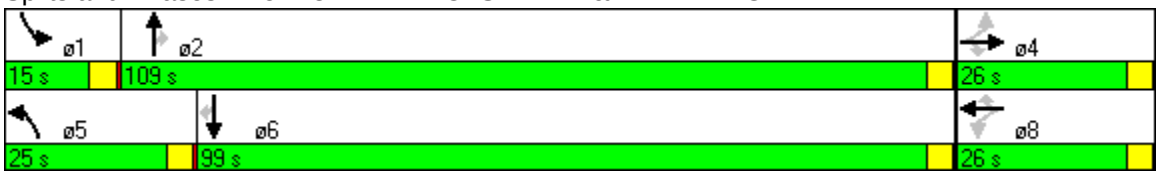


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	36	7	96	39	3	13	85	1815	30	12	1639	83
Lane Group Flow (vph)	0	47	104	0	45	14	92	1973	33	13	1782	90
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Detector Phases	4	4	4	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	8.0	20.0	20.0	8.0	20.0	20.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	25.0	109.0	109.0	15.0	99.0	99.0
Total Split (%)	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	16.7%	72.7%	72.7%	10.0%	66.0%	66.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
v/c Ratio		0.49	0.51		0.48	0.12	0.61	0.66	0.02	0.17	0.66	0.07
Control Delay		69.0	13.8		69.0	26.6	69.6	6.4	1.5	87.4	11.7	1.8
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		69.0	13.8		69.0	26.6	69.6	6.4	1.5	87.4	11.7	1.8
Queue Length 50th (ft)		45	0		43	0	88	197	1	0	769	3
Queue Length 95th (ft)		88	59		86	24	146	543	9	m21	874	m23
Internal Link Dist (ft)		212			168			1849			2017	
Turn Bay Length (ft)												
Base Capacity (vph)		209	321		202	244	248	3000	1346	130	2713	1230
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.22	0.32		0.22	0.06	0.37	0.66	0.02	0.10	0.66	0.07

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 130 (87%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: KULANIHAKOI STREET & PIILANI HIGHWAY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	39	146	2	12	123	78	0	5	18	102	5	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	42	159	2	13	134	85	0	5	20	111	5	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)		817			333							
pX, platoon unblocked												
vC, conflicting volume	218			161			423	489	160	468	448	176
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	218			161			423	489	160	468	448	176
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			99			100	99	98	77	99	98
cM capacity (veh/h)	1351			1418			510	460	885	475	486	867

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	42	161	13	218	0	25	111	22
Volume Left	42	0	13	0	0	0	111	0
Volume Right	0	2	0	85	0	20	0	16
cSH	1351	1700	1418	1700	1700	737	475	725
Volume to Capacity	0.03	0.09	0.01	0.13	0.00	0.03	0.23	0.03
Queue Length 95th (ft)	2	0	1	0	0	3	22	2
Control Delay (s)	7.8	0.0	7.6	0.0	0.0	10.1	14.9	10.1
Lane LOS	A		A		A	B	B	B
Approach Delay (s)	1.6		0.4		10.1		14.1	
Approach LOS					B		B	

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	88	180	17	2	135	6	3	1	2	3	1	63
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	96	196	18	2	147	7	3	1	2	3	1	68
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)		370			780							
pX, platoon unblocked												
vC, conflicting volume	153			214			616	554	205	544	560	150
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	153			214			616	554	205	544	560	150
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	93			100			99	100	100	99	100	92
cM capacity (veh/h)	1427			1356			352	410	836	424	407	896

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	96	214	2	153	7	73
Volume Left	96	0	2	0	3	3
Volume Right	0	18	0	7	2	68
cSH	1427	1700	1356	1700	449	840
Volume to Capacity	0.07	0.13	0.00	0.09	0.01	0.09
Queue Length 95th (ft)	5	0	0	0	1	7
Control Delay (s)	7.7	0.0	7.7	0.0	13.1	9.7
Lane LOS	A		A		B	A
Approach Delay (s)	2.4		0.1		13.1	9.7
Approach LOS					B	A

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	28.0%	ICU Level of Service	A
Analysis Period (min)	15		

Attachment M
Level-of-Service Worksheets for 2017 Background Projections
Without Project Generated Traffic With Mitigation
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1681	1765	1583	1681	1711	1583	1770	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1681	1765	1583	1681	1711	1583	1770	3539	1583	3433	3539	1583
Volume (vph)	100	94	84	224	43	189	27	1101	43	178	1520	84
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	102	91	243	47	205	29	1197	47	193	1652	91
RTOR Reduction (vph)	0	0	79	0	0	178	0	0	21	0	0	27
Lane Group Flow (vph)	103	108	12	141	149	27	29	1197	26	193	1652	64
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Actuated Green, G (s)	15.4	15.4	15.4	15.7	15.7	15.7	6.0	60.5	60.5	13.4	67.9	67.9
Effective Green, g (s)	16.4	16.4	16.4	16.7	16.7	16.7	7.0	61.5	61.5	14.4	68.9	68.9
Actuated g/C Ratio	0.13	0.13	0.13	0.13	0.13	0.13	0.06	0.49	0.49	0.12	0.55	0.55
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)	221	232	208	225	229	211	99	1741	779	395	1951	873
v/s Ratio Prot	c0.06	0.06		0.08	0.09		0.02	0.34		c0.06	c0.47	
v/s Ratio Perm			0.06			0.13			0.03			0.06
v/c Ratio	0.47	0.47	0.06	0.63	0.65	0.13	0.29	0.69	0.03	0.49	0.85	0.07
Uniform Delay, d1	50.2	50.2	47.5	51.2	51.4	47.7	56.6	24.4	16.4	51.8	23.6	13.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.07	0.91	0.81	1.28	0.70	0.39
Incremental Delay, d2	1.6	1.5	0.1	5.4	6.5	0.3	0.6	2.1	0.1	0.3	4.3	0.1
Delay (s)	51.8	51.7	47.6	56.6	57.9	48.0	61.0	24.3	13.4	66.9	20.8	5.3
Level of Service	D	D	D	E	E	D	E	C	B	E	C	A
Approach Delay (s)		50.5			53.4			24.7			24.7	
Approach LOS		D			D			C			C	

Intersection Summary

HCM Average Control Delay	30.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1783	1583		1799	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.59	1.00		0.49	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1097	1583		909	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	147	18	113	75	30	114	18	1339	59	36	1340	22
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	20	123	82	33	124	20	1455	64	39	1457	24
RTOR Reduction (vph)	0	0	99	0	0	100	0	0	22	0	0	8
Lane Group Flow (vph)	0	180	24	0	115	24	20	1455	42	39	1457	16
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Actuated Green, G (s)		22.9	22.9		22.9	22.9	4.0	81.1	81.1	6.0	83.1	83.1
Effective Green, g (s)		23.9	23.9		23.9	23.9	5.0	82.1	82.1	7.0	84.1	84.1
Actuated g/C Ratio		0.19	0.19		0.19	0.19	0.04	0.66	0.66	0.06	0.67	0.67
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		4.0	4.0		4.0	4.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		210	303		174	303	71	2324	1040	99	2381	1065
v/s Ratio Prot							0.01	0.41		c0.02	c0.41	
v/s Ratio Perm		c0.16	0.08		0.13	0.08			0.04			0.02
v/c Ratio		0.86	0.08		0.66	0.08	0.28	0.63	0.04	0.39	0.61	0.02
Uniform Delay, d1		48.9	41.5		46.8	41.5	58.3	12.5	7.6	57.0	11.4	6.8
Progression Factor		1.00	1.00		1.00	1.00	0.65	1.66	4.11	1.00	1.00	1.00
Incremental Delay, d2		28.2	0.1		9.9	0.2	0.6	1.0	0.1	0.9	1.2	0.0
Delay (s)		77.1	41.7		56.7	41.7	38.5	21.8	31.1	57.9	12.6	6.8
Level of Service		E	D		E	D	D	C	C	E	B	A
Approach Delay (s)		62.7			48.9			22.4			13.6	
Approach LOS		E			D			C			B	

Intersection Summary

HCM Average Control Delay	23.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Volume (vph)	40	239	114	1074	1609	68
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	260	124	1167	1749	74
RTOR Reduction (vph)	0	188	0	0	0	19
Lane Group Flow (vph)	43	72	124	1167	1749	55
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	11.3	11.3	13.3	105.7	88.4	88.4
Effective Green, g (s)	11.3	11.3	13.3	105.7	88.4	88.4
Actuated g/C Ratio	0.09	0.09	0.11	0.85	0.71	0.71
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	160	143	188	2993	2503	1119
v/s Ratio Prot	0.02		c0.07	0.33	c0.49	
v/s Ratio Perm		0.16				0.05
v/c Ratio	0.27	0.50	0.66	0.39	0.70	0.05
Uniform Delay, d1	53.0	54.2	53.7	2.2	10.6	5.6
Progression Factor	1.00	1.00	1.00	1.00	1.12	2.36
Incremental Delay, d2	0.9	2.8	8.1	0.4	1.0	0.1
Delay (s)	53.9	56.9	61.8	2.6	12.9	13.1
Level of Service	D	E	E	A	B	B
Approach Delay (s)	56.5			8.3	13.0	
Approach LOS	E			A	B	

Intersection Summary

HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1827		1770	1863
Flt Permitted	0.95	1.00	1.00		0.34	1.00
Satd. Flow (perm)	1770	1583	1827		630	1863
Volume (vph)	90	37	552	91	34	383
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	40	600	99	37	416
RTOR Reduction (vph)	0	34	7	0	0	0
Lane Group Flow (vph)	98	6	692	0	37	416
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	9.0	9.0	44.5		44.5	44.5
Effective Green, g (s)	9.0	9.0	44.5		44.5	44.5
Actuated g/C Ratio	0.15	0.15	0.72		0.72	0.72
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	259	232	1322		456	1348
v/s Ratio Prot	c0.06		c0.38			0.22
v/s Ratio Perm		0.03			0.06	
v/c Ratio	0.38	0.03	0.52		0.08	0.31
Uniform Delay, d1	23.7	22.5	3.8		2.5	3.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9	0.0	0.4		0.1	0.1
Delay (s)	24.6	22.5	4.2		2.6	3.2
Level of Service	C	C	A		A	A
Approach Delay (s)	24.0		4.2			3.1
Approach LOS	C		A			A

Intersection Summary

HCM Average Control Delay	5.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1827	1583		1781	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.86	1.00		0.70	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1606	1583		1300	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	22	35	132	75	6	27	33	1305	137	56	1930	33
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	24	38	143	82	7	29	36	1418	149	61	2098	36
RTOR Reduction (vph)	0	0	127	0	0	26	0	0	42	0	0	9
Lane Group Flow (vph)	0	62	16	0	89	3	36	1418	107	61	2098	27
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		11.8	11.8		11.8	11.8	4.7	74.2	74.2	5.7	75.2	75.2
Effective Green, g (s)		11.8	11.8		11.8	11.8	4.7	74.2	74.2	5.7	75.2	75.2
Actuated g/C Ratio		0.11	0.11		0.11	0.11	0.05	0.72	0.72	0.05	0.73	0.73
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		183	180		148	180	80	2532	1133	97	2566	1148
v/s Ratio Prot							0.02	0.40		c0.03	c0.59	
v/s Ratio Perm		0.04	0.09		0.07	0.02			0.09			0.02
v/c Ratio		0.34	0.09		0.60	0.02	0.45	0.56	0.09	0.63	0.82	0.02
Uniform Delay, d1		42.4	41.1		43.7	40.8	48.2	7.0	4.5	48.0	9.6	4.0
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.1	0.2		6.7	0.0	4.0	0.3	0.0	12.1	2.1	0.0
Delay (s)		43.5	41.4		50.4	40.8	52.2	7.3	4.5	60.0	11.8	4.0
Level of Service		D	D		D	D	D	A	A	E	B	A
Approach Delay (s)		42.0			48.1			8.0			13.0	
Approach LOS		D			D			A			B	

Intersection Summary

HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	103.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.0%	ICU Level of Service	D
Analysis Period (min)	15		

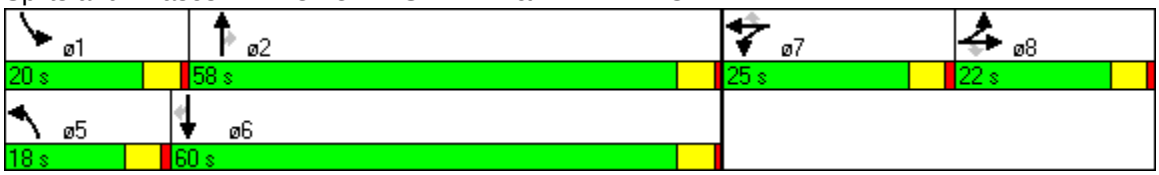
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	94	84	224	43	189	27	1101	43	178	1520	84
Lane Group Flow (vph)	103	108	91	141	149	205	29	1197	47	193	1652	91
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Detector Phases	8	8	8	7	7	7	5	2	2	1	6	6
Minimum Initial (s)	15.0	15.0	15.0	10.0	10.0	10.0	10.0	25.0	25.0	13.0	22.0	22.0
Minimum Split (s)	22.0	22.0	22.0	25.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (s)	22.0	22.0	22.0	25.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (%)	17.6%	17.6%	17.6%	20.0%	20.0%	20.0%	14.4%	46.4%	46.4%	16.0%	48.0%	48.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
v/c Ratio	0.47	0.47	0.32	0.63	0.65	0.53	0.19	0.69	0.06	0.49	0.82	0.10
Control Delay	56.1	55.8	12.3	56.8	57.3	9.8	58.5	25.4	5.6	69.7	21.6	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.1	55.8	12.3	56.8	57.3	9.8	58.5	25.4	5.6	69.7	21.6	3.0
Queue Length 50th (ft)	83	86	0	114	122	0	23	384	1	76	622	3
Queue Length 95th (ft)	143	148	49	182	191	67	56	524	17	124	#865	m14
Internal Link Dist (ft)		459			456			2865			2675	
Turn Bay Length (ft)												
Base Capacity (vph)	242	254	306	282	287	437	198	1741	800	439	2007	924
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.43	0.30	0.50	0.52	0.47	0.15	0.69	0.06	0.44	0.82	0.10

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 125
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: OHUKAI STREET & PIILANI HIGHWAY

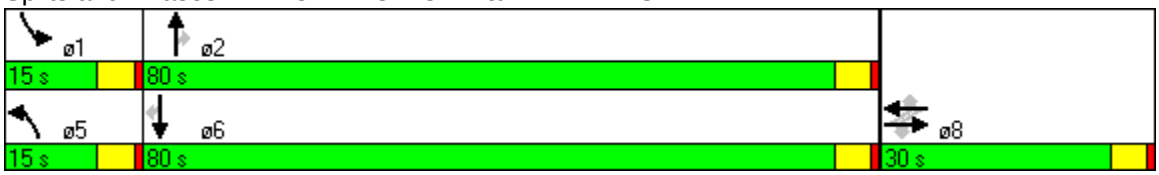


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	147	18	113	75	30	114	18	1339	59	36	1340	22
Lane Group Flow (vph)	0	180	123	0	115	124	20	1455	64	39	1457	24
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Detector Phases	8	8	8	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	25.0	25.0	10.0	25.0	25.0
Minimum Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	80.0	80.0	15.0	80.0	80.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	80.0	80.0	15.0	80.0	80.0
Total Split (%)	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	12.0%	64.0%	64.0%	12.0%	64.0%	64.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio		0.85	0.31		0.61	0.31	0.13	0.61	0.06	0.25	0.59	0.02
Control Delay		70.9	8.8		57.5	8.9	35.8	22.9	10.0	57.6	12.6	3.6
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		70.9	8.8		57.5	8.9	35.8	22.9	10.0	57.6	12.6	3.6
Queue Length 50th (ft)		139	0		84	0	15	373	6	30	253	0
Queue Length 95th (ft)		#255	52		151	52	m24	597	m36	67	467	11
Internal Link Dist (ft)		530			620			2675			2120	
Turn Bay Length (ft)												
Base Capacity (vph)		232	427		203	427	156	2381	1086	156	2466	1110
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.78	0.29		0.57	0.29	0.13	0.61	0.06	0.25	0.59	0.02

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 125
Offset: 50 (40%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: UWAPO ROAD & PIILANI HIGHWAY



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	40	239	114	1074	1609	68
Lane Group Flow (vph)	43	260	124	1167	1749	74
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	24.0	24.0	20.0	101.0	81.0	81.0
Total Split (%)	19.2%	19.2%	16.0%	80.8%	64.8%	64.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Min	C-Min	C-Min
v/c Ratio	0.27	0.79	0.66	0.39	0.70	0.06
Control Delay	51.5	19.2	62.4	3.1	15.0	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.5	19.2	62.4	3.1	15.0	5.9
Queue Length 50th (ft)	33	42	97	76	363	5
Queue Length 95th (ft)	66	127	161	170	436	m15
Internal Link Dist (ft)	253			2017	2865	
Turn Bay Length (ft)						
Base Capacity (vph)	283	427	227	2992	2503	1139
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.61	0.55	0.39	0.70	0.06

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 125
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: KAONOULU STREET & PIILANI HIGHWAY

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	90	37	552	34	383
Lane Group Flow (vph)	98	40	699	37	416
Turn Type		Perm		Perm	
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phases	8	8	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	35.0	35.0	35.0
Total Split (%)	36.4%	36.4%	63.6%	63.6%	63.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Min	Min	Min
v/c Ratio	0.36	0.14	0.53	0.11	0.31
Control Delay	14.8	6.8	6.1	4.6	4.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.8	6.8	6.1	4.6	4.3
Queue Length 50th (ft)	20	0	71	3	36
Queue Length 95th (ft)	55	18	175	13	86
Internal Link Dist (ft)	290		106		222
Turn Bay Length (ft)					
Base Capacity (vph)	456	437	1355	350	1374
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.21	0.09	0.52	0.11	0.30

Intersection Summary

Cycle Length: 55
Actuated Cycle Length: 62.4
Natural Cycle: 55
Control Type: Actuated-Uncoordinated

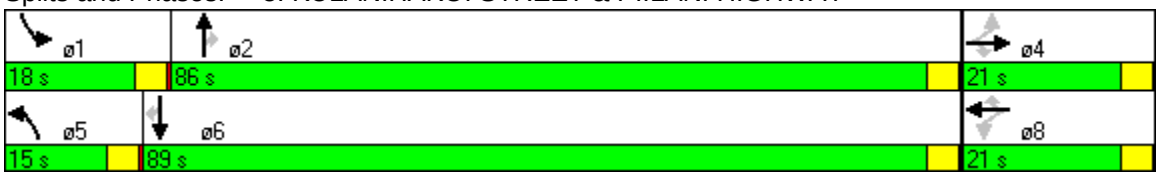
Splits and Phases: 4: KAONOULU STREET & SOUTH KIHEI ROAD

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	35	132	75	6	27	33	1305	137	56	1930	33
Lane Group Flow (vph)	0	62	143	0	89	29	36	1418	149	61	2098	36
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Detector Phases	4	4	4	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	8.0	20.0	20.0	8.0	20.0	20.0
Total Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	15.0	86.0	86.0	18.0	89.0	89.0
Total Split (%)	16.8%	16.8%	16.8%	16.8%	16.8%	16.8%	12.0%	68.8%	68.8%	14.4%	71.2%	71.2%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	Min
v/c Ratio		0.33	0.46		0.60	0.14	0.28	0.55	0.13	0.41	0.81	0.03
Control Delay		47.9	11.0		52.3	17.6	53.8	9.0	1.4	52.5	13.7	2.5
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		47.9	11.0		52.3	17.6	53.8	9.0	1.4	52.5	13.7	2.5
Queue Length 50th (ft)		42	0		62	0	25	244	0	43	504	1
Queue Length 95th (ft)		91	60		124	29	63	377	22	92	763	12
Internal Link Dist (ft)		212			205			1849			2017	
Turn Bay Length (ft)												
Base Capacity (vph)		269	381		215	286	184	2647	1221	229	2692	1212
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.23	0.38		0.41	0.10	0.20	0.54	0.12	0.27	0.78	0.03

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 102.2
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 5: KULANIHAKOI STREET & PIILANI HIGHWAY



Attachment N
Level-of-Service Worksheets for 2017 Background Projections
Without Project Generated Traffic With Mitigation
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.99	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1681	1750	1583	1681	1724	1583	1770	3539	1583	3433	3539	1583
Flt Permitted	0.95	0.99	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1681	1750	1583	1681	1724	1583	1770	3539	1583	3433	3539	1583
Volume (vph)	124	81	86	217	70	179	111	1507	60	147	1407	91
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	135	88	93	236	76	195	121	1638	65	160	1529	99
RTOR Reduction (vph)	0	0	83	0	0	168	0	0	18	0	0	30
Lane Group Flow (vph)	109	114	10	152	160	27	121	1638	47	160	1529	69
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Actuated Green, G (s)	15.8	15.8	15.8	17.4	17.4	17.4	12.9	83.5	83.5	13.3	83.9	83.9
Effective Green, g (s)	16.8	16.8	16.8	18.4	18.4	18.4	13.9	84.5	84.5	14.3	84.9	84.9
Actuated g/C Ratio	0.11	0.11	0.11	0.12	0.12	0.12	0.09	0.56	0.56	0.10	0.57	0.57
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)	188	196	177	206	211	194	164	1994	892	327	2003	896
v/s Ratio Prot	0.06	c0.07		0.09	0.09		c0.07	c0.46		0.05	0.43	
v/s Ratio Perm			0.06			0.12			0.04			0.06
v/c Ratio	0.58	0.58	0.06	0.74	0.76	0.14	0.74	0.82	0.05	0.49	0.76	0.08
Uniform Delay, d1	63.2	63.3	59.5	63.5	63.6	58.7	66.3	26.6	14.7	64.4	24.9	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.06	1.06	1.29	1.10	0.75	0.52
Incremental Delay, d2	4.3	4.3	0.1	12.9	14.4	0.3	11.8	3.3	0.1	0.3	2.3	0.1
Delay (s)	67.5	67.6	59.7	76.4	78.1	59.1	82.2	31.6	19.0	71.3	20.9	7.8
Level of Service	E	E	E	E	E	E	F	C	B	E	C	A
Approach Delay (s)		65.2			70.3			34.5			24.7	
Approach LOS		E			E			C			C	

Intersection Summary

HCM Average Control Delay	36.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1791	1583		1822	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.62	1.00		0.73	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1155	1583		1352	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	83	21	84	36	45	71	51	1539	116	108	1503	68
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	23	91	39	49	77	55	1673	126	117	1634	74
RTOR Reduction (vph)	0	0	78	0	0	66	0	0	29	0	0	16
Lane Group Flow (vph)	0	113	13	0	88	11	55	1673	97	117	1634	58
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Actuated Green, G (s)		19.7	19.7		19.7	19.7	8.7	101.7	101.7	13.6	106.6	106.6
Effective Green, g (s)		20.7	20.7		20.7	20.7	9.7	102.7	102.7	14.6	107.6	107.6
Actuated g/C Ratio		0.14	0.14		0.14	0.14	0.06	0.68	0.68	0.10	0.72	0.72
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		4.0	4.0		4.0	4.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		159	218		187	218	114	2423	1084	172	2539	1136
v/s Ratio Prot							0.03	c0.47		c0.07	0.46	
v/s Ratio Perm		c0.10	0.06		0.07	0.05			0.08			0.05
v/c Ratio		0.71	0.06		0.47	0.05	0.48	0.69	0.09	0.68	0.64	0.05
Uniform Delay, d1		61.8	56.2		59.6	56.1	67.7	14.1	7.9	65.4	11.1	6.2
Progression Factor		1.00	1.00		1.00	1.00	0.70	1.16	2.26	1.00	1.00	1.00
Incremental Delay, d2		14.8	0.2		2.5	0.1	0.7	1.0	0.1	8.5	1.3	0.1
Delay (s)		76.6	56.3		62.1	56.2	48.0	17.4	18.0	73.9	12.4	6.3
Level of Service		E	E		E	E	D	B	B	E	B	A
Approach Delay (s)		67.6			59.4			18.3			16.1	
Approach LOS		E			E			B			B	

Intersection Summary

HCM Average Control Delay	21.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Volume (vph)	44	194	131	1629	1552	85
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	211	142	1771	1687	92
RTOR Reduction (vph)	0	197	0	0	0	17
Lane Group Flow (vph)	48	14	142	1771	1687	75
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	9.7	9.7	16.8	132.3	111.5	111.5
Effective Green, g (s)	9.7	9.7	16.8	132.3	111.5	111.5
Actuated g/C Ratio	0.06	0.06	0.11	0.88	0.74	0.74
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	114	102	198	3121	2631	1177
v/s Ratio Prot	0.03		c0.08	0.50	c0.48	
v/s Ratio Perm		0.13				0.06
v/c Ratio	0.42	0.13	0.72	0.57	0.64	0.06
Uniform Delay, d1	67.5	66.2	64.3	2.1	9.4	5.2
Progression Factor	1.00	1.00	0.92	0.99	0.51	0.62
Incremental Delay, d2	2.5	0.6	9.1	0.6	0.8	0.1
Delay (s)	70.0	66.8	68.4	2.7	5.6	3.3
Level of Service	E	E	E	A	A	A
Approach Delay (s)	67.4			7.5	5.5	
Approach LOS	E			A	A	

Intersection Summary

HCM Average Control Delay	10.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.97		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1807		1770	1863
Flt Permitted	0.95	1.00	1.00		0.18	1.00
Satd. Flow (perm)	1770	1583	1807		332	1863
Volume (vph)	78	283	554	156	69	530
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	85	308	602	170	75	576
RTOR Reduction (vph)	0	256	14	0	0	0
Lane Group Flow (vph)	85	52	758	0	75	576
Turn Type		Perm			pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8			6	
Actuated Green, G (s)	8.6	8.6	28.5		34.5	34.5
Effective Green, g (s)	8.6	8.6	28.5		34.5	34.5
Actuated g/C Ratio	0.17	0.17	0.56		0.68	0.68
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	298	266	1008		280	1258
v/s Ratio Prot	0.05		c0.43		0.01	c0.31
v/s Ratio Perm		0.19			0.17	
v/c Ratio	0.29	0.19	0.75		0.27	0.46
Uniform Delay, d1	18.6	18.3	8.6		6.0	3.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.5	0.4	3.2		0.5	0.3
Delay (s)	19.1	18.6	11.8		6.5	4.2
Level of Service	B	B	B		A	A
Approach Delay (s)	18.7		11.8			4.4
Approach LOS	B		B			A

Intersection Summary

HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	51.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1789	1583		1780	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.73	1.00		0.71	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1362	1583		1315	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	36	7	96	39	3	13	85	1815	30	12	1639	83
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	39	8	104	42	3	14	92	1973	33	13	1782	90
RTOR Reduction (vph)	0	0	97	0	0	13	0	0	5	0	0	16
Lane Group Flow (vph)	0	47	7	0	45	1	92	1973	28	13	1782	74
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		10.1	10.1		10.1	10.1	12.9	124.8	124.8	3.1	115.0	115.0
Effective Green, g (s)		10.1	10.1		10.1	10.1	12.9	124.8	124.8	3.1	115.0	115.0
Actuated g/C Ratio		0.07	0.07		0.07	0.07	0.09	0.83	0.83	0.02	0.77	0.77
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		92	107		89	107	152	2944	1317	37	2713	1214
v/s Ratio Prot							c0.05	c0.56		0.01	0.50	
v/s Ratio Perm		0.03	0.07		0.03	0.01			0.02			0.06
v/c Ratio		0.51	0.07		0.51	0.01	0.61	0.67	0.02	0.35	0.66	0.06
Uniform Delay, d1		67.6	65.5		67.5	65.3	66.1	4.8	2.2	72.5	8.2	4.3
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.19	1.62	1.19
Incremental Delay, d2		4.7	0.3		4.5	0.0	6.7	1.2	0.0	4.5	1.0	0.1
Delay (s)		72.3	65.8		72.0	65.3	72.7	6.0	2.2	90.3	14.3	5.2
Level of Service		E	E		E	E	E	A	A	F	B	A
Approach Delay (s)		67.8			70.4			8.9			14.4	
Approach LOS		E			E			A			B	

Intersection Summary

HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.5%	ICU Level of Service	C
Analysis Period (min)	15		

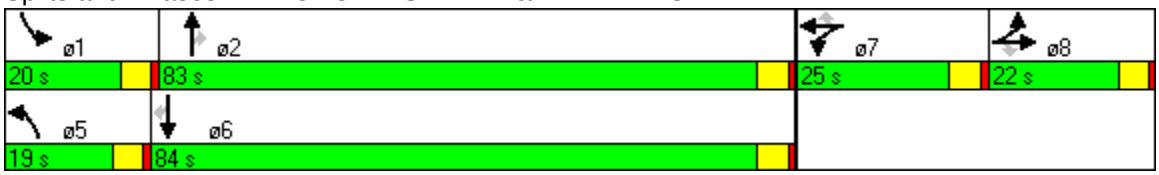
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	124	81	86	217	70	179	111	1507	60	147	1407	91
Lane Group Flow (vph)	109	114	93	152	160	195	121	1638	65	160	1529	99
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Detector Phases	8	8	8	7	7	7	5	2	2	1	6	6
Minimum Initial (s)	15.0	15.0	15.0	10.0	10.0	10.0	10.0	25.0	25.0	13.0	22.0	22.0
Minimum Split (s)	22.0	22.0	22.0	25.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (s)	22.0	22.0	22.0	25.0	25.0	25.0	19.0	83.0	83.0	20.0	84.0	84.0
Total Split (%)	14.7%	14.7%	14.7%	16.7%	16.7%	16.7%	12.7%	55.3%	55.3%	13.3%	56.0%	56.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
v/c Ratio	0.58	0.58	0.36	0.73	0.75	0.54	0.74	0.82	0.07	0.49	0.76	0.11
Control Delay	73.6	73.4	14.5	76.2	77.0	12.8	86.8	33.0	9.5	74.1	21.8	3.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.6	73.4	14.5	76.2	77.0	12.8	86.8	33.0	9.5	74.1	21.8	3.3
Queue Length 50th (ft)	109	113	0	151	160	3	115	588	5	69	655	24
Queue Length 95th (ft)	178	185	56	234	246	79	#204	783	m32	107	788	m23
Internal Link Dist (ft)		459			456			2865			2675	
Turn Bay Length (ft)												
Base Capacity (vph)	202	210	272	235	241	386	177	1992	910	366	2003	926
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.54	0.34	0.65	0.66	0.51	0.68	0.82	0.07	0.44	0.76	0.11

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: OHUKAI STREET & PIILANI HIGHWAY

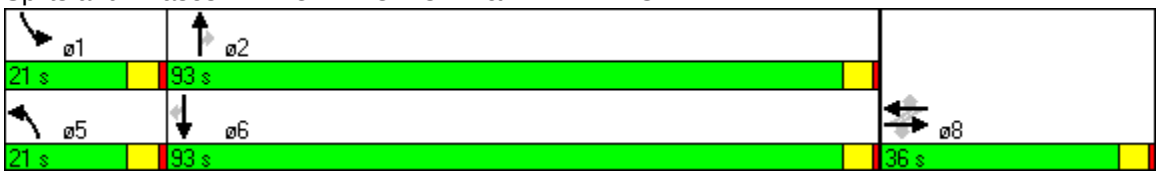


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	83	21	84	36	45	71	51	1539	116	108	1503	68
Lane Group Flow (vph)	0	113	91	0	88	77	55	1673	126	117	1634	74
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Detector Phases	8	8	8	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	25.0	25.0	10.0	25.0	25.0
Minimum Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	80.0	80.0	15.0	80.0	80.0
Total Split (s)	36.0	36.0	36.0	36.0	36.0	36.0	21.0	93.0	93.0	21.0	93.0	93.0
Total Split (%)	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	14.0%	62.0%	62.0%	14.0%	62.0%	62.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio		0.65	0.31		0.41	0.27	0.40	0.69	0.11	0.68	0.64	0.06
Control Delay		64.7	10.8		59.2	11.4	48.1	19.3	7.9	77.0	14.0	3.4
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		64.7	10.8		59.2	11.4	48.1	19.3	7.9	77.0	14.0	3.4
Queue Length 50th (ft)		107	0		80	0	53	365	21	112	411	5
Queue Length 95th (ft)		166	49		130	46	m70	598	m51	181	640	26
Internal Link Dist (ft)		530			620			2675			2120	
Turn Bay Length (ft)												
Base Capacity (vph)		268	409		333	398	201	2423	1113	201	2562	1161
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.42	0.22		0.26	0.19	0.27	0.69	0.11	0.58	0.64	0.06

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 50 (33%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: UWAPO ROAD & PIILANI HIGHWAY



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	44	194	131	1629	1552	85
Lane Group Flow (vph)	48	211	142	1771	1687	92
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	28.0	28.0	28.0	122.0	94.0	94.0
Total Split (%)	18.7%	18.7%	18.7%	81.3%	62.7%	62.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Min	C-Min	C-Min
v/c Ratio	0.42	0.71	0.72	0.57	0.64	0.08
Control Delay	67.7	11.9	63.3	2.9	6.3	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.7	11.9	63.3	2.9	6.3	1.7
Queue Length 50th (ft)	46	0	137	139	163	3
Queue Length 95th (ft)	89	82	204	257	230	m7
Internal Link Dist (ft)	253			2017	2865	
Turn Bay Length (ft)						
Base Capacity (vph)	283	431	283	3122	2631	1194
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.49	0.50	0.57	0.64	0.08

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

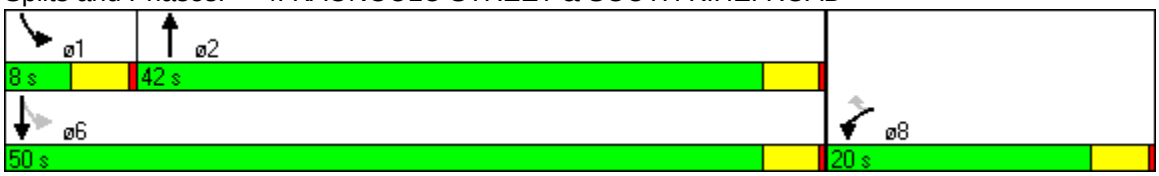
Splits and Phases: 3: KAONOULU STREET & PIILANI HIGHWAY

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	78	283	554	69	530
Lane Group Flow (vph)	85	308	772	75	576
Turn Type		Perm		pm+pt	
Protected Phases	8		2	1	6
Permitted Phases		8		6	
Detector Phases	8	8	2	1	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	8.0	20.0
Total Split (s)	20.0	20.0	42.0	8.0	50.0
Total Split (%)	28.6%	28.6%	60.0%	11.4%	71.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lead/Lag			Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	
Recall Mode	None	None	Min	None	Min
v/c Ratio	0.28	0.58	0.74	0.25	0.47
Control Delay	21.8	6.0	12.4	5.6	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	21.8	6.0	12.4	5.6	5.5
Queue Length 50th (ft)	23	0	158	5	57
Queue Length 95th (ft)	65	58	364	20	155
Internal Link Dist (ft)	290		106		222
Turn Bay Length (ft)					
Base Capacity (vph)	517	680	1181	297	1371
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.16	0.45	0.65	0.25	0.42

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 49.9
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 4: KAONOULU STREET & SOUTH KIHEI ROAD

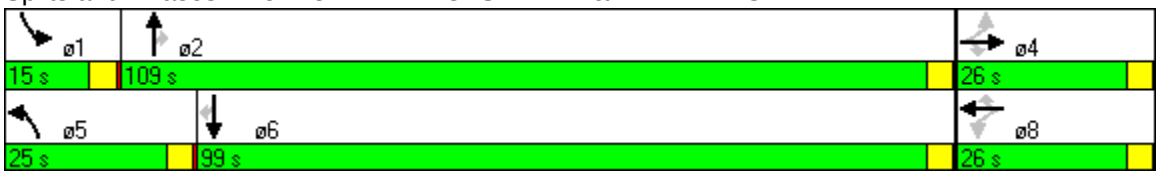


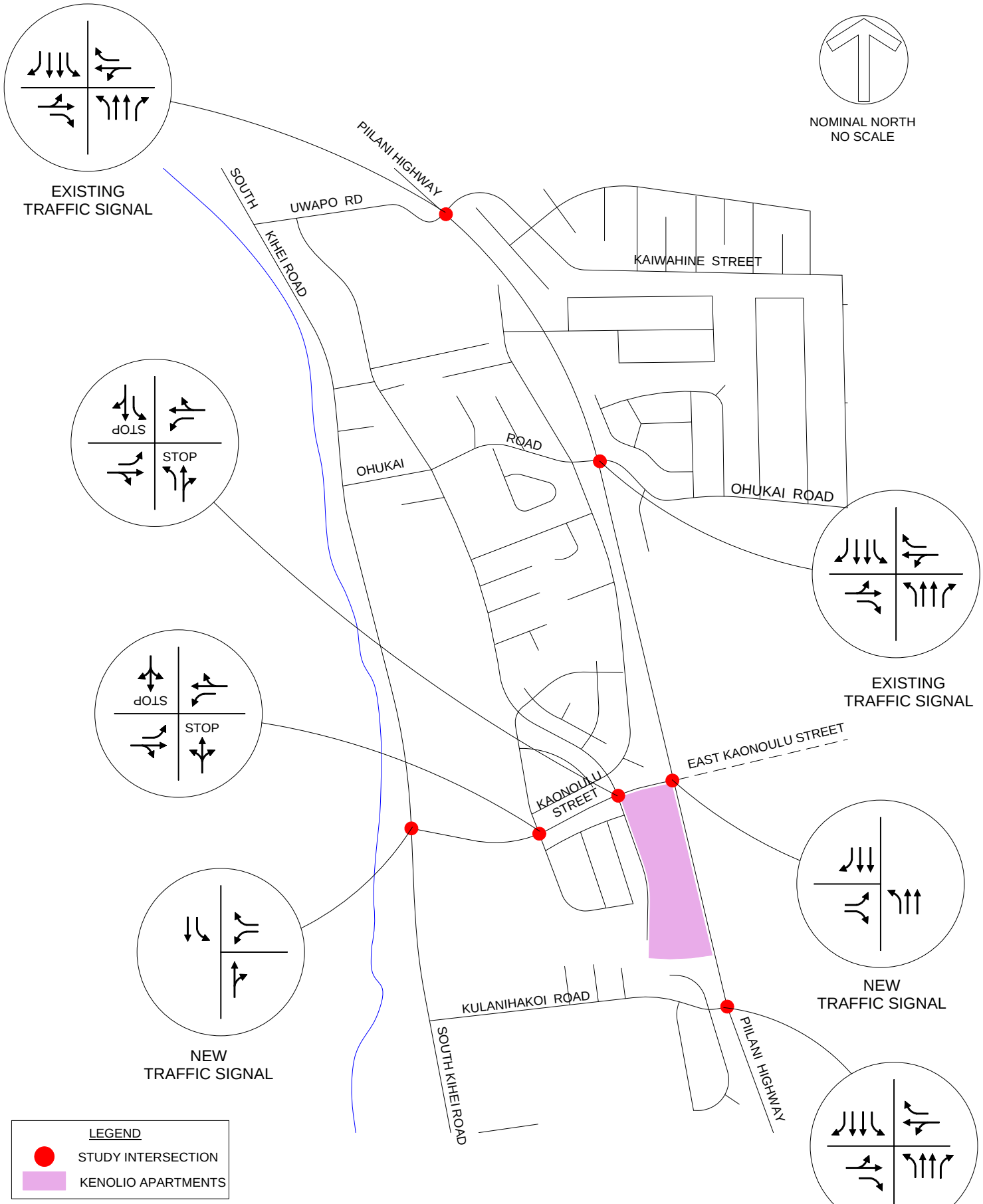
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	36	7	96	39	3	13	85	1815	30	12	1639	83
Lane Group Flow (vph)	0	47	104	0	45	14	92	1973	33	13	1782	90
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Detector Phases	4	4	4	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	8.0	20.0	20.0	8.0	20.0	20.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	25.0	109.0	109.0	15.0	99.0	99.0
Total Split (%)	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	16.7%	72.7%	72.7%	10.0%	66.0%	66.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
v/c Ratio		0.49	0.51		0.48	0.12	0.61	0.66	0.02	0.17	0.66	0.07
Control Delay		69.0	13.8		69.0	26.6	69.6	6.4	1.5	82.6	16.0	2.4
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		69.0	13.8		69.0	26.6	69.6	6.4	1.5	82.6	16.0	2.4
Queue Length 50th (ft)		45	0		43	0	88	197	1	12	773	10
Queue Length 95th (ft)		88	59		86	24	146	543	9	m19	874	m27
Internal Link Dist (ft)		212			168			1849			2017	
Turn Bay Length (ft)												
Base Capacity (vph)		209	321		202	244	248	3000	1346	130	2713	1230
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.22	0.32		0.22	0.06	0.37	0.66	0.02	0.10	0.66	0.07

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 130 (87%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

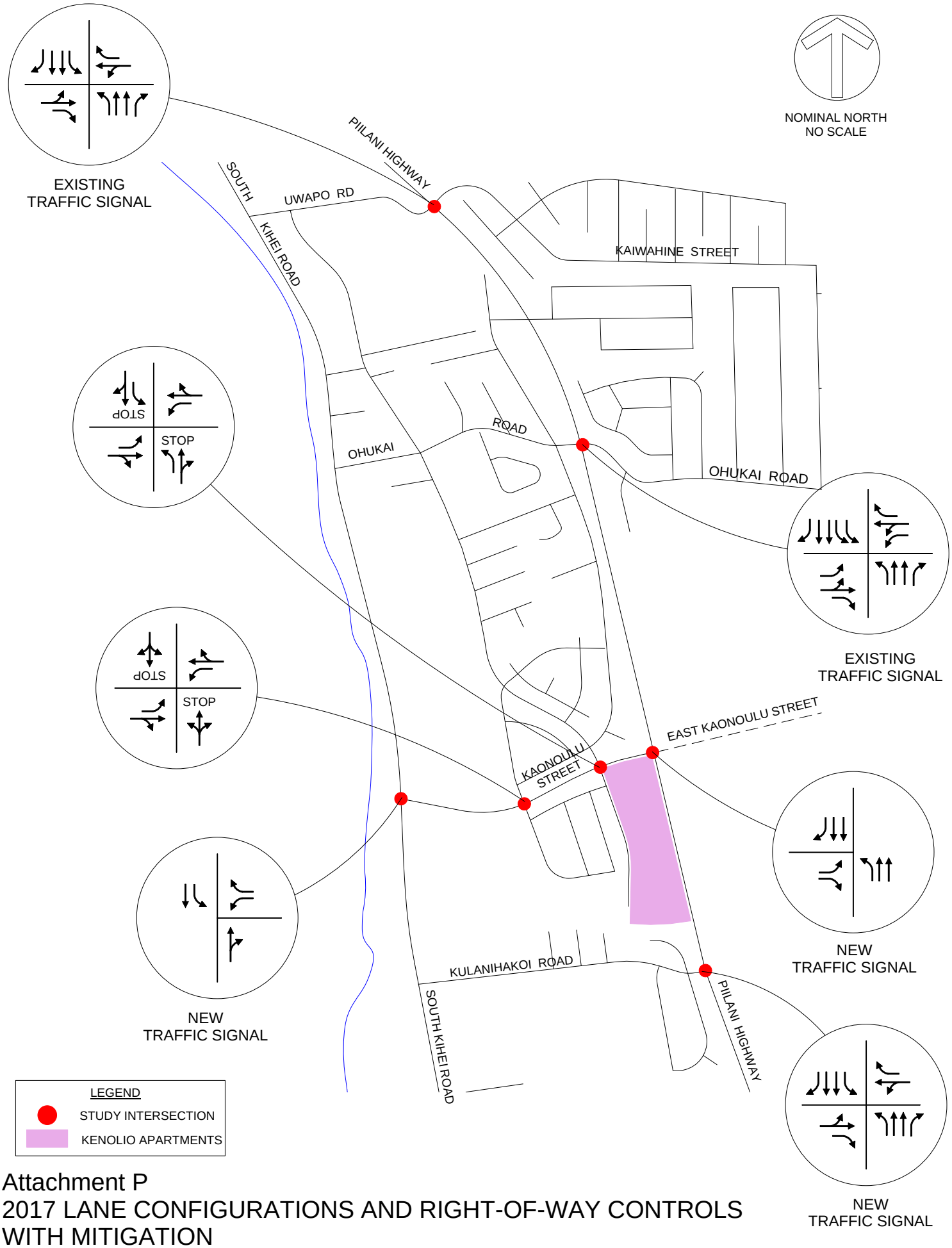
Splits and Phases: 5: KULANIHAKOI STREET & PIILANI HIGHWAY





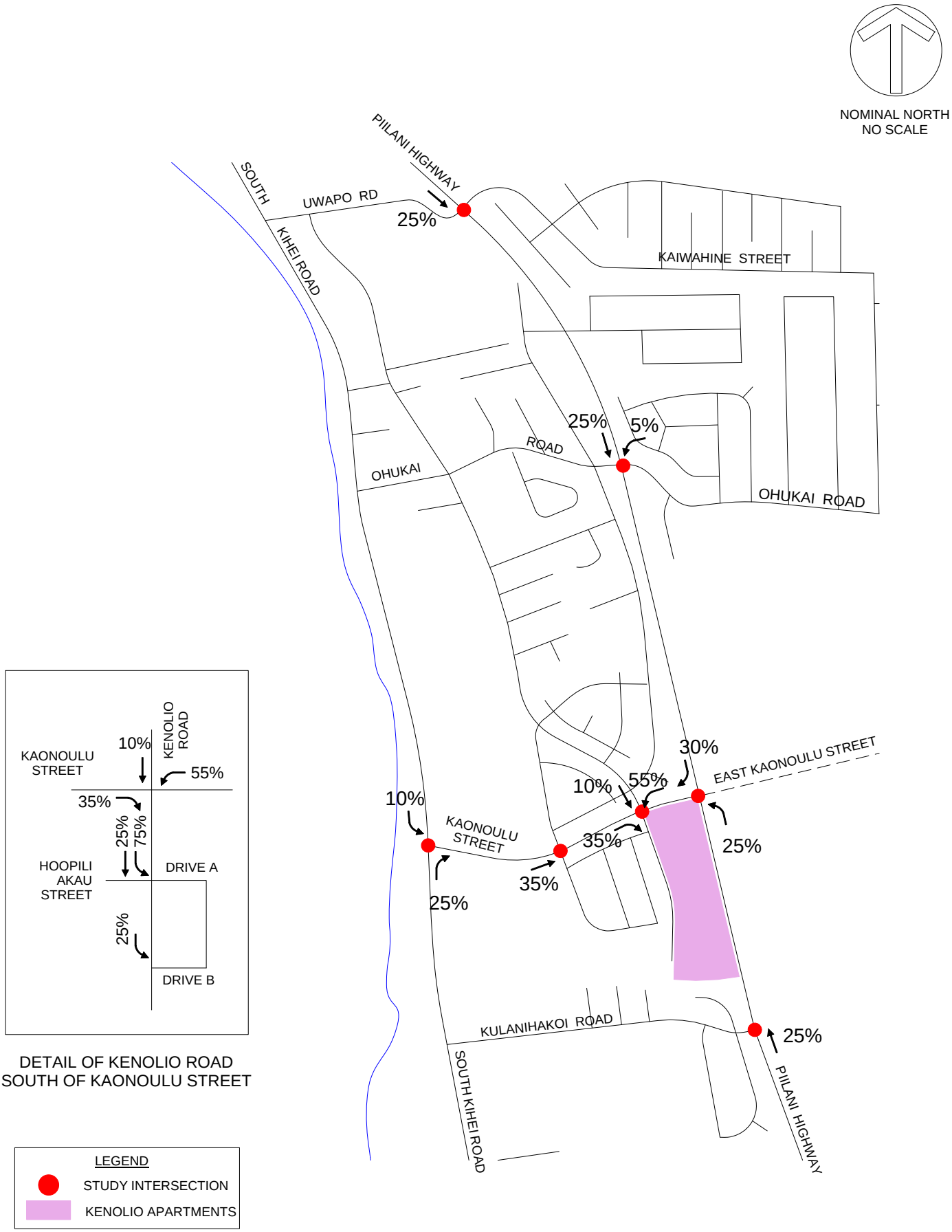
Attachment O
2017 LANE CONFIGURATIONS AND RIGHT-OF-WAY CONTROLS
WITHOUT MITIGATION

Phillip Rowell and Associates



Attachment P
2017 LANE CONFIGURATIONS AND RIGHT-OF-WAY CONTROLS WITH MITIGATION

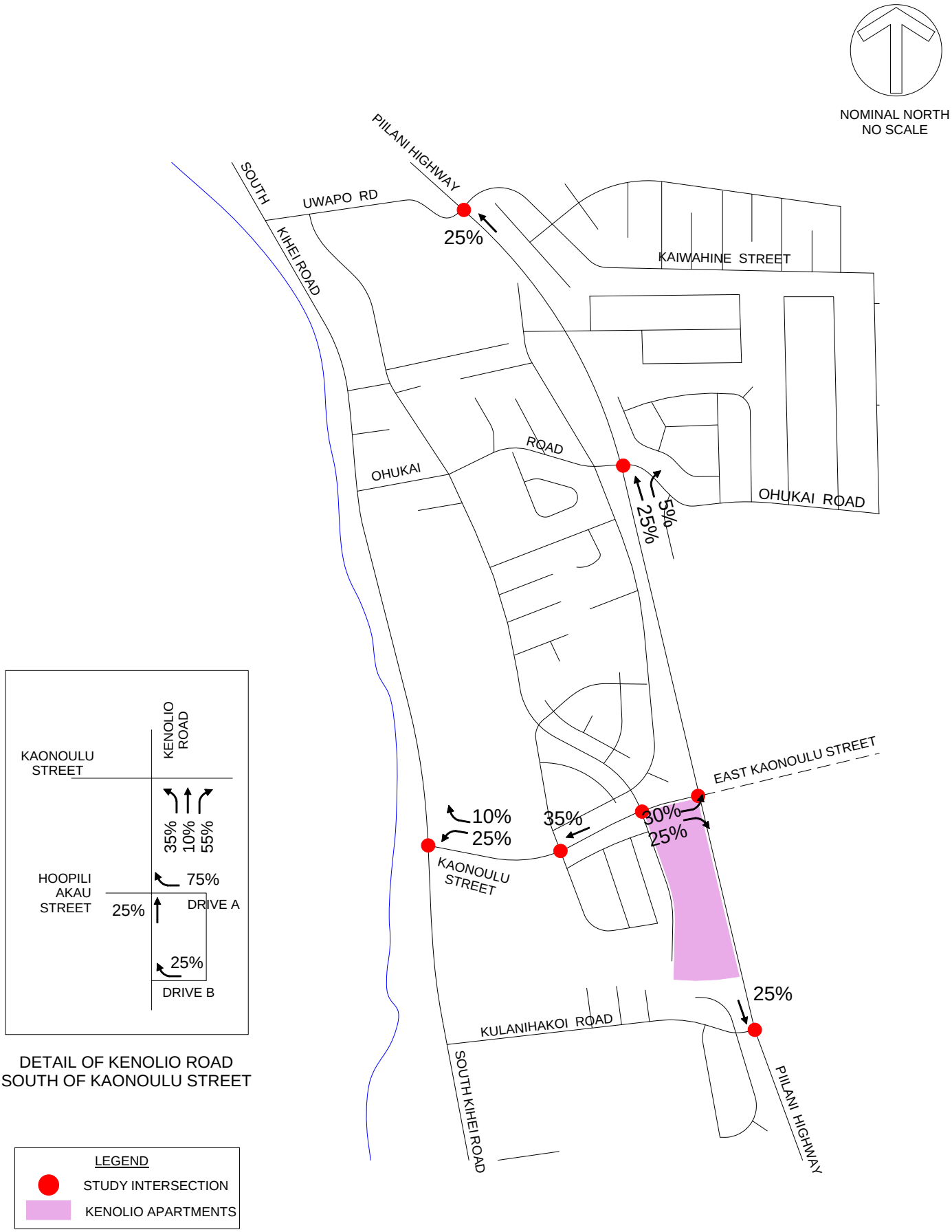
Phillip Rowell and Associates



DETAIL OF KENOLIO ROAD
SOUTH OF KAONOULU STREET

Attachment Q
INBOUND PROJECT TRIP DISTRIBUTION

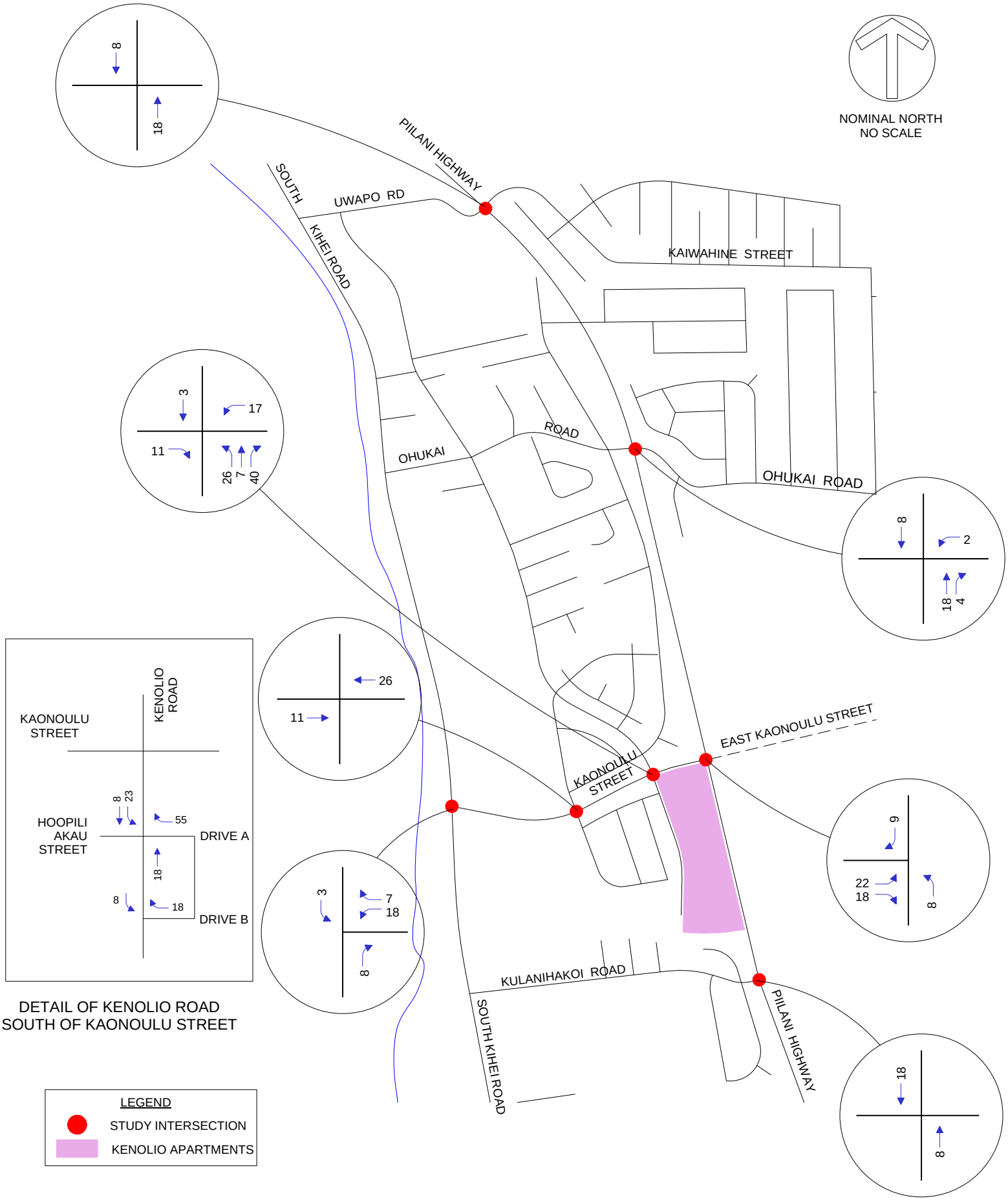
Phillip Rowell and Associates



DETAIL OF KENOLIO ROAD
SOUTH OF KAONOULU STREET

Attachment R
OUTBOUND PROJECT TRIP DISTRIBUTION

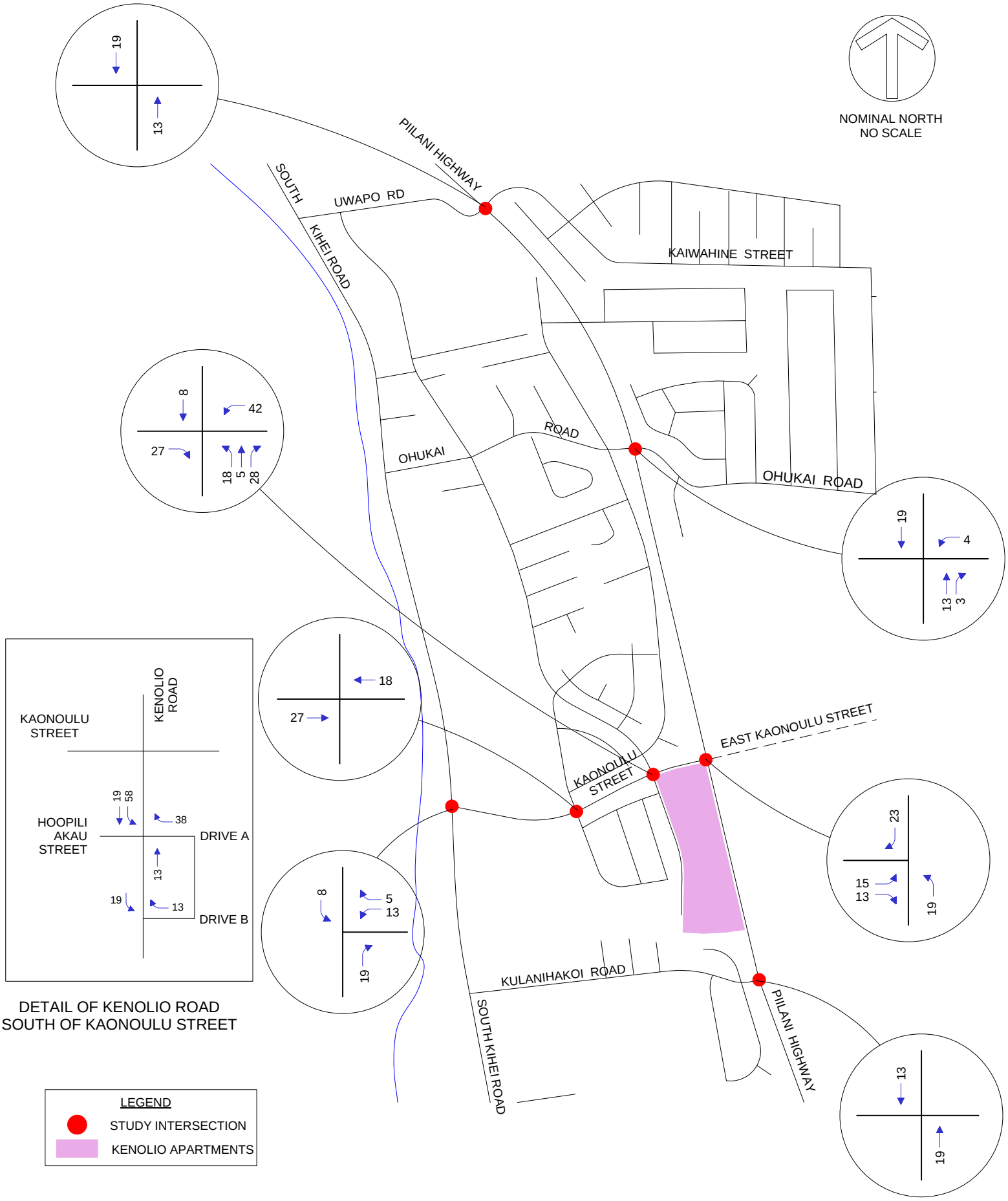
Phillip Rowell and Associates



DETAIL OF KENOLIO ROAD
SOUTH OF KAONOULU STREET

Attachment S
AM PEAK HOUR TRAFFIC ASSIGNMENTS

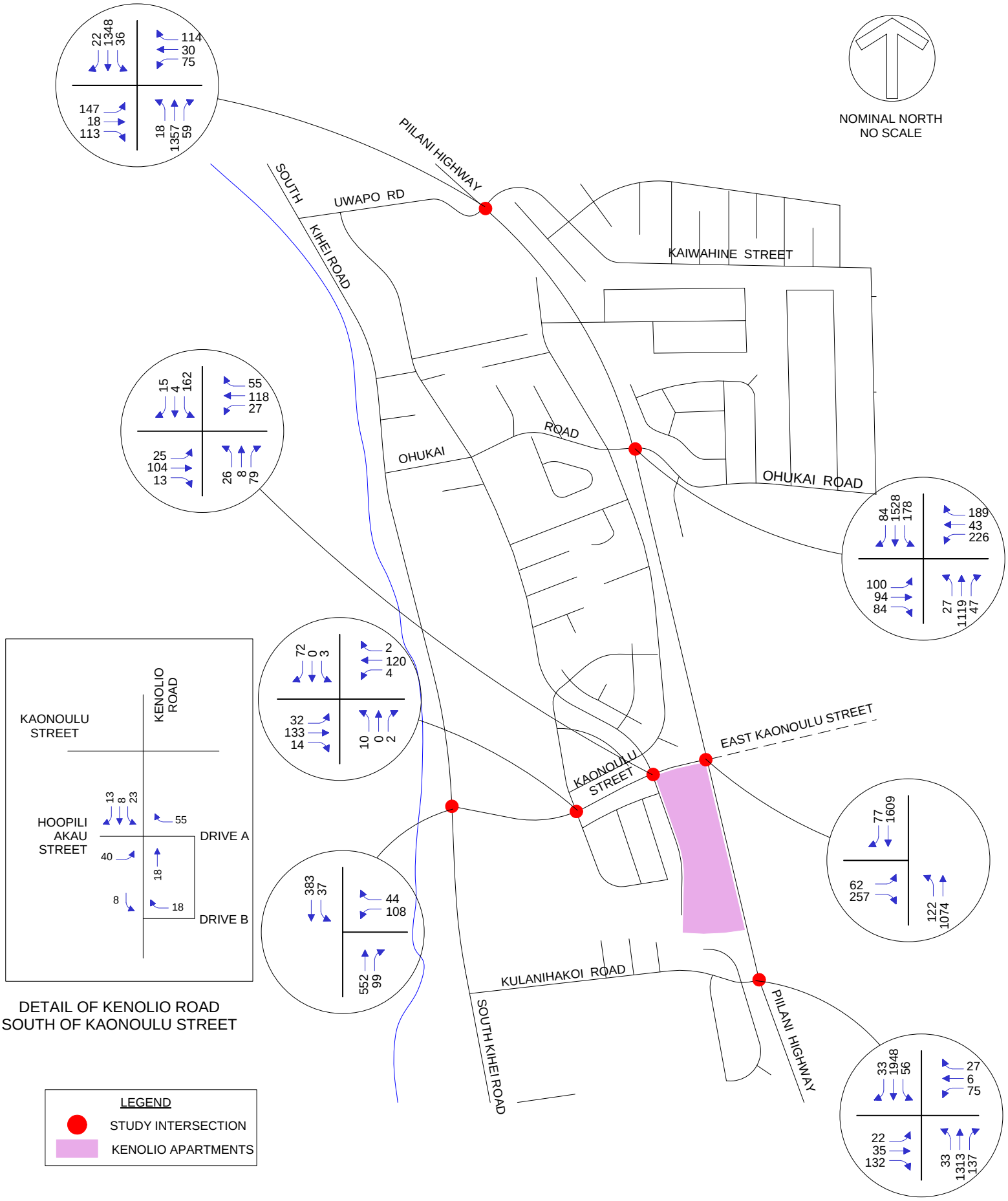
Phillip Rowell and Associates



DETAIL OF KENOLIO ROAD
SOUTH OF KAONOULU STREET

Attachment T
PM PEAK HOUR TRAFFIC ASSIGNMENTS

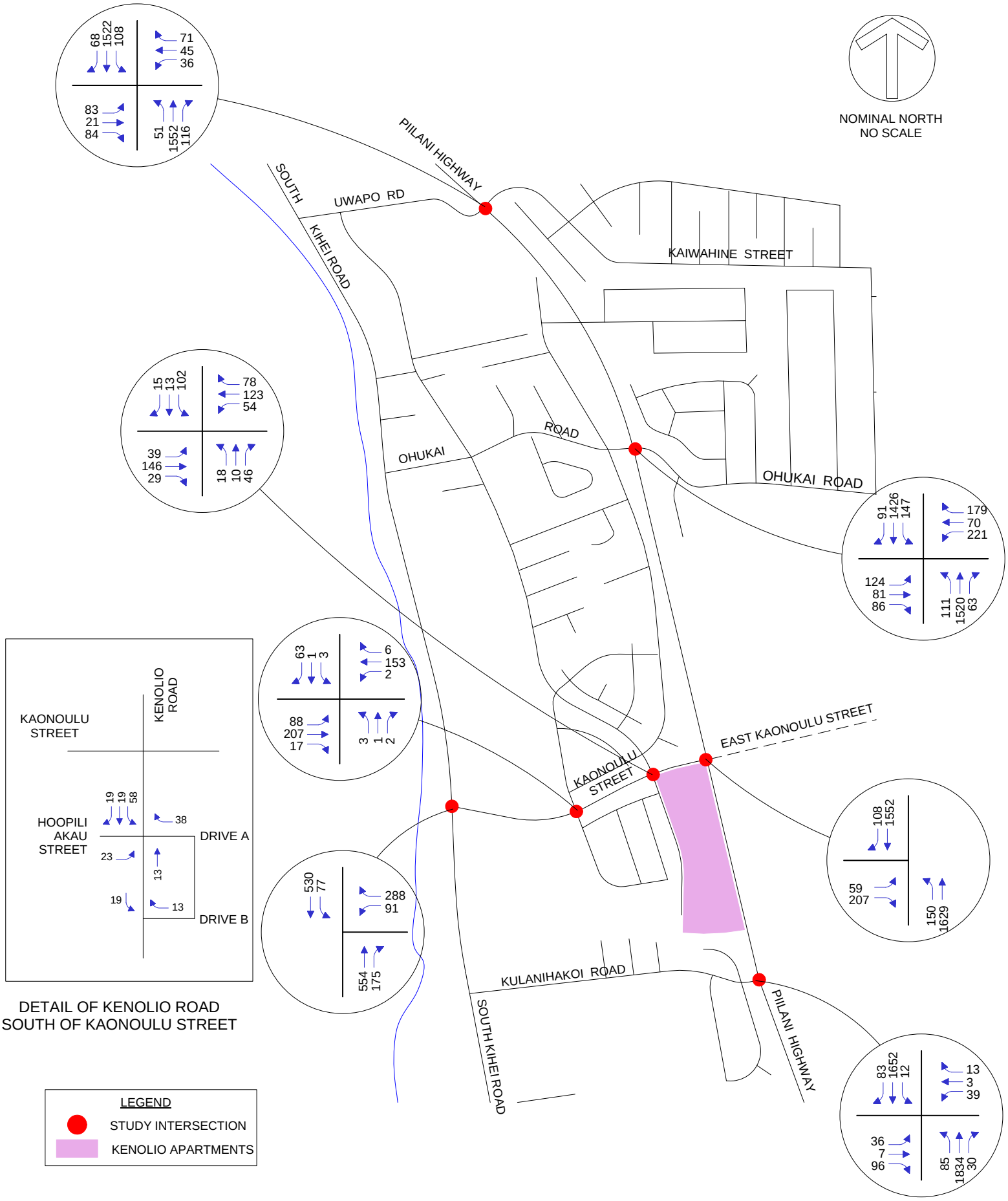
Phillip Rowell and Associates



DETAIL OF KENOLIO ROAD
SOUTH OF KAONOULU STREET

Attachment U
2017 AM PEAK HOUR TRAFFIC PROJECTIONS WITH PROJECT TRAFFIC

Phillip Rowell and Associates



Attachment V
2017 PM PEAK HOUR TRAFFIC PROJECTIONS WITH PROJECT TRAFFIC

Phillip Rowell and Associates

Attachment W
Level-of-Service Worksheets for 2017 Background Projections
With Project Generated
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1681	1765	1583	1681	1711	1583	1770	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1681	1765	1583	1681	1711	1583	1770	3539	1583	3433	3539	1583
Volume (vph)	100	94	84	226	43	189	27	1119	47	178	1528	84
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	102	91	246	47	205	29	1216	51	193	1661	91
RTOR Reduction (vph)	0	0	79	0	0	177	0	0	22	0	0	27
Lane Group Flow (vph)	103	108	12	143	150	28	29	1216	29	193	1661	64
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Actuated Green, G (s)	15.4	15.4	15.4	15.8	15.8	15.8	6.0	60.4	60.4	13.4	67.8	67.8
Effective Green, g (s)	16.4	16.4	16.4	16.8	16.8	16.8	7.0	61.4	61.4	14.4	68.8	68.8
Actuated g/C Ratio	0.13	0.13	0.13	0.13	0.13	0.13	0.06	0.49	0.49	0.12	0.55	0.55
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)	221	232	208	226	230	213	99	1738	778	395	1948	871
v/s Ratio Prot	c0.06	0.06		0.09	0.09		0.02	0.34		c0.06	c0.47	
v/s Ratio Perm			0.06			0.13			0.03			0.06
v/c Ratio	0.47	0.47	0.06	0.63	0.65	0.13	0.29	0.70	0.04	0.49	0.85	0.07
Uniform Delay, d1	50.2	50.2	47.5	51.2	51.3	47.7	56.6	24.7	16.5	51.8	23.8	13.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.05	0.91	0.79	1.29	0.70	0.39
Incremental Delay, d2	1.6	1.5	0.1	5.7	6.5	0.3	0.6	2.2	0.1	0.3	4.4	0.1
Delay (s)	51.8	51.7	47.6	56.9	57.8	47.9	60.3	24.7	13.0	66.9	21.1	5.3
Level of Service	D	D	D	E	E	D	E	C	B	E	C	A
Approach Delay (s)		50.5			53.5			25.1			24.9	
Approach LOS		D			D			C			C	

Intersection Summary

HCM Average Control Delay	30.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1783	1583		1799	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.59	1.00		0.49	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1097	1583		909	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	147	18	113	75	30	114	18	1357	59	36	1348	22
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	20	123	82	33	124	20	1475	64	39	1465	24
RTOR Reduction (vph)	0	0	99	0	0	100	0	0	22	0	0	8
Lane Group Flow (vph)	0	180	24	0	115	24	20	1475	42	39	1465	16
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Actuated Green, G (s)		22.9	22.9		22.9	22.9	4.0	81.1	81.1	6.0	83.1	83.1
Effective Green, g (s)		23.9	23.9		23.9	23.9	5.0	82.1	82.1	7.0	84.1	84.1
Actuated g/C Ratio		0.19	0.19		0.19	0.19	0.04	0.66	0.66	0.06	0.67	0.67
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		4.0	4.0		4.0	4.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		210	303		174	303	71	2324	1040	99	2381	1065
v/s Ratio Prot							0.01	c0.42		c0.02	0.41	
v/s Ratio Perm		c0.16	0.08		0.13	0.08			0.04			0.02
v/c Ratio		0.86	0.08		0.66	0.08	0.28	0.63	0.04	0.39	0.62	0.02
Uniform Delay, d1		48.9	41.5		46.8	41.5	58.3	12.6	7.6	57.0	11.4	6.8
Progression Factor		1.00	1.00		1.00	1.00	0.65	1.68	4.16	1.00	1.00	1.00
Incremental Delay, d2		28.2	0.1		9.9	0.2	0.6	1.0	0.1	0.9	1.2	0.0
Delay (s)		77.1	41.7		56.7	41.7	38.2	22.2	31.5	57.9	12.6	6.8
Level of Service		E	D		E	D	D	C	C	E	B	A
Approach Delay (s)		62.7			48.9			22.8			13.7	
Approach LOS		E			D			C			B	

Intersection Summary

HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Volume (vph)	62	257	122	1074	1609	77
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	67	279	133	1167	1749	84
RTOR Reduction (vph)	0	186	0	0	0	23
Lane Group Flow (vph)	67	93	133	1167	1749	61
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	12.4	12.4	13.7	104.6	86.9	86.9
Effective Green, g (s)	12.4	12.4	13.7	104.6	86.9	86.9
Actuated g/C Ratio	0.10	0.10	0.11	0.84	0.70	0.70
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	176	157	194	2961	2460	1101
v/s Ratio Prot	0.04		c0.08	0.33	c0.49	
v/s Ratio Perm		0.18				0.05
v/c Ratio	0.38	0.59	0.69	0.39	0.71	0.06
Uniform Delay, d1	52.7	53.9	53.6	2.5	11.5	6.0
Progression Factor	1.00	1.00	1.00	1.00	1.10	2.39
Incremental Delay, d2	1.4	5.6	9.6	0.4	1.1	0.1
Delay (s)	54.1	59.4	63.2	2.9	13.7	14.5
Level of Service	D	E	E	A	B	B
Approach Delay (s)	58.4			9.0	13.7	
Approach LOS	E			A	B	

Intersection Summary

HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1824		1770	1863
Flt Permitted	0.95	1.00	1.00		0.33	1.00
Satd. Flow (perm)	1770	1583	1824		606	1863
Volume (vph)	108	44	552	99	37	383
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	117	48	600	108	40	416
RTOR Reduction (vph)	0	40	8	0	0	0
Lane Group Flow (vph)	117	8	700	0	40	416
Turn Type		Perm			Perm	
Protected Phases	8		2			6
Permitted Phases		8			6	
Actuated Green, G (s)	9.6	9.6	41.4		41.4	41.4
Effective Green, g (s)	9.6	9.6	41.4		41.4	41.4
Actuated g/C Ratio	0.16	0.16	0.70		0.70	0.70
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	288	258	1280		425	1307
v/s Ratio Prot	c0.07		c0.39			0.22
v/s Ratio Perm		0.03			0.07	
v/c Ratio	0.41	0.03	0.55		0.09	0.32
Uniform Delay, d1	22.1	20.8	4.3		2.8	3.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.9	0.0	0.5		0.1	0.1
Delay (s)	23.1	20.8	4.7		2.9	3.5
Level of Service	C	C	A		A	A
Approach Delay (s)	22.4		4.7			3.5
Approach LOS	C		A			A

Intersection Summary

HCM Average Control Delay	6.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	59.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1827	1583		1781	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.86	1.00		0.70	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1606	1583		1300	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	22	35	132	75	6	27	33	1313	137	56	1948	33
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	24	38	143	82	7	29	36	1427	149	61	2117	36
RTOR Reduction (vph)	0	0	108	0	0	26	0	0	42	0	0	9
Lane Group Flow (vph)	0	62	35	0	89	3	36	1427	107	61	2117	27
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		11.8	11.8		11.8	11.8	4.3	74.6	74.6	5.6	75.9	75.9
Effective Green, g (s)		11.8	11.8		11.8	11.8	4.3	74.6	74.6	5.6	75.9	75.9
Actuated g/C Ratio		0.11	0.11		0.11	0.11	0.04	0.72	0.72	0.05	0.73	0.73
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		182	180		148	180	73	2539	1135	95	2583	1155
v/s Ratio Prot							0.02	0.40		c0.03	c0.60	
v/s Ratio Perm		0.04	0.09		0.07	0.02			0.09			0.02
v/c Ratio		0.34	0.19		0.60	0.02	0.49	0.56	0.09	0.64	0.82	0.02
Uniform Delay, d1		42.5	41.8		43.9	41.0	48.8	7.0	4.5	48.2	9.4	3.9
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.1	0.5		6.7	0.0	5.2	0.3	0.0	13.9	2.1	0.0
Delay (s)		43.6	42.3		50.6	41.0	53.9	7.2	4.5	62.1	11.6	3.9
Level of Service		D	D		D	D	D	A	A	E	B	A
Approach Delay (s)		42.7			48.2			8.0			12.9	
Approach LOS		D			D			A			B	

Intersection Summary

HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	104.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		

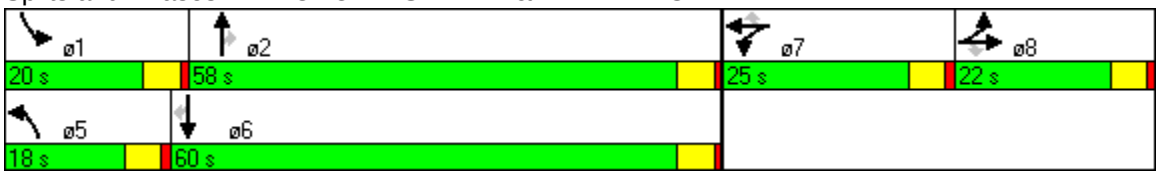
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	94	84	226	43	189	27	1119	47	178	1528	84
Lane Group Flow (vph)	103	108	91	143	150	205	29	1216	51	193	1661	91
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Detector Phases	8	8	8	7	7	7	5	2	2	1	6	6
Minimum Initial (s)	15.0	15.0	15.0	10.0	10.0	10.0	10.0	25.0	25.0	13.0	22.0	22.0
Minimum Split (s)	22.0	22.0	22.0	25.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (s)	22.0	22.0	22.0	25.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (%)	17.6%	17.6%	17.6%	20.0%	20.0%	20.0%	14.4%	46.4%	46.4%	16.0%	48.0%	48.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
v/c Ratio	0.47	0.47	0.32	0.63	0.65	0.53	0.19	0.70	0.06	0.49	0.83	0.10
Control Delay	56.1	55.8	12.3	56.9	57.4	9.8	57.8	25.9	5.6	69.7	21.8	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.1	55.8	12.3	56.9	57.4	9.8	57.8	25.9	5.6	69.7	21.8	3.0
Queue Length 50th (ft)	83	86	0	116	122	0	22	398	1	76	628	3
Queue Length 95th (ft)	143	148	49	185	192	67	56	539	18	124	#874	m13
Internal Link Dist (ft)		459			456			2865			2675	
Turn Bay Length (ft)												
Base Capacity (vph)	242	254	306	282	287	437	198	1739	800	439	2005	923
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.43	0.30	0.51	0.52	0.47	0.15	0.70	0.06	0.44	0.83	0.10

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 125
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: OHUKAI STREET & PIILANI HIGHWAY

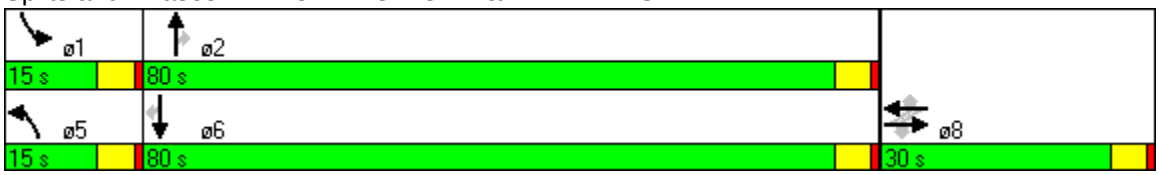


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	147	18	113	75	30	114	18	1357	59	36	1348	22
Lane Group Flow (vph)	0	180	123	0	115	124	20	1475	64	39	1465	24
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Detector Phases	8	8	8	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	25.0	25.0	10.0	25.0	25.0
Minimum Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	80.0	80.0	15.0	80.0	80.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	80.0	80.0	15.0	80.0	80.0
Total Split (%)	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	12.0%	64.0%	64.0%	12.0%	64.0%	64.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio		0.85	0.31		0.61	0.31	0.13	0.62	0.06	0.25	0.59	0.02
Control Delay		70.9	8.8		57.5	8.9	35.6	23.3	10.1	57.6	12.6	3.6
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		70.9	8.8		57.5	8.9	35.6	23.3	10.1	57.6	12.6	3.6
Queue Length 50th (ft)		139	0		84	0	15	393	6	30	256	0
Queue Length 95th (ft)		#255	52		151	52	m23	607	m36	67	472	11
Internal Link Dist (ft)		530			620			2675			2120	
Turn Bay Length (ft)												
Base Capacity (vph)		232	427		203	427	156	2381	1086	156	2466	1110
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.78	0.29		0.57	0.29	0.13	0.62	0.06	0.25	0.59	0.02

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 125
Offset: 50 (40%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: UWAPO ROAD & PIILANI HIGHWAY



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	62	257	122	1074	1609	77
Lane Group Flow (vph)	67	279	133	1167	1749	84
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	24.0	24.0	20.0	101.0	81.0	81.0
Total Split (%)	19.2%	19.2%	16.0%	80.8%	64.8%	64.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Min	C-Min	C-Min
v/c Ratio	0.38	0.81	0.68	0.39	0.71	0.07
Control Delay	52.7	22.7	63.5	3.3	15.7	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.7	22.7	63.5	3.3	15.7	6.0
Queue Length 50th (ft)	52	56	104	86	362	6
Queue Length 95th (ft)	93	148	172	170	436	m17
Internal Link Dist (ft)	253			2017	2865	
Turn Bay Length (ft)						
Base Capacity (vph)	283	427	229	2962	2460	1123
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.65	0.58	0.39	0.71	0.07

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 125
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: KAONOULU STREET & PIILANI HIGHWAY

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	108	44	552	37	383
Lane Group Flow (vph)	117	48	708	40	416
Turn Type		Perm		Perm	
Protected Phases	8		2		6
Permitted Phases		8		6	
Detector Phases	8	8	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	35.0	35.0	35.0
Total Split (%)	36.4%	36.4%	63.6%	63.6%	63.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	Min	Min	Min
v/c Ratio	0.39	0.16	0.55	0.12	0.32
Control Delay	14.8	6.4	6.7	5.1	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.8	6.4	6.7	5.1	4.7
Queue Length 50th (ft)	22	0	74	3	37
Queue Length 95th (ft)	64	20	190	15	91
Internal Link Dist (ft)	290		106		222
Turn Bay Length (ft)					
Base Capacity (vph)	479	463	1324	334	1345
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.24	0.10	0.53	0.12	0.31

Intersection Summary

Cycle Length: 55
Actuated Cycle Length: 60.1
Natural Cycle: 55
Control Type: Actuated-Uncoordinated

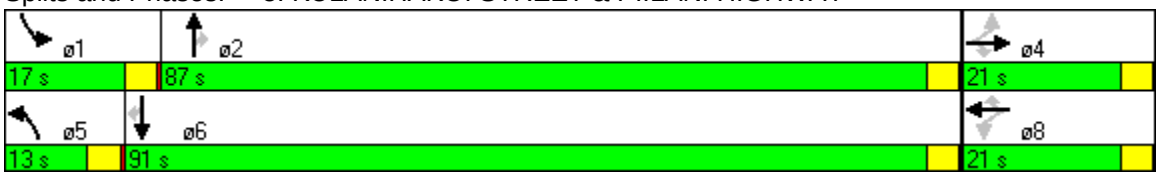
Splits and Phases: 4: KAONOULU STREET & SOUTH KIHEI ROAD

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	35	132	75	6	27	33	1313	137	56	1948	33
Lane Group Flow (vph)	0	62	143	0	89	29	36	1427	149	61	2117	36
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Detector Phases	4	4	4	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	8.0	20.0	20.0	8.0	20.0	20.0
Total Split (s)	21.0	21.0	21.0	21.0	21.0	21.0	13.0	87.0	87.0	17.0	91.0	91.0
Total Split (%)	16.8%	16.8%	16.8%	16.8%	16.8%	16.8%	10.4%	69.6%	69.6%	13.6%	72.8%	72.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	Min
v/c Ratio		0.33	0.49		0.59	0.14	0.29	0.56	0.13	0.41	0.81	0.03
Control Delay		48.4	16.0		52.9	17.6	56.4	9.0	1.4	53.7	13.4	2.1
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		48.4	16.0		52.9	17.6	56.4	9.0	1.4	53.7	13.4	2.1
Queue Length 50th (ft)		43	14		63	0	26	248	0	44	516	0
Queue Length 95th (ft)		91	78		125	29	64	377	22	92	742	11
Internal Link Dist (ft)		212			205			1849			2017	
Turn Bay Length (ft)												
Base Capacity (vph)		268	364		215	286	153	2654	1224	214	2711	1220
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.23	0.39		0.41	0.10	0.24	0.54	0.12	0.29	0.78	0.03

Intersection Summary

Cycle Length: 125
Actuated Cycle Length: 102.7
Natural Cycle: 90
Control Type: Actuated-Uncoordinated

Splits and Phases: 5: KULANIHAKOI STREET & PIILANI HIGHWAY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	25	104	13	27	118	55	26	8	79	162	4	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	113	14	29	128	60	28	9	86	176	4	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)		817			333							
pX, platoon unblocked												
vC, conflicting volume	188			127			380	421	120	474	398	158
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	188			127			380	421	120	474	398	158
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			98			95	98	91	60	99	98
cM capacity (veh/h)	1386			1459			547	503	931	435	518	887

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	27	127	29	188	28	95	176	21
Volume Left	27	0	29	0	28	0	176	0
Volume Right	0	14	0	60	0	86	0	16
cSH	1386	1700	1459	1700	547	864	435	772
Volume to Capacity	0.02	0.07	0.02	0.11	0.05	0.11	0.40	0.03
Queue Length 95th (ft)	1	0	2	0	4	9	48	2
Control Delay (s)	7.6	0.0	7.5	0.0	11.9	9.7	18.8	9.8
Lane LOS	A		A		B	A	C	A
Approach Delay (s)	1.3		1.0		10.2		17.9	
Approach LOS					B		C	

Intersection Summary			
Average Delay	7.5		
Intersection Capacity Utilization	38.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	32	133	14	4	120	2	10	0	2	3	0	72
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	145	15	4	130	2	11	0	2	3	0	78
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)		370			780							
pX, platoon unblocked												
vC, conflicting volume	133			160			439	363	152	357	370	132
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	133			160			439	363	152	357	370	132
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			98	100	100	99	100	91
cM capacity (veh/h)	1452			1419			473	549	894	585	545	918

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	35	160	4	133	13	82
Volume Left	35	0	4	0	11	3
Volume Right	0	15	0	2	2	78
cSH	1452	1700	1419	1700	513	897
Volume to Capacity	0.02	0.09	0.00	0.08	0.03	0.09
Queue Length 95th (ft)	2	0	0	0	2	7
Control Delay (s)	7.5	0.0	7.5	0.0	12.2	9.4
Lane LOS	A		A		B	A
Approach Delay (s)	1.3		0.2		12.2	9.4
Approach LOS					B	A

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	26.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	40	0	0	0	0	55	0	18	0	23	8	13
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	0	0	0	0	60	0	20	0	25	9	14
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	145	85	16	85	92	20	23			20		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	145	85	16	85	92	20	23			20		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	100	100	100	100	94	100			98		
cM capacity (veh/h)	768	792	1064	890	785	1058	1592			1597		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	43	60	20	48
Volume Left	43	0	0	25
Volume Right	0	60	0	14
cSH	768	1058	1592	1597
Volume to Capacity	0.06	0.06	0.00	0.02
Queue Length 95th (ft)	4	4	0	1
Control Delay (s)	10.0	8.6	0.0	3.9
Lane LOS	A	A		A
Approach Delay (s)	10.0	8.6	0.0	3.9
Approach LOS	A	A		

Intersection Summary			
Average Delay	6.6		
Intersection Capacity Utilization	24.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	18	0	0	8	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	20	0	0	9	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	17	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	17	0			0	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			99	
cM capacity (veh/h)	995	1085			1623	

Direction, Lane #	WB 1	SB 1
Volume Total	20	9
Volume Left	0	9
Volume Right	20	0
cSH	1085	1623
Volume to Capacity	0.02	0.01
Queue Length 95th (ft)	1	0
Control Delay (s)	8.4	7.2
Lane LOS	A	A
Approach Delay (s)	8.4	7.2
Approach LOS	A	

Intersection Summary			
Average Delay	8.0		
Intersection Capacity Utilization	6.7%	ICU Level of Service	A
Analysis Period (min)	15		

Attachment X
Level-of-Service Worksheets for 2017 Background Projections
With Project Generated
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.99	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1681	1750	1583	1681	1724	1583	1770	3539	1583	3433	3539	1583
Flt Permitted	0.95	0.99	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1681	1750	1583	1681	1724	1583	1770	3539	1583	3433	3539	1583
Volume (vph)	124	81	86	221	70	179	111	1520	63	147	1426	91
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	135	88	93	240	76	195	121	1652	68	160	1550	99
RTOR Reduction (vph)	0	0	83	0	0	167	0	0	19	0	0	30
Lane Group Flow (vph)	109	114	10	154	162	28	121	1652	49	160	1550	69
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Actuated Green, G (s)	15.8	15.8	15.8	17.5	17.5	17.5	12.8	83.4	83.4	13.3	83.9	83.9
Effective Green, g (s)	16.8	16.8	16.8	18.5	18.5	18.5	13.8	84.4	84.4	14.3	84.9	84.9
Actuated g/C Ratio	0.11	0.11	0.11	0.12	0.12	0.12	0.09	0.56	0.56	0.10	0.57	0.57
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)	188	196	177	207	213	195	163	1991	891	327	2003	896
v/s Ratio Prot	0.06	c0.07		0.09	0.09		c0.07	c0.47		0.05	0.44	
v/s Ratio Perm			0.06			0.12			0.04			0.06
v/c Ratio	0.58	0.58	0.06	0.74	0.76	0.15	0.74	0.83	0.05	0.49	0.77	0.08
Uniform Delay, d1	63.2	63.3	59.5	63.5	63.6	58.7	66.4	26.9	14.8	64.4	25.1	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.07	1.06	1.26	1.11	0.75	0.51
Incremental Delay, d2	4.3	4.3	0.1	13.5	14.7	0.3	12.5	3.5	0.1	0.3	2.4	0.1
Delay (s)	67.5	67.6	59.7	76.9	78.3	59.0	83.3	32.1	18.7	71.5	21.3	7.6
Level of Service	E	E	E	E	E	E	F	C	B	E	C	A
Approach Delay (s)		65.2			70.6			34.9			25.0	
Approach LOS		E			E			C			C	

Intersection Summary

HCM Average Control Delay	37.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1791	1583		1822	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.62	1.00		0.73	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1155	1583		1352	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	83	21	84	36	45	71	51	1552	116	108	1522	68
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	23	91	39	49	77	55	1687	126	117	1654	74
RTOR Reduction (vph)	0	0	78	0	0	66	0	0	29	0	0	16
Lane Group Flow (vph)	0	113	13	0	88	11	55	1687	97	117	1654	58
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Actuated Green, G (s)		19.7	19.7		19.7	19.7	8.7	101.7	101.7	13.6	106.6	106.6
Effective Green, g (s)		20.7	20.7		20.7	20.7	9.7	102.7	102.7	14.6	107.6	107.6
Actuated g/C Ratio		0.14	0.14		0.14	0.14	0.06	0.68	0.68	0.10	0.72	0.72
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)		4.0	4.0		4.0	4.0	2.0	5.0	5.0	2.0	5.0	5.0
Lane Grp Cap (vph)		159	218		187	218	114	2423	1084	172	2539	1136
v/s Ratio Prot							0.03	c0.48		c0.07	0.47	
v/s Ratio Perm		c0.10	0.06		0.07	0.05			0.08			0.05
v/c Ratio		0.71	0.06		0.47	0.05	0.48	0.70	0.09	0.68	0.65	0.05
Uniform Delay, d1		61.8	56.2		59.6	56.1	67.7	14.3	7.9	65.4	11.2	6.2
Progression Factor		1.00	1.00		1.00	1.00	0.70	1.17	2.28	1.00	1.00	1.00
Incremental Delay, d2		14.8	0.2		2.5	0.1	0.7	1.0	0.1	8.5	1.3	0.1
Delay (s)		76.6	56.3		62.1	56.2	47.9	17.6	18.2	73.9	12.6	6.3
Level of Service		E	E		E	E	D	B	B	E	B	A
Approach Delay (s)		67.6			59.4			18.6			16.2	
Approach LOS		E			E			B			B	

Intersection Summary

HCM Average Control Delay	21.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Volume (vph)	59	207	150	1629	1552	108
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	64	225	163	1771	1687	117
RTOR Reduction (vph)	0	209	0	0	0	24
Lane Group Flow (vph)	64	16	163	1771	1687	93
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	10.7	10.7	18.7	131.3	108.6	108.6
Effective Green, g (s)	10.7	10.7	18.7	131.3	108.6	108.6
Actuated g/C Ratio	0.07	0.07	0.12	0.88	0.72	0.72
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	126	113	221	3098	2562	1146
v/s Ratio Prot	0.04		c0.09	0.50	c0.48	
v/s Ratio Perm		0.14				0.07
v/c Ratio	0.51	0.14	0.74	0.57	0.66	0.08
Uniform Delay, d1	67.1	65.3	63.3	2.3	10.9	6.1
Progression Factor	1.00	1.00	0.92	1.02	0.51	0.62
Incremental Delay, d2	3.2	0.6	9.3	0.6	0.9	0.1
Delay (s)	70.3	65.9	67.6	3.0	6.4	3.8
Level of Service	E	E	E	A	A	A
Approach Delay (s)	66.9			8.4	6.2	
Approach LOS	E			A	A	

Intersection Summary

HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.97		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	1802		1770	1863
Flt Permitted	0.95	1.00	1.00		0.17	1.00
Satd. Flow (perm)	1770	1583	1802		315	1863
Volume (vph)	91	288	554	175	77	530
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	99	313	602	190	84	576
RTOR Reduction (vph)	0	260	16	0	0	0
Lane Group Flow (vph)	99	53	776	0	84	576
Turn Type		Perm			pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8			6	
Actuated Green, G (s)	8.9	8.9	29.4		35.4	35.4
Effective Green, g (s)	8.9	8.9	29.4		35.4	35.4
Actuated g/C Ratio	0.17	0.17	0.56		0.68	0.68
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	301	269	1013		269	1261
v/s Ratio Prot	0.06		c0.44		0.01	c0.31
v/s Ratio Perm		0.20			0.20	
v/c Ratio	0.33	0.20	0.77		0.31	0.46
Uniform Delay, d1	19.1	18.6	8.8		6.4	4.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.6	0.4	3.5		0.7	0.3
Delay (s)	19.7	19.0	12.3		7.1	4.2
Level of Service	B	B	B		A	A
Approach Delay (s)	19.2		12.3			4.6
Approach LOS	B		B			A

Intersection Summary

HCM Average Control Delay	11.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	52.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1789	1583		1780	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.73	1.00		0.71	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1362	1583		1315	1583	1770	3539	1583	1770	3539	1583
Volume (vph)	36	7	96	39	3	13	85	1834	30	12	1652	83
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	39	8	104	42	3	14	92	1993	33	13	1796	90
RTOR Reduction (vph)	0	0	97	0	0	13	0	0	5	0	0	16
Lane Group Flow (vph)	0	47	7	0	45	1	92	1993	28	13	1796	74
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		10.1	10.1		10.1	10.1	12.9	124.8	124.8	3.1	115.0	115.0
Effective Green, g (s)		10.1	10.1		10.1	10.1	12.9	124.8	124.8	3.1	115.0	115.0
Actuated g/C Ratio		0.07	0.07		0.07	0.07	0.09	0.83	0.83	0.02	0.77	0.77
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		92	107		89	107	152	2944	1317	37	2713	1214
v/s Ratio Prot							c0.05	c0.56		0.01	0.51	
v/s Ratio Perm		0.03	0.07		0.03	0.01			0.02			0.06
v/c Ratio		0.51	0.07		0.51	0.01	0.61	0.68	0.02	0.35	0.66	0.06
Uniform Delay, d1		67.6	65.5		67.5	65.3	66.1	4.8	2.2	72.5	8.3	4.3
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.17	1.68	1.43
Incremental Delay, d2		4.7	0.3		4.5	0.0	6.7	1.3	0.0	4.4	1.0	0.1
Delay (s)		72.3	65.8		72.0	65.3	72.7	6.1	2.2	89.0	14.9	6.2
Level of Service		E	E		E	E	E	A	A	F	B	A
Approach Delay (s)		67.8			70.4			8.9			15.0	
Approach LOS		E			E			A			B	

Intersection Summary

HCM Average Control Delay	14.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

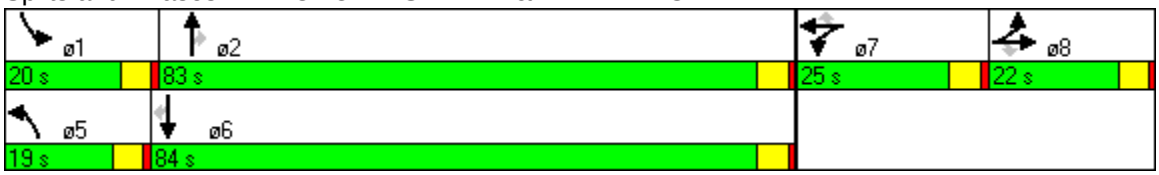
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	124	81	86	221	70	179	111	1520	63	147	1426	91
Lane Group Flow (vph)	109	114	93	154	162	195	121	1652	68	160	1550	99
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	8	8		7	7		5	2		1	6	
Permitted Phases			8			7			2			6
Detector Phases	8	8	8	7	7	7	5	2	2	1	6	6
Minimum Initial (s)	15.0	15.0	15.0	10.0	10.0	10.0	10.0	25.0	25.0	13.0	22.0	22.0
Minimum Split (s)	22.0	22.0	22.0	25.0	25.0	25.0	18.0	58.0	58.0	20.0	60.0	60.0
Total Split (s)	22.0	22.0	22.0	25.0	25.0	25.0	19.0	83.0	83.0	20.0	84.0	84.0
Total Split (%)	14.7%	14.7%	14.7%	16.7%	16.7%	16.7%	12.7%	55.3%	55.3%	13.3%	56.0%	56.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
v/c Ratio	0.58	0.58	0.36	0.74	0.76	0.54	0.74	0.83	0.07	0.49	0.77	0.11
Control Delay	73.6	73.4	14.5	76.7	77.4	13.1	87.0	33.4	9.2	74.4	22.3	3.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.6	73.4	14.5	76.7	77.4	13.1	87.0	33.4	9.2	74.4	22.3	3.3
Queue Length 50th (ft)	109	113	0	153	162	4	117	596	5	69	672	24
Queue Length 95th (ft)	178	185	56	238	249	80	#205	792	m33	107	807	m22
Internal Link Dist (ft)		459			456			2865			2675	
Turn Bay Length (ft)												
Base Capacity (vph)	202	210	272	235	241	385	177	1990	910	366	2001	925
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.54	0.34	0.66	0.67	0.51	0.68	0.83	0.07	0.44	0.77	0.11

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: OHUKAI STREET & PIILANI HIGHWAY

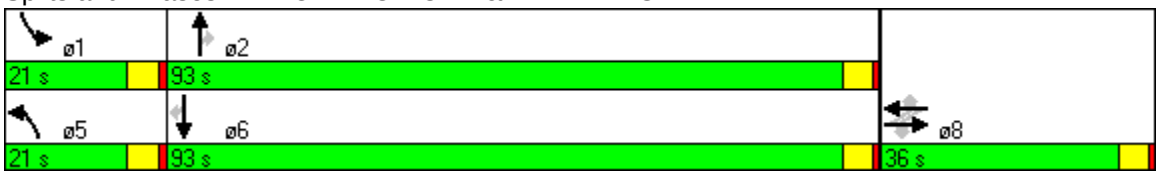


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	83	21	84	36	45	71	51	1552	116	108	1522	68
Lane Group Flow (vph)	0	113	91	0	88	77	55	1687	126	117	1654	74
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			8		5	2		1	6	
Permitted Phases	8		8	8		8			2			6
Detector Phases	8	8	8	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	25.0	25.0	10.0	25.0	25.0
Minimum Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	80.0	80.0	15.0	80.0	80.0
Total Split (s)	36.0	36.0	36.0	36.0	36.0	36.0	21.0	93.0	93.0	21.0	93.0	93.0
Total Split (%)	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%	14.0%	62.0%	62.0%	14.0%	62.0%	62.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
v/c Ratio		0.65	0.31		0.41	0.27	0.40	0.70	0.11	0.68	0.65	0.06
Control Delay		64.7	10.8		59.2	11.4	48.0	19.6	8.1	77.0	14.2	3.4
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		64.7	10.8		59.2	11.4	48.0	19.6	8.1	77.0	14.2	3.4
Queue Length 50th (ft)		107	0		80	0	53	375	22	112	421	5
Queue Length 95th (ft)		166	49		130	46	m68	602	m50	181	655	27
Internal Link Dist (ft)		530			620			2675			2120	
Turn Bay Length (ft)												
Base Capacity (vph)		268	409		333	398	201	2423	1113	201	2562	1161
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.42	0.22		0.26	0.19	0.27	0.70	0.11	0.58	0.65	0.06

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 50 (33%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle: 125
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: UWAPO ROAD & PIILANI HIGHWAY



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	59	207	150	1629	1552	108
Lane Group Flow (vph)	64	225	163	1771	1687	117
Turn Type		Perm	Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases		4				6
Detector Phases	4	4	5	2	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	8.0	20.0	20.0	20.0
Total Split (s)	28.0	28.0	28.0	122.0	94.0	94.0
Total Split (%)	18.7%	18.7%	18.7%	81.3%	62.7%	62.7%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Recall Mode	None	None	None	C-Min	C-Min	C-Min
v/c Ratio	0.51	0.70	0.74	0.57	0.66	0.10
Control Delay	68.2	11.8	63.5	3.2	7.1	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.2	11.8	63.5	3.2	7.1	1.8
Queue Length 50th (ft)	62	0	157	155	165	4
Queue Length 95th (ft)	110	84	229	276	240	m10
Internal Link Dist (ft)	253			2017	2865	
Turn Bay Length (ft)						
Base Capacity (vph)	283	442	288	3099	2563	1170
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.51	0.57	0.57	0.66	0.10

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

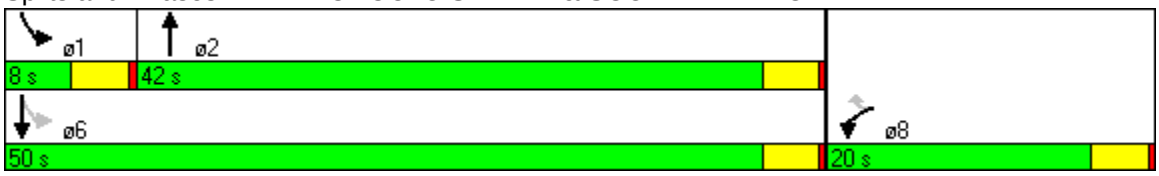
Splits and Phases: 3: KAONOULU STREET & PIILANI HIGHWAY

Lane Group	WBL	WBR	NBT	SBL	SBT
Lane Configurations					
Volume (vph)	91	288	554	77	530
Lane Group Flow (vph)	99	313	792	84	576
Turn Type		Perm		pm+pt	
Protected Phases	8		2	1	6
Permitted Phases		8		6	
Detector Phases	8	8	2	1	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	8.0	20.0
Total Split (s)	20.0	20.0	42.0	8.0	50.0
Total Split (%)	28.6%	28.6%	60.0%	11.4%	71.4%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lead/Lag			Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	
Recall Mode	None	None	Min	None	Min
v/c Ratio	0.32	0.59	0.75	0.30	0.47
Control Delay	22.5	6.0	13.1	6.4	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	22.5	6.0	13.1	6.4	5.6
Queue Length 50th (ft)	28	0	169	6	60
Queue Length 95th (ft)	73	59	#384	23	156
Internal Link Dist (ft)	290		106		222
Turn Bay Length (ft)					
Base Capacity (vph)	509	678	1174	282	1364
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.19	0.46	0.67	0.30	0.42

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 51.1
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: KAONOULU STREET & SOUTH KIHEI ROAD

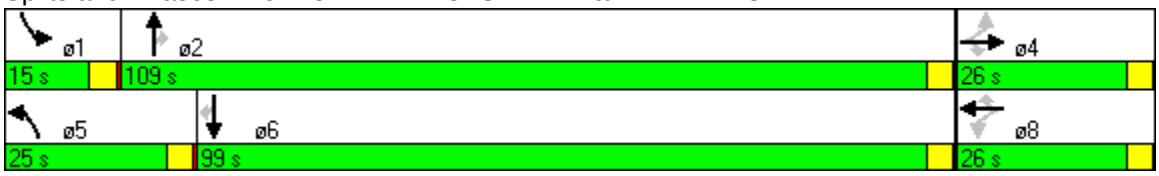


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	36	7	96	39	3	13	85	1834	30	12	1652	83
Lane Group Flow (vph)	0	47	104	0	45	14	92	1993	33	13	1796	90
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Detector Phases	4	4	4	8	8	8	5	2	2	1	6	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	8.0	20.0	20.0	8.0	20.0	20.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	25.0	109.0	109.0	15.0	99.0	99.0
Total Split (%)	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	16.7%	72.7%	72.7%	10.0%	66.0%	66.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
v/c Ratio		0.49	0.51		0.48	0.12	0.61	0.66	0.02	0.17	0.66	0.07
Control Delay		69.0	13.8		69.0	26.6	69.6	6.5	1.5	81.3	16.8	2.9
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		69.0	13.8		69.0	26.6	69.6	6.5	1.5	81.3	16.8	2.9
Queue Length 50th (ft)		45	0		43	0	88	202	1	12	778	10
Queue Length 95th (ft)		88	59		86	24	146	555	9	m18	915	m31
Internal Link Dist (ft)		212			168			1849			2017	
Turn Bay Length (ft)												
Base Capacity (vph)		209	321		202	244	248	3000	1346	130	2713	1230
Starvation Cap Reductn		0	0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0	0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0	0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.22	0.32		0.22	0.06	0.37	0.66	0.02	0.10	0.66	0.07

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 130 (87%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: KULANIHAKOI STREET & PIILANI HIGHWAY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	39	146	29	54	123	78	18	10	46	102	13	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	42	159	32	59	134	85	20	11	50	111	14	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)		817			333							
pX, platoon unblocked												
vC, conflicting volume	218			190			534	595	174	592	568	176
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	218			190			534	595	174	592	568	176
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			96			95	97	94	70	96	98
cM capacity (veh/h)	1351			1384			412	387	869	364	401	867

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	42	190	59	218	20	61	111	30
Volume Left	42	0	59	0	20	0	111	0
Volume Right	0	32	0	85	0	50	0	16
cSH	1351	1700	1384	1700	412	711	364	563
Volume to Capacity	0.03	0.11	0.04	0.13	0.05	0.09	0.30	0.05
Queue Length 95th (ft)	2	0	3	0	4	7	32	4
Control Delay (s)	7.8	0.0	7.7	0.0	14.2	10.5	19.2	11.8
Lane LOS	A		A		B	B	C	B
Approach Delay (s)	1.4		1.6		11.4		17.6	
Approach LOS					B		C	

Intersection Summary			
Average Delay	5.7		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	88	207	17	2	153	6	3	1	2	3	1	63
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	96	225	18	2	166	7	3	1	2	3	1	68
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)		370			780							
pX, platoon unblocked												
vC, conflicting volume	173			243			665	603	234	593	609	170
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	173			243			665	603	234	593	609	170
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	93			100			99	100	100	99	100	92
cM capacity (veh/h)	1404			1323			325	384	805	393	381	874

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	96	243	2	173	7	73
Volume Left	96	0	2	0	3	3
Volume Right	0	18	0	7	2	68
cSH	1404	1700	1323	1700	419	814
Volume to Capacity	0.07	0.14	0.00	0.10	0.02	0.09
Queue Length 95th (ft)	5	0	0	0	1	7
Control Delay (s)	7.8	0.0	7.7	0.0	13.7	9.9
Lane LOS	A		A		B	A
Approach Delay (s)	2.2		0.1		13.7	9.9
Approach LOS					B	A

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	29.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	23	0	0	0	0	38	0	13	0	58	19	19
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	25	0	0	0	0	41	0	14	0	63	21	21
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	212	171	31	171	182	14	41			14		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	212	171	31	171	182	14	41			14		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	100	100	100	100	96	100			96		
cM capacity (veh/h)	694	694	1043	768	684	1066	1568			1604		

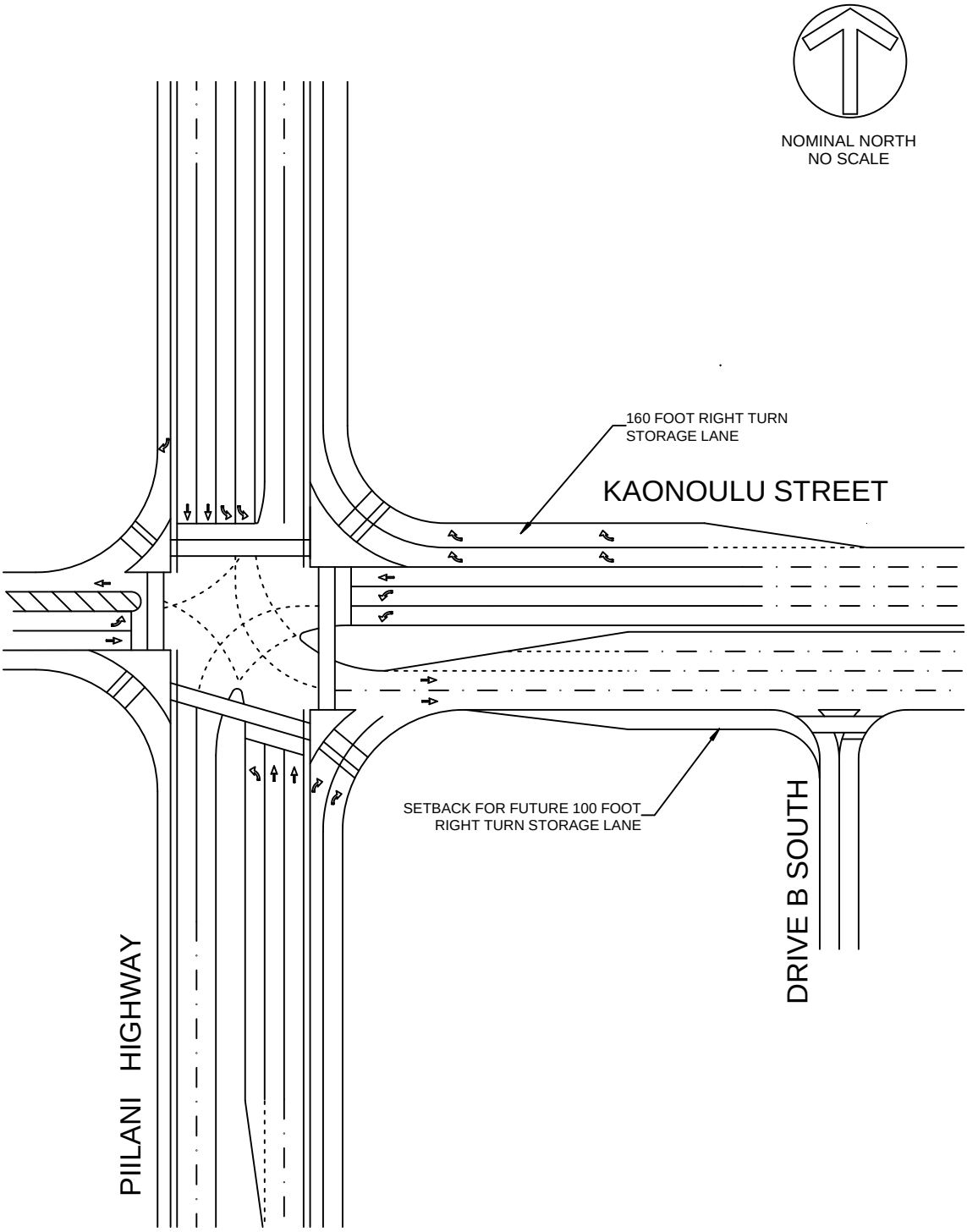
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	25	41	14	104
Volume Left	25	0	0	63
Volume Right	0	41	0	21
cSH	694	1066	1568	1604
Volume to Capacity	0.04	0.04	0.00	0.04
Queue Length 95th (ft)	3	3	0	3
Control Delay (s)	10.4	8.5	0.0	4.5
Lane LOS	B	A		A
Approach Delay (s)	10.4	8.5	0.0	4.5
Approach LOS	B	A		

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	26.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	13	0	0	19	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	14	0	0	21	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	41	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	41	0			0	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			99	
cM capacity (veh/h)	958	1085			1623	

Direction, Lane #	WB 1	SB 1
Volume Total	14	21
Volume Left	0	21
Volume Right	14	0
cSH	1085	1623
Volume to Capacity	0.01	0.01
Queue Length 95th (ft)	1	1
Control Delay (s)	8.4	7.2
Lane LOS	A	A
Approach Delay (s)	8.4	7.2
Approach LOS	A	

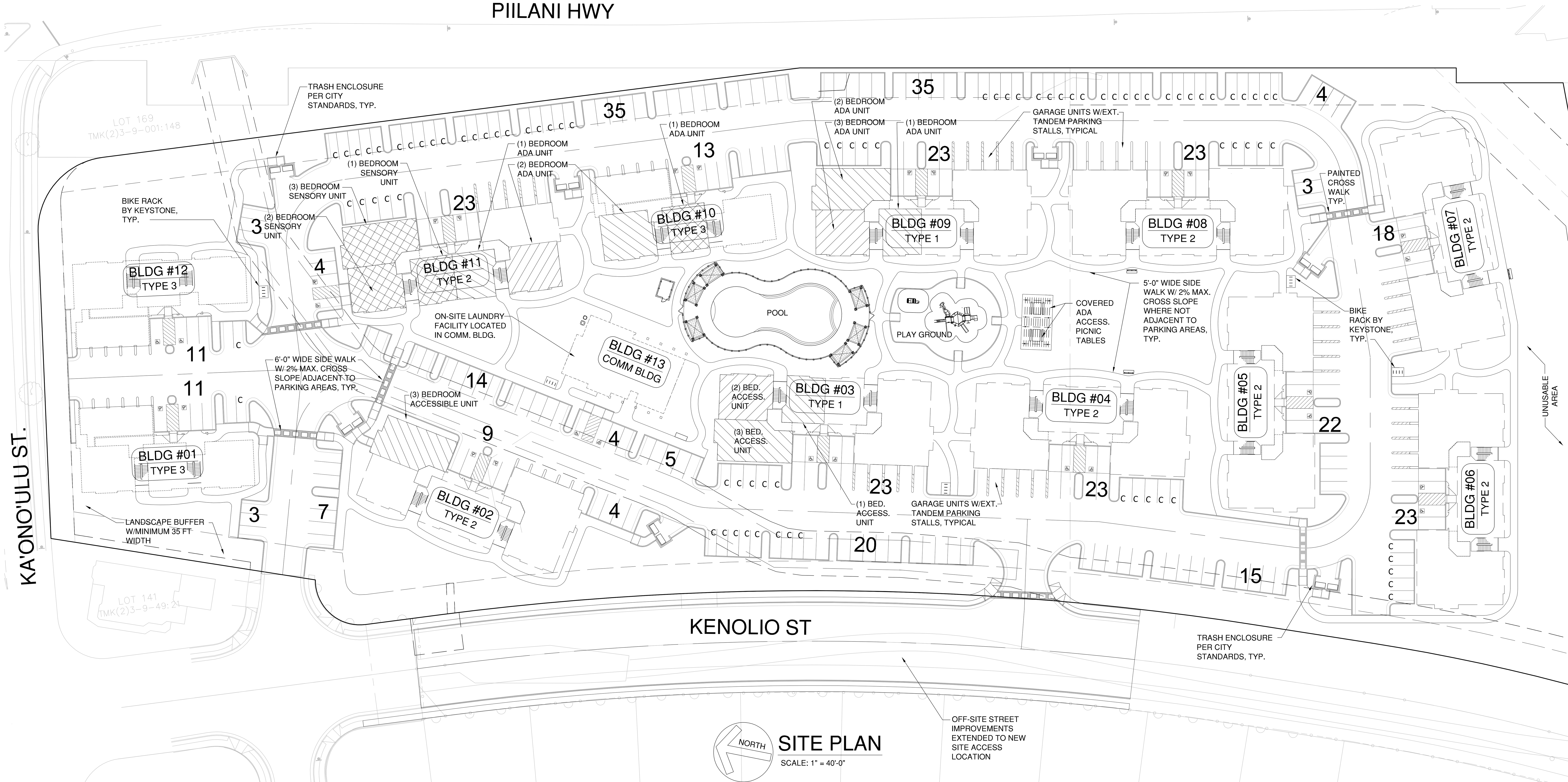
Intersection Summary			
Average Delay	7.7		
Intersection Capacity Utilization	6.7%	ICU Level of Service	A
Analysis Period (min)	15		



Attachment Y
SCHEMATIC DRAWING OF PIILANI HIGHWAY AT KAONOULU STREET
WITH PIILANI PROMENADE

Phillip Rowell and Associates

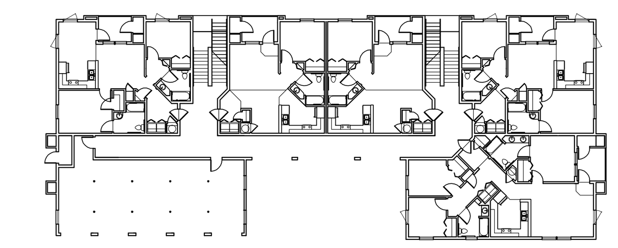
APPENDIX H
Architectural Drawings



SITE PLAN

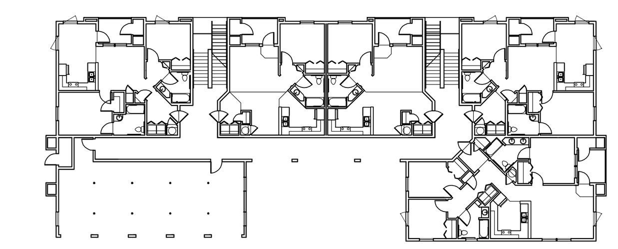
SCALE: 1" = 40'-0"

BLDG. TYPE 1



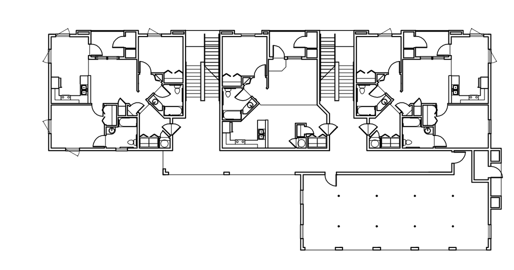
BUILDING TYPE 1 - (17) 1,2 & 3 BDRM UNITS
(2) BUILDINGS TOTAL
FOOTPRINT - 7,504 S.F.
MAXIMUM HEIGHT - 39'-0"±
(3) STORIES - MULTIFAMILY RESIDENTIAL
OCCUPANCY R-2 , FULLY SPRINKLERED PER NFPA 13-R
CONSTRUCTION TYPE: VB

BLDG. TYPE 2



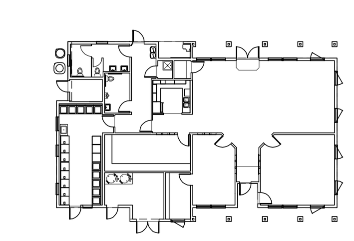
BUILDING TYPE 2 - (17) 1, 2 & 3 BDRM UNITS
(7) BUILDINGS TOTAL
FOOTPRINT - 7,504 S.F.
MAXIMUM HEIGHT - 39'-0"±
(3) STORIES - MULTIFAMILY RESIDENTIAL
OCCUPANCY R-2 , FULLY SPRINKLERED PER NFPA 13-R
CONSTRUCTION TYPE: VB

BLDG. TYPE 3



BUILDING TYPE 3 - (11)1, 2 & 3 BDRM UNITS
(3) BUILDINGS TOTAL
FOOTPRINT - 5,249 S.F.
MAXIMUM HEIGHT - 39'-0"±
(3) STORIES - MULTIFAMILY RESIDENTIAL
OCCUPANCY R-2 , FULLY SPRINKLERED PER NFPA 13-R
CONSTRUCTION TYPE: VB

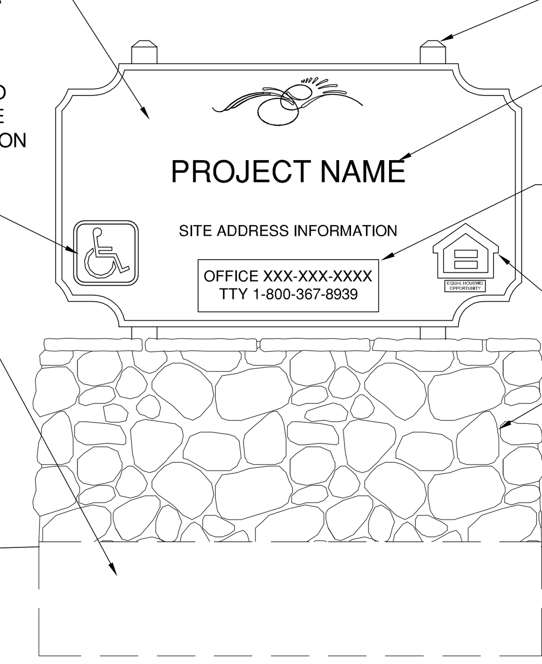
COMMUNITY BUILDING



COMMUNITY BUILDING
(1) BUILDINGS TOTAL
FOOTPRINT - 3,042 S.F.
MAXIMUM HEIGHT - 16'-6"±
(1) STORY - OCCUPANCY B
FULLY SPRINKLERED PER NFPA 13-R
CONSTRUCTION TYPE: VB

VICINITY MAP

N.T.S.



WEATHERED CEDAR DISTRESSED WOOD MONUMENT SIGN PER OWNER SPEC. (MIN. SIGN AREA 16 S.F.)

NOTE: MOUNT SECOND SIGN TO OPPOSITE SIDE OF 4 X 4 P.T. POST TO CREATE A TWO SIDED SIGN, SEE SITE PLAN FOR LOCATION AND ORIENTATION

ACCESSIBLE SIGN LOGO (MIN. 5% SIGN AREA), HIGH CONTRAST

REINFORCED CONC. FOOTING

NOTE:
MONUMENT SIGNAGE TO BE UNDER SEPARATE PERMIT.

G.C. TO VERIFY MONUMENT SIGN DESIGN, LOCATION AND PROJECT NAME W/ OWNER PRIOR TO INSTALLATION. G.C. RESPONSIBLE FOR SUBMITTING AND OBTAINING ANY SIGN PERMITS AS REQUIRED BY LOCAL JURISDICTIONAL REQUIREMENTS

ALL LOGOS AND TEXT TO BE HIGH CONTRAST TO BACKGROUNDS.

BEVELED CAP, (2) 4x4 P.T. POST SECURED TO BASE

SEE TITLEBLOCK FOR PROJECT NAME, FONT TYPE AND SIZE BY OWNER

METAL PLACARD BY OWNER, TEXT WILL SHOW OFFICE TELEPHONE NUMBER AND TTY TELEPHONE NUMBER AS SHOWN

FAIR HOUSING LOGO (MIN. 5% SIGN AREA), HIGH CONTRAST

NATURAL STONE BASE "RIVERROCK" STYLE OR EQUAL TO MATCH ENTRY ELEMENT BASE AT BUILDING. INSTALL OVER SCRATCH COAT CEMENT STUCCO W/ APPROVED ANCHORS ON CONC. BASE AND FOUNDATION

1 / A1.1 MONUMENT SIGN

SCALE: 1/2"=1'-0"

APPLICANT

MAUI PACIFIC ASSOCIATES
DON SLATTERY
430 E. STATE STREET, SUITE 100
EAGLE, IDAHO 83616
(208)-461-0022 X3023

ACCESSIBILITY	# OF UNITS	PERCENTAGE
SECOND & THIRD FLOOR UNITS	118	63.44%
ADAPTABLE UNITS (ALL GROUND FLOOR UNITS REQ.)	54	29.03%
ACCESSIBLE UNITS (5% TOTAL)	10	5.38%
SENSORY IMPAIRED UNITS (2% TOTAL)	4	2.15%
TOTAL UNITS	186	100%

UNIT MIX SUMMARY	SQ. FOOTAGES	PERCENTAGE
(63) 1-BEDROOM UNITS	(63) X 679 S.F. = 42,777 S.F.	(33.87% OF TOTAL)
(72) 2-BEDROOM UNITS	(72) X 908 S.F. = 65,376 S.F.	(38.71% OF TOTAL)
(28) 2-BEDROOM UNITS	(28) X 1060 S.F.= 29,680 S.F.	(15.05% OF TOTAL)
(23) 3-BEDROOM UNITS	(23) X 1,141 S.F. = 26,243 S.F.	(12.37% OF TOTAL)
(186) UNITS TOTAL	42,777 S.F. + 65,376 S.F. + 29,680 + 26,243 = 164,076 S.F.	
TOTAL	164,076 S.F.	

PARKING STALLS REQUIRED: 186 X 2 (DWELLING UNITS) + 6 (COMM. BLDG.) = 378 STALLS
PARKING STALLS PROVIDED: 378 STALLS

COMPACT STALLS ALLOW (25%): 378 X 0.25 = 94.5 STALLS / COMPACT STALLS PROVIDED: 94 STALLS

ADA STALLS REQUIRED (PER TABLE 1106.1): 6 STALLS / ADA STALLS PROVIDED: 26 STALLS

SITE AREA / LOT COVERAGE / FAR CALCULATIONS

SITE AREA: 5.171 ACRES (LOT 1) + 3.103 ACRES (LOT 2) = 8.274 ACRES OR 8.274 ACRES X 43,560 SF = 360,415 SF

ALLOWABLE LOT COVERAGE: 25% OR 360,418 SF X 0.25 = 90,105 SF
ALLOWABLE FAR COVERAGE: 40% OR 360,418 SF X 0.40 = 144,167 SF

BUILDING LOT COVERAGE BY BUILDING TYPE & TOTAL LOT COVERAGE:

BUILDING TYPE #1: (2) BUILDINGS X 7504 SF = 15,008 SF
BUILDING TYPE #2: (7) BUILDINGS X 7504 SF = 52,528 SF
BUILDING TYPE #3: (3) BUILDINGS X 5249 SF = 15,747 SF
COMMUNITY BLDG: (1) BUILDING X 3033 SF = 3,042 SF
TOTAL LOT COVERAGE BY BUILDINGS 86,325 SF

FAR LOT COVERAGE BY BUILDING TYPE & TOTAL FAR LOT COVERAGE:

BUILDING TYPE #1: (2) BUILDINGS X 22,458 SF = 44,916 SF
BUILDING TYPE #2: (7) BUILDINGS X 22,166 SF = 155,162 SF
BUILDING TYPE #3: (3) BUILDINGS X 15,693 SF = 47,079 SF
COMMUNITY BLDG: (1) BUILDING X 3033 SF = 3,042 SF
TOTAL FAR LOT COVERAGE BY BUILDINGS 250,199 SF

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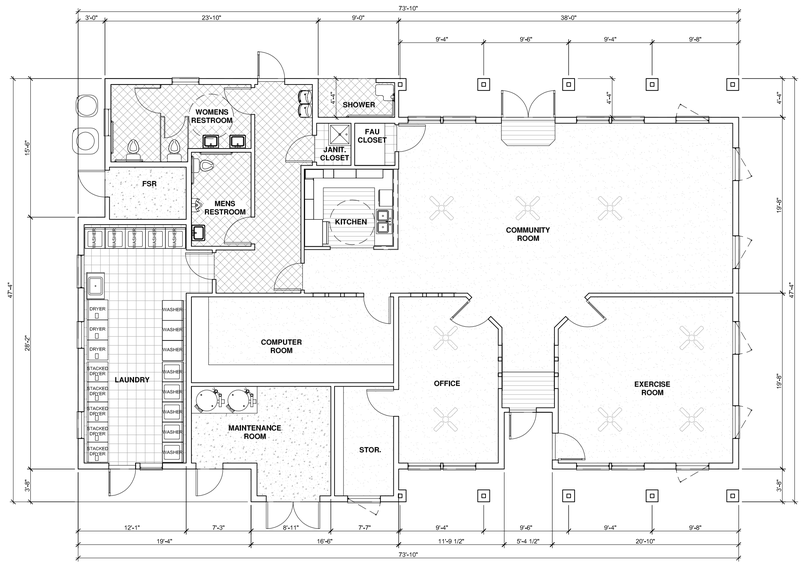
PROJECT
KENOLIO APARTMENTS

PROJECT ADDRESS
MAUI, HAWAII

A1.1

SCHEMATIC SET / NOT FOR CONSTRUCTION



SCHEMATIC COMMUNITY BUILDING FLOOR PLAN

SCALE: 1/8"=1'-0"

REVISIONS

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04/22/14

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KENOLIO APARTMENTS

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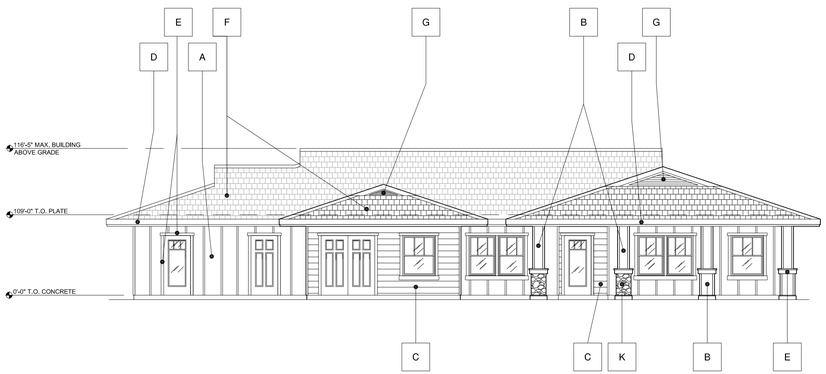
MAUI, HAWAII

A4.1A

SCHEMATIC SET / NOT FOR CONSTRUCTION

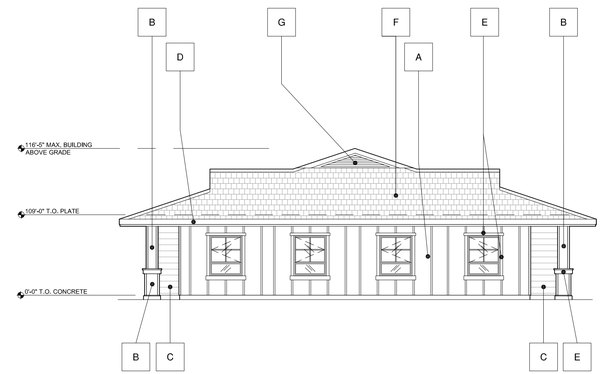
MATERIAL FINISHES:

A	CEMENT BOARD VERTICAL SIDING WITH BATTENS
B	CEMENT BOARD VERTICAL SIDING
C	CEMENT BOARD LAP SIDING WITH 8 1/4" EXPOSURE
D	CEMENT BOARD FASCIA
E	CEMENT BOARD TRIM
F	30 YEAR COMPOSITION SHINGLE ROOFING
G	PRE-FINISHED METAL GABLE VENT
H	HEAVY TIMBER KNEE BRACE
J	SHADING DEVICE WITH KNEE BRACE SUPPORTS
K	LOCAL STONE VENEER BASE



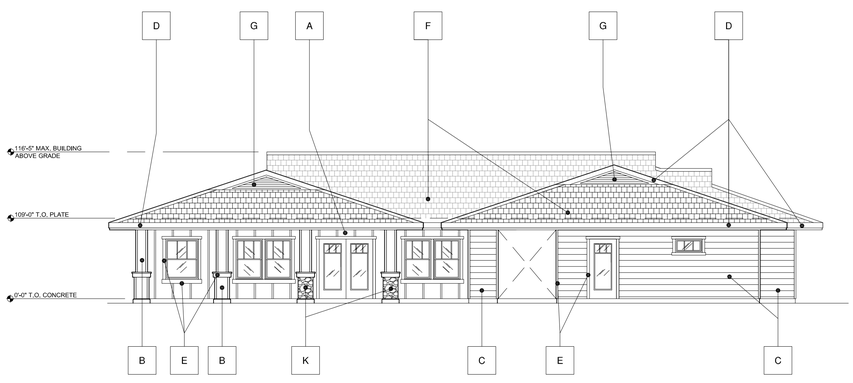
SCHEMATIC COMMUNITY BUILDING - FRONT ELEVATION

SCALE: 1/8"=1'-0"



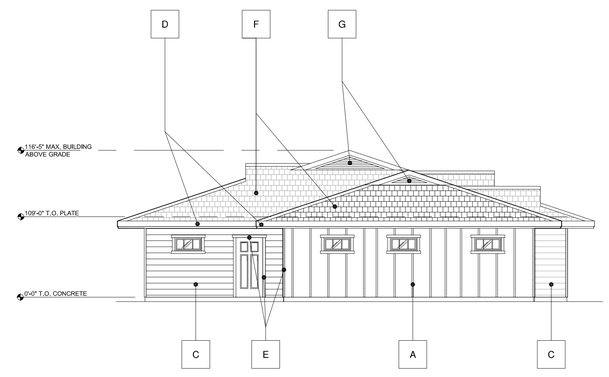
SCHEMATIC COMMUNITY BUILDING - RIGHT ELEVATION

SCALE: 1/8"=1'-0"



SCHEMATIC COMMUNITY BUILDING - REAR ELEVATION

SCALE: 1/8"=1'-0"



SCHEMATIC COMMUNITY BUILDING - LEFT ELEVATION

SCALE: 1/8"=1'-0"

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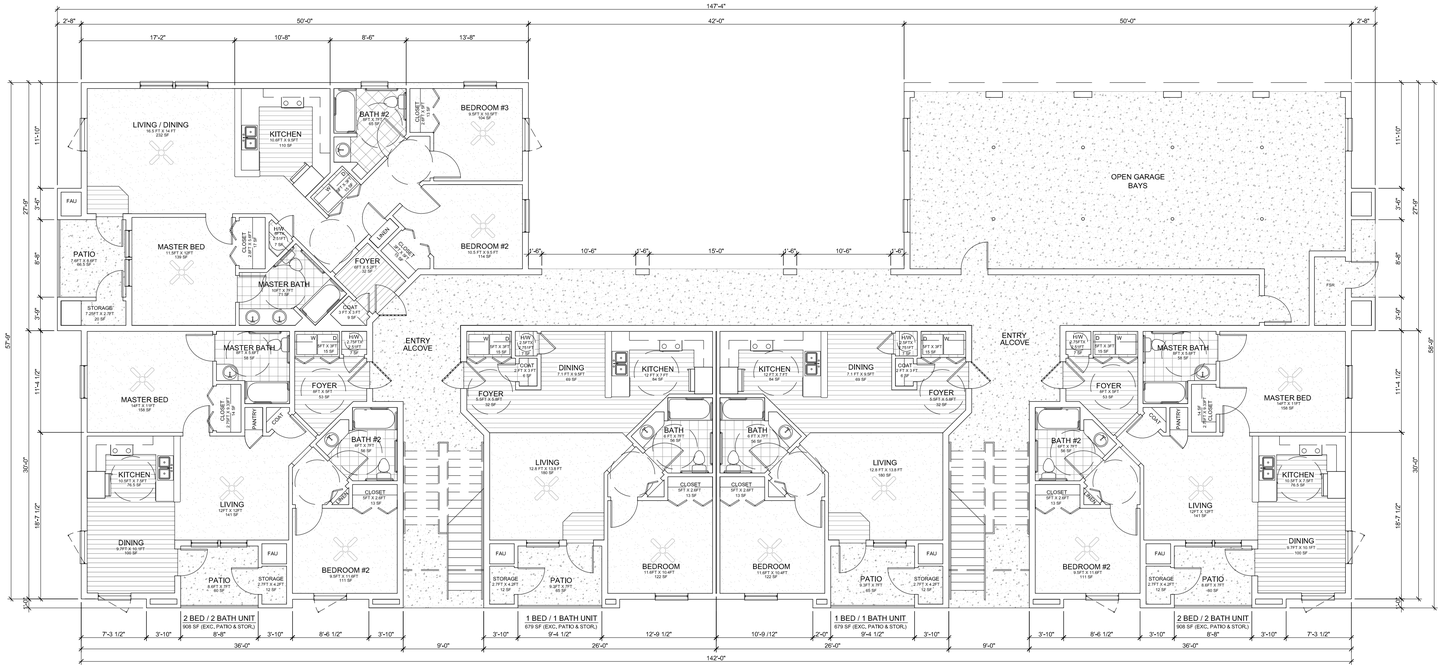
PROJECT

KENOLIO APARTMENTS

PROJECT ADDRESS
MAUI, HAWAII

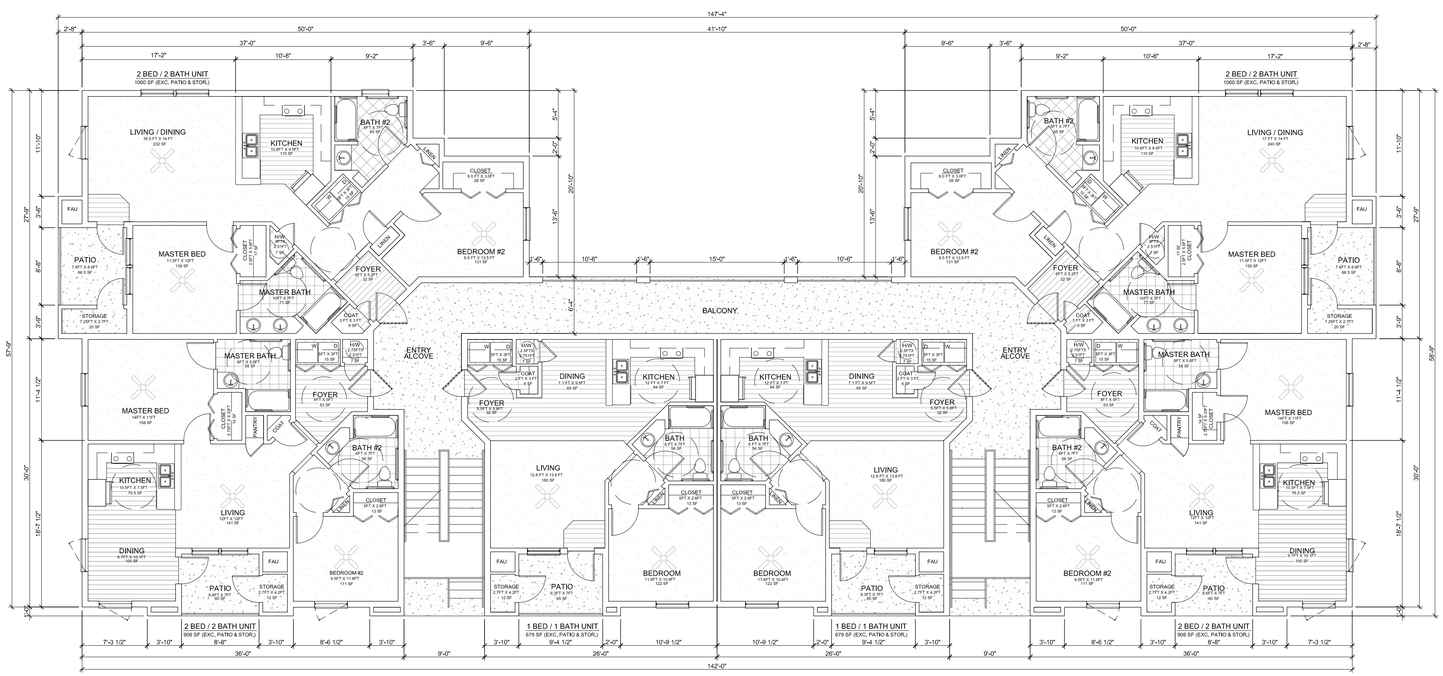
A4.1B

SCHEMATIC SET / NOT FOR CONSTRUCTION



SCHEMATIC BUILDING TYPE-1: 1ST FLOOR PLAN

SCALE: 1/8"=1'-0"



SCHEMATIC BUILDING TYPE-1: 2ND & 3RD FLOOR PLAN

SCALE: 1/8"=1'-0"

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PROJECT

KENOLIO APARTMENTS

PROJECT ADDRESS

MAUI, HAWAII

A4.2A

SCHEMATIC SET / NOT FOR CONSTRUCTION

MATERIAL FINISHES:

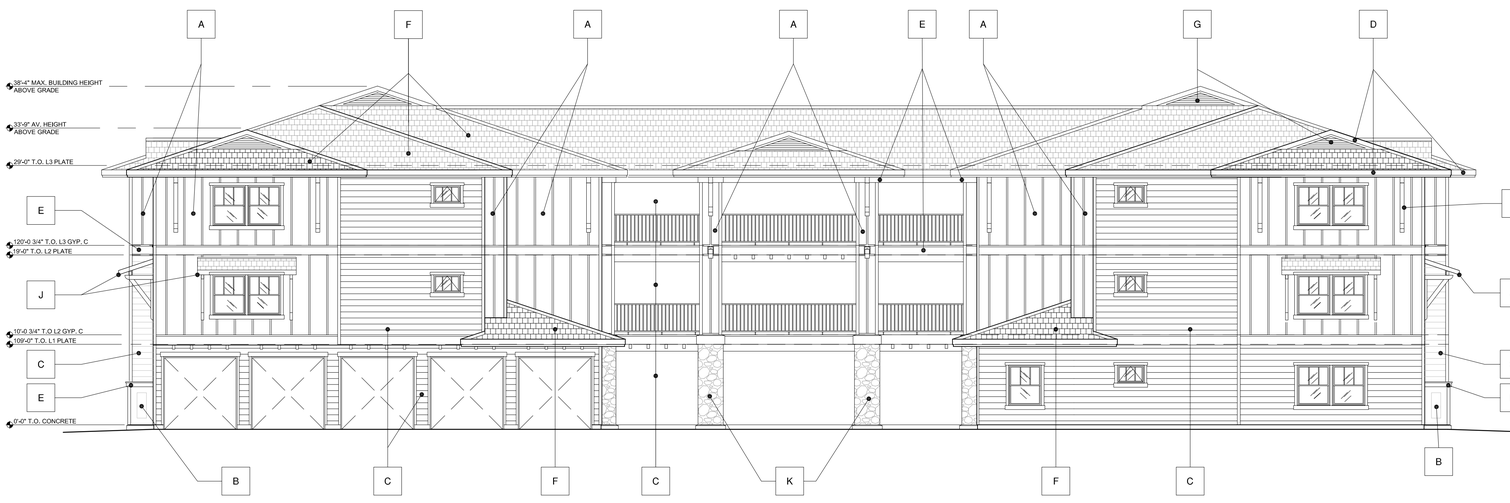
A	CEMENT BOARD VERTICAL SIDING WITH BATTENS
B	CEMENT BOARD VERTICAL SIDING
C	CEMENT BOARD LAP SIDING WITH 8 1/4" EXPOSURE
D	CEMENT BOARD FASCIA
E	CEMENT BOARD TRIM
F	30 YEAR COMPOSITION SHINGLE ROOFING
G	PRE-FINISHED METAL GABLE VENT
H	HEAVY TIMBER KNEE BRACE
J	SHADING DEVICE WITH KNEE BRACE SUPPORTS
K	LOCAL STONE VENEER BASE

SCHEMATIC BUILDING 1 - FRONT ELEVATION

SCALE: 1/8"=1'-0"

SCHEMATIC BUILDING 1 - LEFT ELEVATION

SCALE: 1/8"=1'-0"



SCHEMATIC BUILDING 1 - REAR ELEVATION

SCALE: 1/8"=1'-0"

SCHEMATIC BUILDING 1 - RIGHT ELEVATION

SCALE: 1/8"=1'-0"

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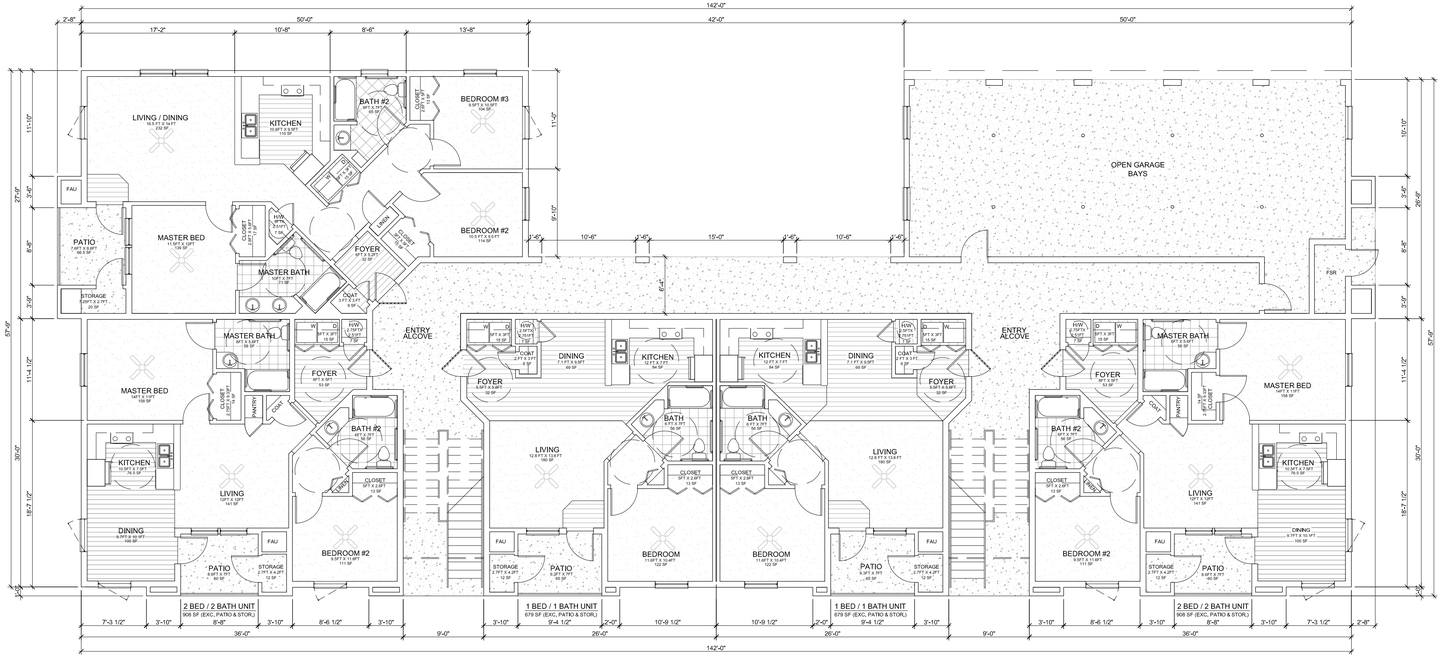
PROJECT

KENOLIO APARTMENTS

PROJECT ADDRESS
MAUI, HAWAII

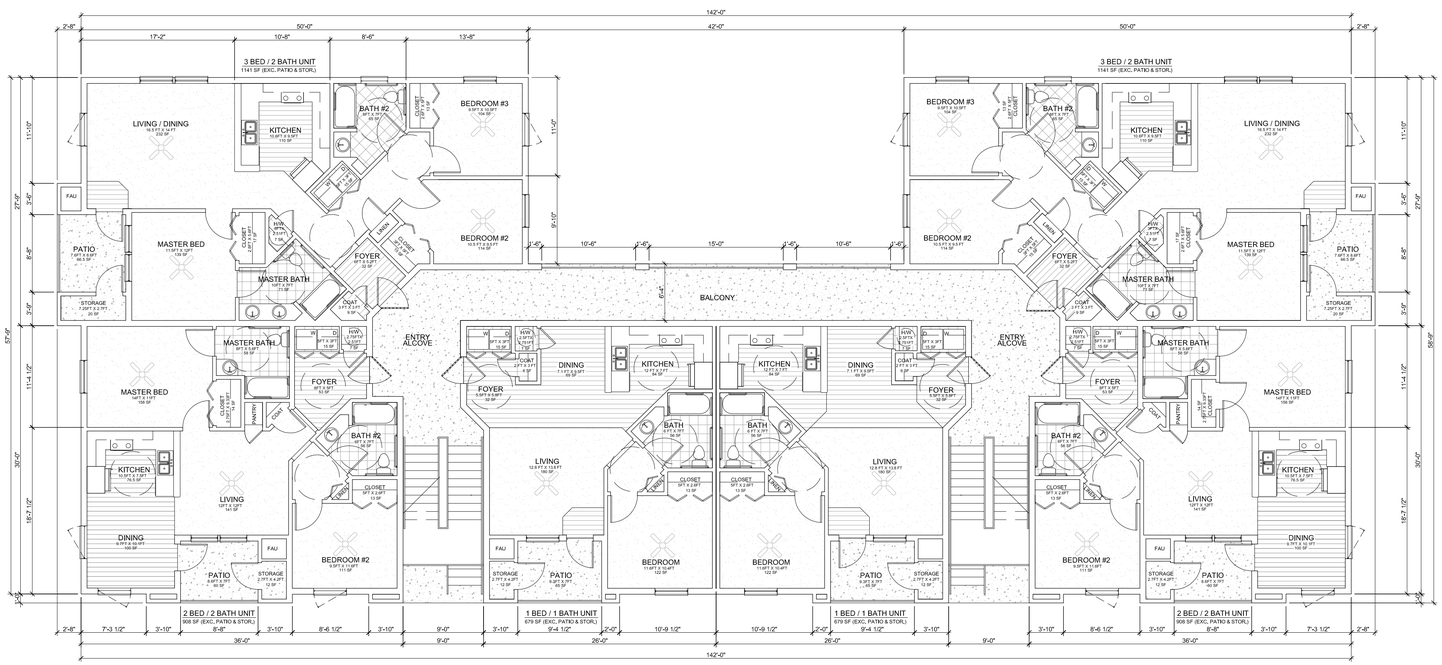
A4.2B

SCHEMATIC SET / NOT FOR CONSTRUCTION



SCHEMATIC BUILDING TYPE-2: 1ST FLOOR PLAN

SCALE: 1/8"=1'-0"



SCHEMATIC BUILDING TYPE-2: 2ND & 3RD FLOOR PLAN

SCALE: 1/8"=1'-0"

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PROJECT

KENOLIO APARTMENTS

PROJECT ADDRESS

MAUI, HAWAII

A4.3A

SCHEMATIC SET / NOT FOR CONSTRUCTION

MATERIAL FINISHES:

A	CEMENT BOARD VERTICAL SIDING WITH BATTENS
B	CEMENT BOARD VERTICAL SIDING
C	CEMENT BOARD LAP SIDING WITH 8 1/4" EXPOSURE
D	CEMENT BOARD FASCIA
E	CEMENT BOARD TRIM
F	30 YEAR COMPOSITION SHINGLE ROOFING
G	PRE-FINISHED METAL GABLE VENT
H	HEAVY TIMBER KNEE BRACE
J	SHADING DEVICE WITH KNEE BRACE SUPPORTS
K	LOCAL STONE VENEER BASE

SCHEMATIC BUILDING 2 - FRONT ELEVATION

SCALE: 1/8"=1'-0"

SCHEMATIC BUILDING 2 - LEFT ELEVATION

SCALE: 1/8"=1'-0"

SCHEMATIC BUILDING 2 - REAR ELEVATION

SCALE: 1/8"=1'-0"

SCHEMATIC BUILDING 2 - RIGHT ELEVATION

SCALE: 1/8"=1'-0"

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PROJECT

KENOLIO APARTMENTS

PROJECT ADDRESS
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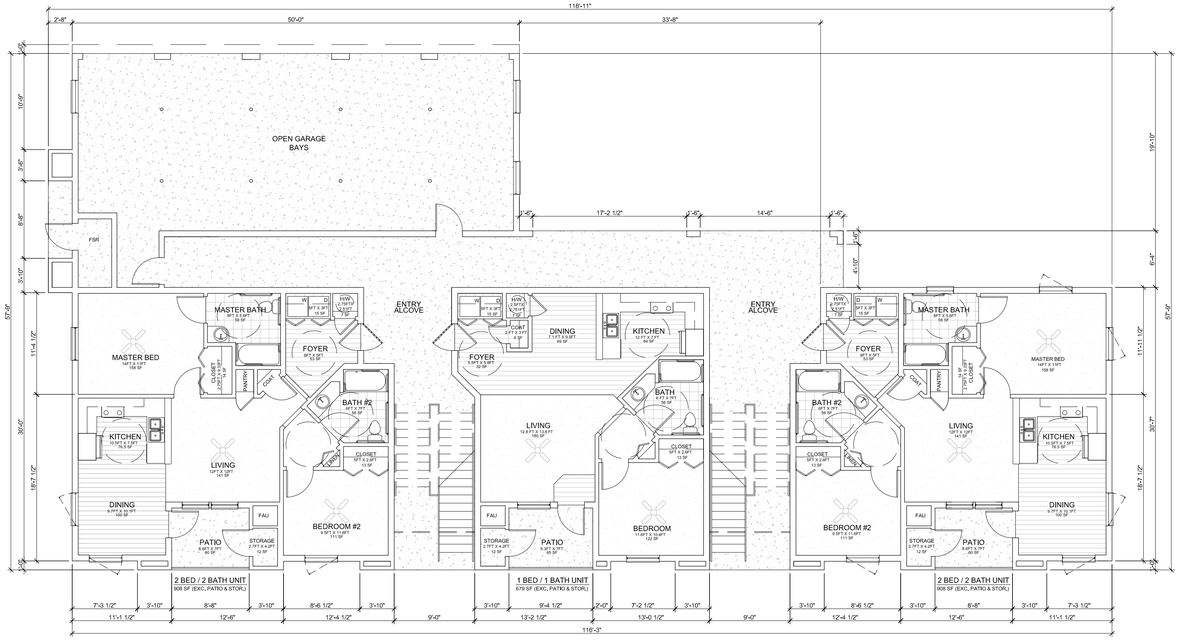
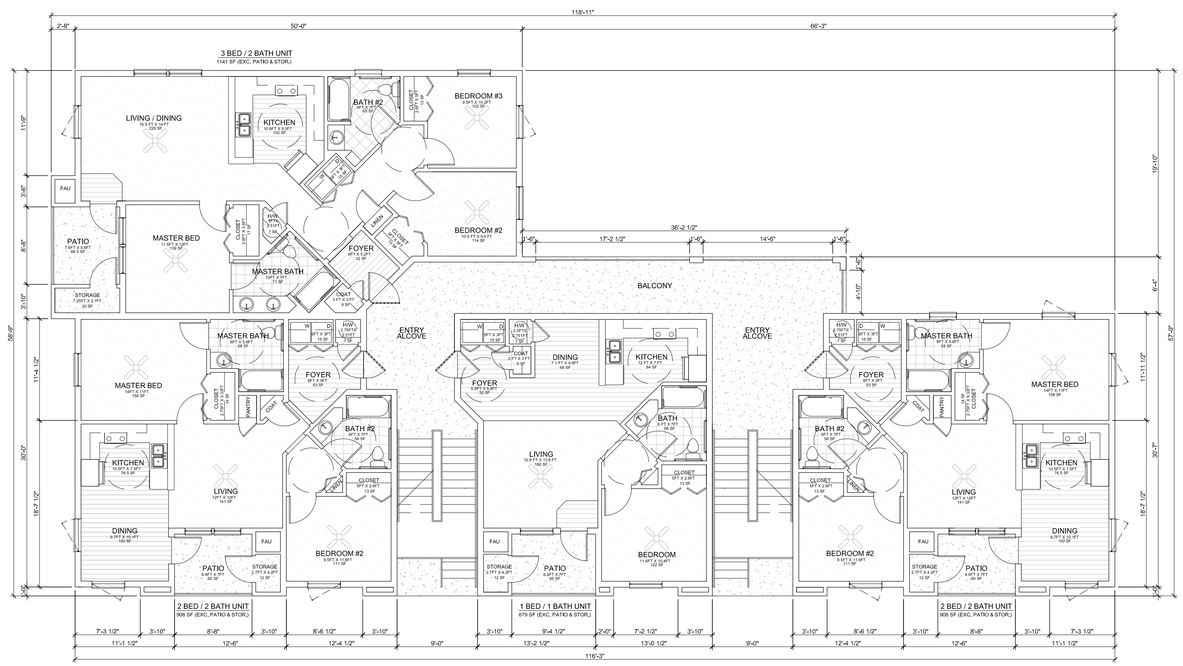
A4.3B

SCHEMATIC SET / NOT FOR CONSTRUCTION



SCHEMATIC BUILDING TYPE-3: 1ST FLOOR PLAN

SCALE: 1/8"=1'-0"



SCHEMATIC BUILDING TYPE-3: 2ND & 3RD FLOOR PLAN

SCALE: 1/8"=1'-0"

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PROJECT

KENOLIO APARTMENTS

PROJECT ADDRESS

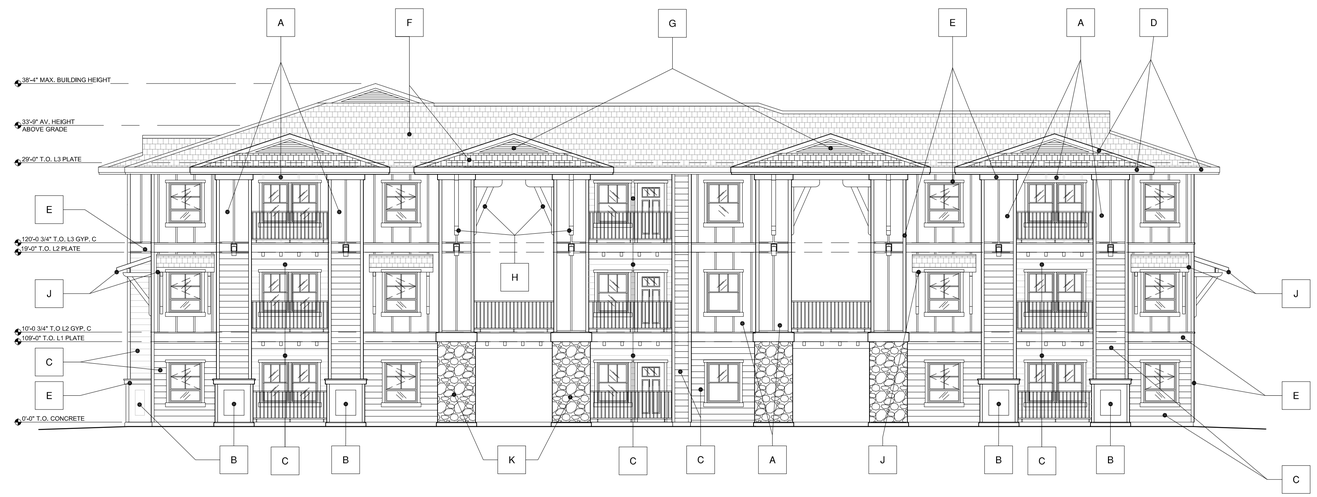
MAUI, HAWAII

A4.4A

SCHEMATIC SET / NOT FOR CONSTRUCTION

MATERIAL FINISHES:

A	CEMENT BOARD VERTICAL SIDING WITH BATTENS
B	CEMENT BOARD VERTICAL SIDING
C	CEMENT BOARD LAP SIDING WITH 8 1/4" EXPOSURE
D	CEMENT BOARD FASCIA
E	CEMENT BOARD TRIM
F	30 YEAR COMPOSITION SHINGLE ROOFING
G	PRE-FINISHED METAL GABLE VENT
H	HEAVY TIMBER KNEE BRACE
J	SHADING DEVICE WITH KNEE BRACE SUPPORTS
K	LOCAL STONE VENEER BASE

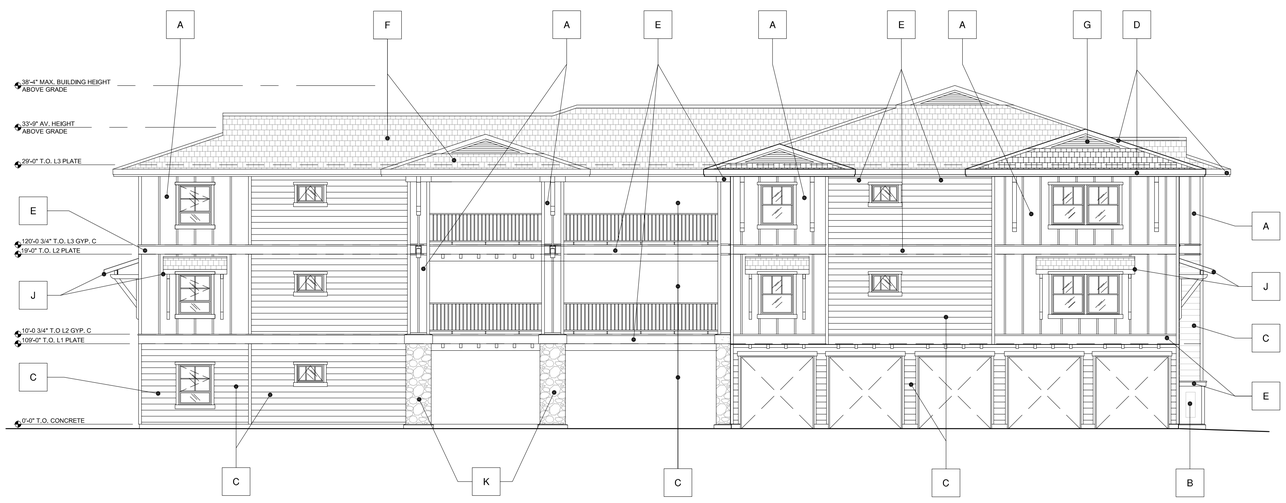


SCHEMATIC BUILDING 3 - FRONT ELEVATION

SCALE: 1/8"=1'-0"

SCHEMATIC BUILDING 3 - LEFT ELEVATION

SCALE: 1/8"=1'-0"



SCHEMATIC BUILDING 3 - REAR ELEVATION

SCALE: 1/8"=1'-0"

SCHEMATIC BUILDING 3 - RIGHT ELEVATION

SCALE: 1/8"=1'-0"

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A4.4B

SCHEMATIC SET / NOT FOR CONSTRUCTION